

U.S. Military Forces in FY 2022

Navy

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This paper is part of *U.S. Military Forces in FY 2022*. There is bipartisan support to expand the Navy, but limited budgets and early retirements—“divesting to invest”—make achieving that goal difficult. The Biden administration’s emerging fleet plan incorporates smaller ships and large numbers of unmanned systems, as proposed by many strategists, but high costs, production limitations, and congressional opposition may prevent full implementation.

KEY TAKEAWAYS

- In FY 2022, fleet size stays about the same, at 296 ships. Previously ordered ships arrive in large numbers, but the Navy retires 15 ships, 10 early. Navy active-duty personnel decrease by 1,600 to 346,200.
- Ship numbers matter to the Navy because of high day-to-day demands for its forces for crisis response, allied and partner engagement, conventional deterrence, and ongoing regional conflicts.
- The future fleet architecture—its size and composition—remains a work in progress. The Trump administration’s 355-ship goal was deemed infeasible because of its high cost and outmoded operational concepts. At the end of its term, the Trump administration articulated a new vision incorporating unmanned systems and distributed capabilities. The Biden administration published a similar architecture, but smaller and with ranges for ship numbers. Cost is a problem with all of these notional architectures because they require large funding increases which may not occur. Nevertheless, some insights are emerging:
 - **Carriers:** Recent force structure proposals have implied a reduction in the number of carriers. However, contractual commitments and political constraints may have locked the Navy into the present carrier force for many years regardless of strategic considerations. Small carriers seem to be receding into the background once again.
 - **Large Surface Combatants:** Future architectures envision deep cuts to this fleet, implying production cutbacks and many early retirements. However, industrial base and strategic concerns about shrinking fleet size will clash with the new goals.

- **Small Surface Combatants:** All the future fleet architectures show an increase, the only question being how much of an increase and how fast.
- **Amphibious Ships:** New amphibious concepts and the introduction of a small amphibious ship imply reductions in the number of large amphibious ships. However, as with the large surface combatants, industrial base interests will clash with the new and lower goals.
- **Attack Submarines:** All future architectures envision an increase in the size of the attack submarine fleet. However, slow production in the 1990s and production capacity limits today will limit fleet size until the 2040s.
- **Ballistic Missile Submarines:** The Columbia-class ballistic missile submarine program, the Navy's highest-priority program, remains on schedule and (generally) at target cost but with some risk. Any program delay would disrupt the U.S. nuclear deterrent, while any cost increase would disrupt every other shipbuilding program.
- **Unmanned Surface and Undersea Vessels:** These figure prominently in Navy architectures, but the systems remain experimental and none of the larger programs have a production plan. The FY 2022 budget seems to entail a pause in development.
- Naval aviation is generally in good shape, with stable inventories and acceptable average fleet ages. However, it remains focused on manned platforms.

End Strength in FY 2022

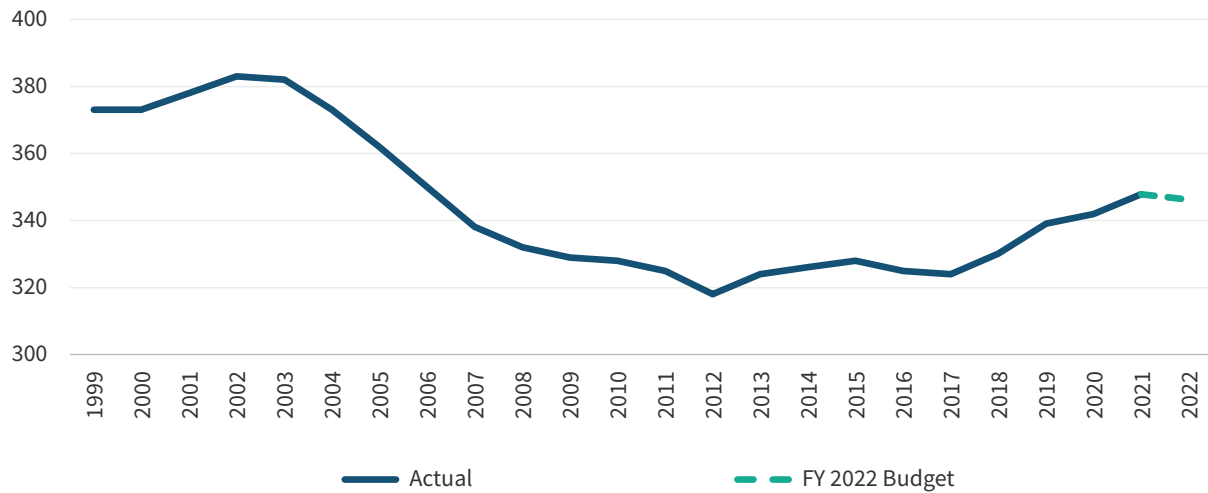
Table 1: Navy End Strength – Active, Reserve, and Civilians

	Active Navy	Navy Reserve	Civilian
	End Strength	End Strength	Full-time Equivalents
FY 2021 Enacted	347,800	58,800	199,051
FY 2022 Request	346,200	58,300	200,192
Change from FY 2020	-1,600	-500	+1,141

Source: Department of the Navy, *Highlights of The Department of the Navy FY 2022 Budget* (Washington, DC: Department of Defense, 2021), Active End Strength data in Figure 7.2, Reserve End Strength data in Figure 7.3, Civilian data in Figure 7.10 (includes direct and indirect hires but excludes Marine Corps civilians), https://www.secnav.Navy.mil/fmc/fmb/Documents/22pres/Highlights_Book.pdf.

Navy personnel levels have been on a roller coaster, reaching a post-Cold War high of 383,000 in FY 2002 and a low of 318,000 in FY 2012. The number has crept back up, but the Navy is still far below its pre-9/11 size. However, the number of sailors tracks roughly to the number of ships in the fleet (see Figure 1).

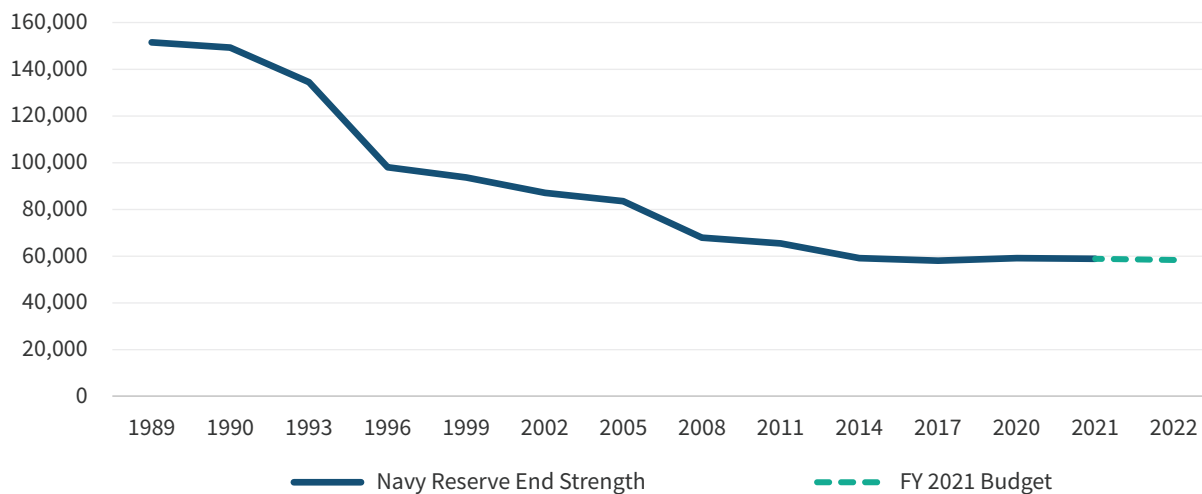
Figure 1: Navy Active-Duty Personnel, 1999–2022



Source: Office of the Under Secretary of Defense (Comptroller), *National Defense Budget Estimates for FY 2022* (Washington, DC: Department of Defense, August 2021), Table 7-5: Department of Defense Manpower, 258–60, https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2022/FY22_Green_Book.pdf.

The Navy projects that active-duty end strength will decline slightly in FY 2022 to 346,200. This reflects the Navy’s near-term plan to retire older ships with large crews. A few Navy personnel will transfer to the Space Force in FY 2022, but major decisions here lie in the future.¹ The FY 2020 and FY 2021 projections had shown continued personnel growth.

Figure 2: Navy Reserve Personnel, 1989–2022

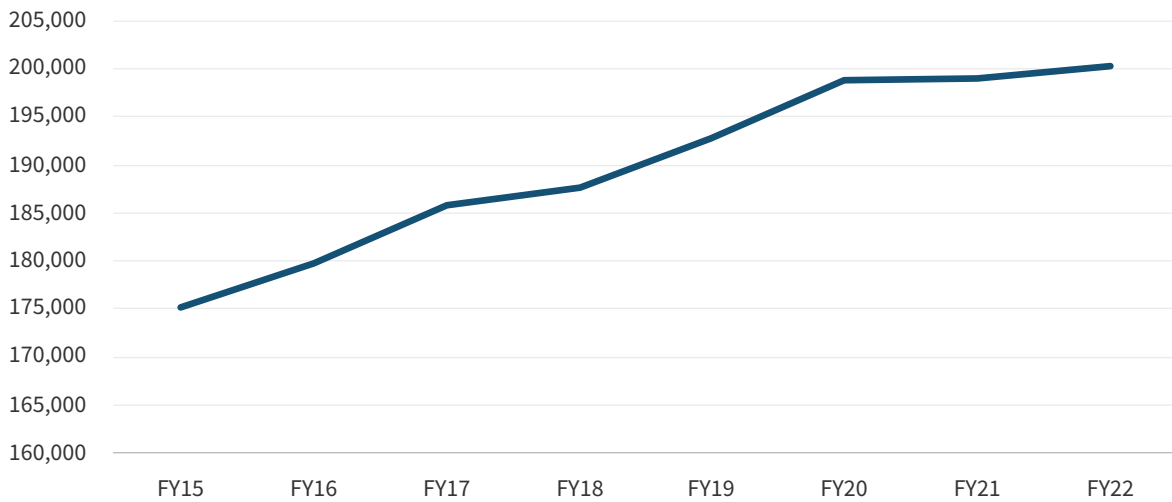


Source: Department of the Navy, *Highlights of The Department of the Navy FY 2022 Budget* (Washington, DC: Department of Defense, 2021), Figure 7.3, https://www.secnav.Navy.mil/fmc/fmb/Documents/22pres/Highlights_Book.pdf; and previous years’ highlights documents.

1. “Space Force Selects over 900 to Transfer in FY 22,” U.S. Space Force, September 30, 2021, <https://www.spaceforce.mil/News/Article/2793972/space-force-selects-more-than-900-personnel-to-transfer-fy22/>. Although 900 personnel were selected, nearly all were from the Army.

Although its end strength has been roughly stable since 2014, the Navy Reserve will shrink by 500 sailors to 58,300 in FY 2022. Over the long term, the Navy Reserve has been shrinking, unlike other Department of Defense (DOD) reserve components. This long-term decline results from the retirement of all Navy Reserve ships and many Navy Reserve aircraft, so the remaining forces are mainly for logistics and support. Billets for staff augmentation are being eliminated. While these remaining functions have an important role, it is much narrower compared to the reserve components of other services. Unlike the Army and Air Force, the Navy and the Marine Corps have not increased the number of reservists to compensate for constraints on the number of active-duty personnel.

Figure 3: Navy Civilian Workforce, FY 2015–FY 2022



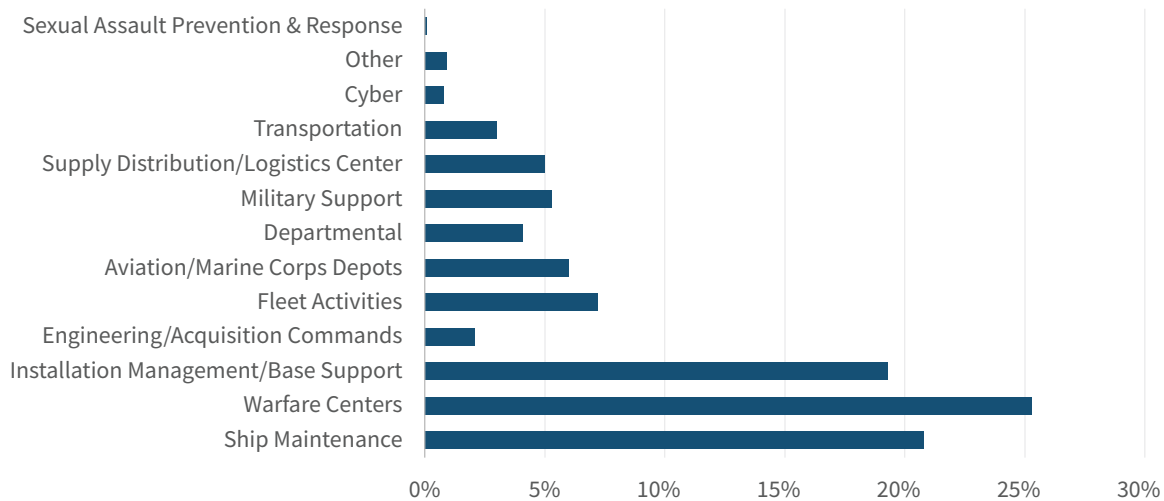
Source: Department of the Navy, *Highlights of The Department of the Navy FY 2022 Budget* (Washington, DC: Department of Defense, 2021), 7–12, https://www.secnav.Navy.mil/fmc/fmb/Documents/22pres/Highlights_Book.pdf; and previous years' highlights documents.

The number of Navy civilians increases by 1,100 in FY 2022, continuing a long-term increase, though at a slower rate. The Navy appears to be using civilians to offset constraints on military personnel. This is a sensible policy because civilians are less expensive than military personnel; stay in their jobs longer, resulting in deeper expertise; and have a more flexible personnel system in that health and age requirements are not as stringent as for the military.

This planned increase is at odds with the Navy's recent announcement about cutting 1,000 civilian jobs from installations as a budget-saving move. Because the cuts would affect popular support activities (beaches and gyms) as well as ship operations, expect continued discussion in this area.² (A later chapter in this series will consider the civilian workforce DOD-wide.)

2. Sam LaGrone, "Navy Plans to Cut 1,000 Civilian Jobs, Close U.S. Base Libraries in \$280M Cost Savings Drive," USNI News, September 22, 2021, <https://news.usni.org/2021/09/22/navy-plans-to-cut-1000-civilian-jobs-close-u-s-base-libraries-in-280m-cost-savings-drive>.

Figure 4: Civilian Manpower Work Areas, FY 2022



Source: Department of the Navy, *Highlights of The Department of the Navy FY 2022 Budget* (Washington, DC: Department of Defense, 2021), 7–9, https://www.secnav.Navy.mil/fmc/fmb/Documents/22pres/Highlights_Book.pdf.

The Navy, like DOD in general, emphasizes that most civilians work outside Washington and are a critical element of readiness because of the work they do on facilities and maintenance.

Fleet Size in FY 2022

To understand the future fleet, the place to start is the FY 2022 budget proposal. The president’s budget proposes to construct only eight ships in FY 2022: two SSN-774 submarines, one DDG-51 destroyer, one FFG-62 frigate, one oiler, two towing/salvage/rescue ships, and one ocean surveillance ship. Although all count as battle force ships, only four are combatants. Congress might add ships in its final bills as it customarily does, another destroyer being the most likely addition, but the number of ships funded in FY 2022 will be low compared with recent shipbuilding budgets.³

The reason for the low number is that the Navy shipbuilding account declines from \$23.3 billion in FY 2021 to \$22.6 billion in FY 2022. This reflects the overall decline in the DOD budget. (For more information on this point, see the budget and strategy overview chapter.)

Table 2: Implied Fleet Size for Shipbuilding Rate and Service Life

Ship Construction/Year	Average life of 30 yrs	Average life of 35 yrs	Average life of 40 yrs
8 (FY 2022 rate)	240	280	320

Source: Department of the Navy, *Highlights of the Department of the Navy FY 2022 Budget* (Washington, DC: Department of Defense, 2021), 2–3, https://www.secnav.Navy.mil/fmc/fmb/Documents/22pres/Highlights_Book.pdf.

3. Both the Senate and the House authorization acts include money for a second destroyer. However, that depends on the higher top line, which authorization committees might not support. Senate Armed Services Committee, *FY 2022 National Defense Authorization Act* (Washington, DC: September 2021), <https://www.armed-services.senate.gov/imo/media/doc/FY22%20NDAA%20Executive%20Summary.pdf>; and House Armed Services Committee, *Summary of the National Defense Authorization Act for FY 2022* (Washington, DC: August 2021), https://armedservices.house.gov/_cache/files/1/3/13abf96a-7f26-48f0-8c54-c6b6d11e2715/0E2DB3E3B22B70F6BDAB86B4D728A433.20210830-fy22-ndaa-full-committee-summary-final.pdf.

Table 2 calculates fleet size with different assumptions about service life. Although building rates will change over time, the calculation gives insight into the implied long-term fleet size given today's budget. The table shows that the Navy will need to increase its building rate unless it holds onto its ships for a long time. Historically, the Navy has tended to retire ships early because of obsolescence or budget pressures.

This tendency to retire ships early appears in the FY 2022 budget. To save money over the long term, the budget proposes early retirement for five CG-47 cruisers, one dock landing ship (LSD), and four littoral combat ships (LCSs). The Navy has wanted to retire these cruisers and amphibious ships for many years, arguing that they are too expensive to modernize. Congress has often pushed back, arguing that the Navy needs numbers to meet its global commitments (see discussion below).

The LCSs proposed for retirement are not old, one being commissioned in 2017. The Navy argues that upgrading them to the current configuration would be too expensive. That the Navy is proposing to retire them so early is a statement of the program's shortfalls.

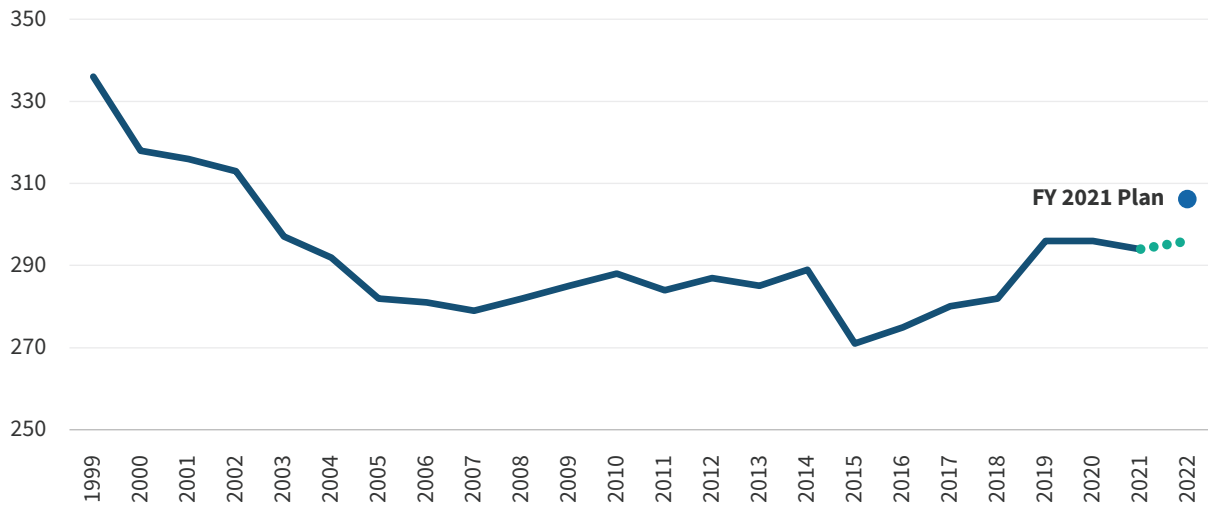
The “divest to invest” strategy—whereby the services retire current capabilities and invest the funds in future capabilities—may work in the long term, but in the short term, the Navy has the worst of both worlds: a constrained shipbuilding plan and a smaller fleet. The first chapter in this series, the budget and strategy overview, describes this strategy in detail.

Rightly or wrongly, the ship count is often used as a measure of Navy capacity, so Figure 5 gets a lot of attention.⁴ The total number of ships in the fleet increases slightly in FY 2022, from 294 in FY 2021 to 296, as previously funded ships join the fleet, but the FY 2021 plan had been to grow to 306.

In the short term, the Navy has the worst of both worlds: a constrained shipbuilding plan and a smaller fleet.

4. Admiral James Winnefeld, for one, argues that focus on ship count distorts decisionmaking. See James Winnefeld, “Charting a New Course for the U.S. Navy,” *Boston Globe*, November 8, 2015, <https://www.bostonglobe.com/opinion/2015/11/08/charting-new-course-for-navy/rJeaDKEDlZiXkpKEXIAFlN/story.html>.

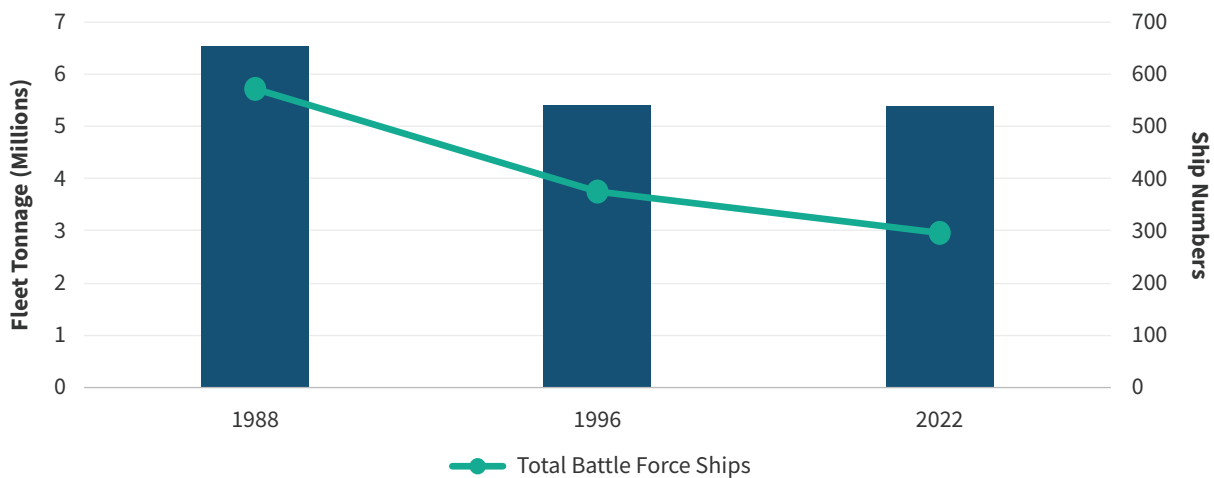
Figure 5: Total Navy Active Ships, 1999–2022



Note: The sharp dip in ship count from 2014 to 2015 was due to the retirement of the last FFG-7 Oliver Hazard Perry-class frigates and to the Navy changing its counting rules briefly in 2014 to include, and then exclude in 2015, patrol coastal craft and hospital ships. See Sydney J. Freedberg, Jr., “Outrage On Capitol Hill As Navy Changes Ship-Counting Rules,” *Breaking Defense*, March 11, 2014, <https://breakingdefense.com/2014/03/outrage-on-capitol-hill-as-Navy-changes-ship-counting-rules/>.

Source: Ship count 1999–2016 data from “U.S. Ship Force Levels: 1886 to Present,” Naval History and Heritage Command, <https://www.history.navy.mil/research/histories/ship-histories/us-ship-force-levels.html#2000>. Current and projected ship count from “FY 2022 President’s Budget,” Department of the Navy, n.d., 5, 15, https://www.secnav.navy.mil/fmc/fmb/Documents/22pres/DON_Press_Brief.pdf.

Figure 6: Ship Count and Tonnage of Navy Battle Force, 1988, 1996, 2022



Source: Ship numbers: “U.S. Ship Force Levels: 1886 to Present,” Naval History and Heritage Command, <https://www.history.navy.mil/research/histories/ship-histories/us-ship-force-levels.html>; and “FY 2022 President’s Budget,” Department of the Navy, n.d., https://www.secnav.navy.mil/fmc/fmb/Documents/22pres/DON_Press_Brief.pdf; Department of the Navy. Tonnage from Richard Sharpe, *Jane’s Fighting Ships 1988* (New York: Jane’s Pub., 1988); Richard Sharpe, *Jane’s Fighting Ships 1996* (New York: Jane’s Pub., 1996); Stephen Saunders, *Jane’s Fighting Ships 2019-2020* (New York: Jane’s Pub., 2019); and “U.S. Navy Ships,” U.S. Navy, n.d., https://www.Navy.mil/Navydata/our_ships.asp.

In part, the decline in ship numbers resulted from Navy decisions to buy bigger, more capable, and more expensive ships. As the chart on tonnage shows, the FY 2022 fleet will have 52 percent of the number of ships of 1988 (296 versus 565) but 83 percent of the tonnage. Today’s DDG-51 destroyer (Flight IIA)

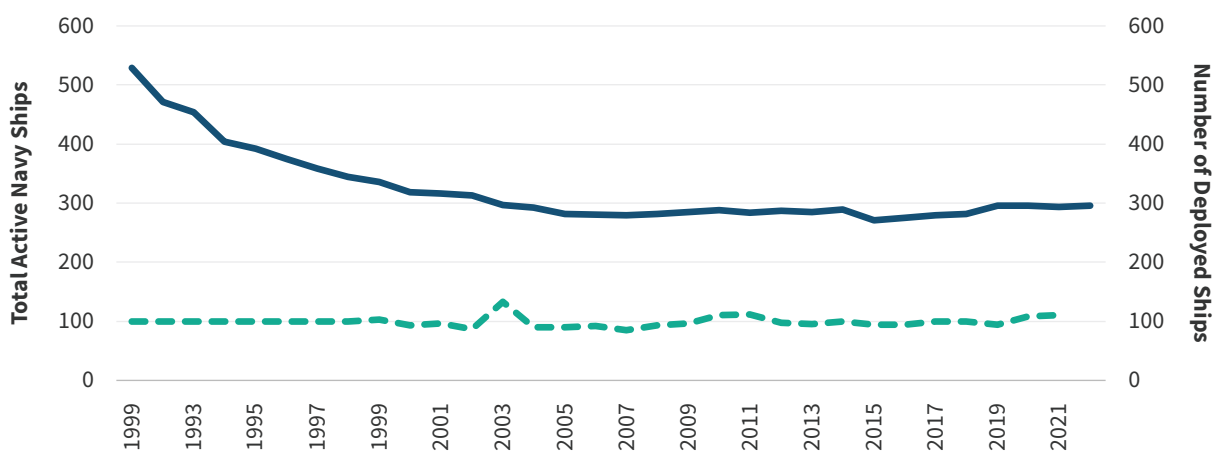
displaces 9,700 tons, twice the tonnage of a 1980s Charles F. Adams-class destroyer and four times the tonnage of a World War II Fletcher-class destroyer (2,500 tons). Indeed, the DDG-51 has the tonnage of a World War II cruiser. The increased size produces greater capability in the individual ship, but ships can only be in one place at a time.

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The Unrelenting Demands of Current Operations

Fleet size matters because it supports the level of naval deployments, but it is in tension with the “divest to invest” strategy. In their statements to Congress, both the acting secretary of the Navy and the chief of naval operations noted that the Navy is a “global force with global responsibilities.”⁵ The *CNO NAVPLAN* makes the broad argument: “Deployed forward, we provide U.S. leaders with quick response options for nearly any challenge—from confronting rivals to helping local populations recover from natural disasters. Our combat-credible presence creates and maintains influence abroad and ensures critical waterways remain open for commerce.”⁶ As a result, the average number of ships deployed has remained at the current level of about 100 for three decades, even though the number of ships has declined over time. The recent need to deploy to Europe (including in the Arctic and Mediterranean), theaters largely ignored since the end of the Cold War, adds to demands. To better cover Europe and the Atlantic, the Navy reactivated the Second Fleet headquarters in Norfolk.

Figure 7: Navy Fleet Size and Deployment Levels



Source: Ship count from “U.S. Ship Force Levels: 1886 to Present,” Naval History and Heritage Command, <https://www.history.navy.mil/research/histories/ship-histories/us-ship-force-levels.html>; and “FY 2022 President’s Budget,” Department of the Navy, n.d., https://www.secnav.navy.mil/fmc/fmb/Documents/22pres/DON_Press_Brief.pdf. Deployment levels from “FY 2022 President’s Budget,” Department of the Navy, 5, https://www.secnav.navy.mil/fmc/fmb/Documents/22pres/DON_Press_Brief.pdf; and previous year’s budget exhibits on operational tempo.

5. Thomas W. Harker and Michael M. Gilday, “Department of the Navy Fiscal Year 2022 Budget Request,” Statements before the House Armed Services Committee, 117th Cong., 1st sess., June 15, 2021, <https://armedservices.house.gov/hearings?ID=A0C361D6-51C0-48A2-95E7-269B80E69D83>.

6. Chief of Naval Operations *CNO NAVPLAN* (Washington, DC: Department of the Navy, January 2021), 3, <https://media.defense.gov/2021/Jan/11/2002562551/-1/-1/1/CNO%20NAVPLAN%202021%20-%20FINAL.PDF>.

The Navy reports that it can fulfill only about half of the theater commanders' requests for ships.⁷ Because these theater requests are not resource constrained, it is unsurprising that the requests greatly exceed what is available.

Nevertheless, this shortfall engenders a concern that the Navy is too small for the tasks that it is being asked to perform, hence the drive to expand. Admiral Michael Gilday was explicit: "It is my military advice that America needs a larger Navy."⁸ Many naval strategists echo this perspective: "The U.S. Navy is on the verge of strategic bankruptcy. Its fleet is not large enough to meet global day-to-day demands for naval forces."⁹ Congress has been sympathetic. Elaine Luria (D-VA), who represents the Norfolk area, with its heavy naval presence, has been particularly vocal in this regard, but there is a bipartisan consensus that the Navy needs to get larger.¹⁰

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The concern about numbers and deployments conflicts with guidance in the *Interim National Security Strategic Guidance* and the Trump administration's *National Defense Strategy* (NDS), both of which focus on great power conflict, especially against China, and call for capability, not capacity (size). Indeed, Admiral Gilday has stated explicitly that readiness and modernization come before capacity.

This tension appears in the secretary of the navy's recent guidance. On the one hand, it says that "the top priority for the Department of the Navy will be to develop concepts of operations and capabilities that bolster deterrence and expand our warfighting advantage vis-à-vis the People's Republic of China." On the other hand, its "top enduring priority" is "expanded forward presence . . . [and to] promote sustained, persistent mobile operations forward."¹¹

Future Fleet Architecture: A Work in Progress

The future fleet architecture—its size and composition—is a work in progress. The FY 2022 budget does not show any future years. That awaits the results of the ongoing strategic review and will appear in

7. John M. Richardson, "Subsurface Warfare at a Crossroads," Testimony before the House Committee on Appropriations, Subcommittee on Defense, 115th Cong., 2nd sess., January 18, 2018, <https://docs.house.gov/meetings/AS/AS03/20180118/106784/HHRG-115-AS03-Wstate-RichardsonJ-20180118.pdf>.

8. Harker and Gilday, "Department of the Navy Fiscal Year 2022 Budget Request," 8.

9. Christopher Dougherty, "Gradually and Then Suddenly: Explaining the Navy's Strategic Bankruptcy," War on the Rocks, June 30, 2021, <https://warontherocks.com/2021/06/gradually-and-then-suddenly-explaining-the-navys-strategic-bankruptcy/>; see also, among many others, Christopher Lehman, Sr., "We Need a Bigger Navy, Fast," Breaking Defense, January 27, 2021, <https://breakingdefense.com/2021/01/we-need-a-bigger-navy-fast-chris-lehman/>.

10. For one example among many, John Grady, "Luria: Navy Should Not Decommission Ships Early in Favor of New Construction," USNI News, March 16, 2021, <https://news.usni.org/2021/03/16/luria-navy-should-not-decommission-ships-early-in-favor-of-new-construction>.

11. Carlos Del Toro, *One Navy-Marine Corps Team: Strategic Guidance from the Secretary of the Navy* (Washington, DC: Department of the Navy, October 2021), https://media.defense.gov/2021/Oct/07/2002870427/-1/-1/0/SECNAV%20STRATEGIC%20GUIDANCE_100721.PDF.

the FY 2023 budget documents. However, the Biden administration did publish an illustrative 30-year shipbuilding plan. Further, two plans are left over from the Trump administration: the 355-ship fleet, the Trump administration’s official goal, and a Navy 30-year shipbuilding plan from December 2020 (“late Trump”). Together these plans give insight into what the future fleet might look like.

Compared to the 355-ship goal, which reflected long-time naval concepts, the recent fleet architectures share several characteristics:

- A larger fleet size but with more small ships, reflecting concepts of distributed operations;
- A larger submarine force, reflecting the need for stealth to operate within Chinese and Russian defensive zones;
- More logistics ships, reflecting a smaller ship design that can support widely distributed operations and sustain losses; and
- A large number of unmanned surface and subsurface vessels, but with uncertainty about the design and role of such vessels.¹²

All these fleet architectures require far more resources than have historically been allocated to shipbuilding. As a result, the actual fleet will likely be substantially smaller than these plans envision. Shrinking plans to fit the funds available will require some difficult and unpopular decisions such as the early retirement of ships and slowing construction of some ship types. Navy program guidance recognizes that “the Navy cannot afford to simultaneously develop the next generation of air, surface, and subsurface platforms and must prioritize these programs balancing the cost of developing next-generation capabilities against maintaining current capabilities.” However, these decisions are deferred to the FY 2023 budget and its associated five-year plan.¹³

The table below shows the different fleet architectures. It displays a total for “combatant force” because the large variations in support vessels make the totals for the different fleets look much larger than they are. The table also shows unmanned vessels separately because their numbers are large, uncertain, and far in the future. Detailed descriptions for each force element follow later in this chapter.

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12. The Navy generally uses “manned” and “unmanned” to describe its systems. To avoid confusion, this report follows the Navy usage rather than “crewed” and “uncrewed” that are taking hold in the broader community.

13. Secretary of the Navy, “Sec. of the Navy Strategic Guidance for Revised Program Objective Memorandum 2023,” June 4, 2021.

Table 3: Future Fleet Structures

Ship Type	Current Fleet (2022)	355-Ship Goal	Late-Trump	Emerging Biden
Aircraft Carriers (CVNs)	11	12	11 (8–11)	9–11
“Light Carriers”	–	–	0 (0–6)	–
Ballistic Missile Submarines (SSBN)	14	12	12	12
Attack Submarines (SSNs/SSGNs)	55	66	72 (72–78)	66–72
Large Surface Combatants (CGs/DDGs)	89	104	74 (73–88)	63–65
Small Surface Combatants (FFs/LCSs/mine warfare)	31	52	66 (60–67)	40–45
Landing helicopter assault/dock (LHA/LHD)	9	12	9 (9–10)	8–9
Other Large Amphibious Ships	22	26	57 (52–57)	19–19
Small Amphibious Ships	–	–	57 (52–57)	24–35
Combatant Force	231	284	301 (286–329)	238–268
Combat Logistics Force	30	32	69 (69–87)	56–75
Command and Support Ships	35	39	33 (27–30)	27–29
Total Battle Force	296	355	403 (382–446)	321–372
Large Unmanned Undersea Vessels	–	–	119 (119–166)	59–89
Large and Medium Unmanned Surface Vessels	–	–	24 (24–76)	18–51

Source: Department of the Navy, *Highlights of the Department of the Navy FY 2022 Budget* (Washington, DC: Department of Defense, 2021), Figure 4.2, https://www.secnav.navy.mil/fmc/fmb/Documents/22pres/Highlights_Book.pdf; Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020* (Washington, DC: Department of the Navy, March 2019), https://www.navy.mil/strategic/PB20_Shipbuilding_Plan.pdf; Office of the Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels* (Washington, DC: Department of the Navy, December 2020), https://media.defense.gov/2020/Dec/10/2002549918/-1/-1/1/SHIPBUILDING%20PLAN%20DEC%2020_NAVY_OSD_OMB_FINAL.PDF; and Office of the Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2022* (Washington, DC: Department of the Navy, June 2021), https://media.defense.gov/2021/Jun/17/2002744915/-1/-1/0/PB22%20SHIPBUILDING%20PLAN%20JUNE%202021_FINAL.PDF.

THE 355-SHIP FLEET

After candidate Trump, who had called for a 350-ship Navy, won the 2016 election, the Navy did a quick force structure assessment and came up with a goal of 355 ships. Compared with the 2014 goal of 308 ships, the Navy’s 355-ship goal added numbers in several categories but especially submarines (+18) and large surface combatants (LSCs) (+16). It focused on existing and proven ship types and included none of the nontraditional ships that appear in many recent alternative force structure proposals. The intention was to get ships built quickly, without the delay and risk of development programs. (Congress endorsed the Navy’s 355-ship goal: “It shall be the policy of the United States to have available, as soon as practicable, not fewer than 355 battle force ships.”¹⁴)

14. U.S. Congress, House, *National Defense Authorization Act for Fiscal Year 2018*, HR 2810, 115th Cong., 1st sess., December 12, 2017, Section 1025, <https://www.congress.gov/bill/115th-congress/house-bill/2810/text>.

However, the 355-ship goal collapsed because of strategy and money. The strategic problem was that it did not explicitly include unmanned systems, which were attracting a lot of attention. By focusing on large and expensive ships, it seemed inconsistent with a developing strategy of dispersed operations for combat in the Western Pacific.

The other problem was that the goal was too expensive. Both the Congressional Budget Office (CBO) and the Congressional Research Service (CRS) concluded that building such a fleet would require much larger shipbuilding budgets.¹⁵

Nevertheless, a fleet of about this size will be the goal cited by naval advocates, even if the specifics of the composition vary.

THE LATE TRUMP FLEET

Recognizing these problems, the Trump administration struggled to develop a new fleet architecture to replace the 355-ship structure. A Navy proposal in December 2019 failed to gain traction because of its high cost. DOD repeatedly delayed publication, greatly annoying Congress.¹⁶ Finally, on October 7, 2020, Secretary Mark Esper presented the outline of a future fleet. This future fleet, which he called “Battle Force 2045,” described the major elements but lacked detail. There was no written product to back up his oral presentation.¹⁷ In developing this future fleet, Esper took inputs from the Navy, the Office of Cost Assessment and Program Evaluation (CAPE), and a study by the Hudson Institute.¹⁸

Building on Secretary Esper’s proposal, the Navy published a shipbuilding plan on December 9, 2020.¹⁹ As this was published after the election and when the Trump administration was ending, the plan represented a statement of policy rather than a roadmap for implementation. This plan differed from Esper’s earlier statements in one important respect: whereas Esper had been positive about light carriers, this plan reflected the Navy’s skepticism, saying only that they were under consideration.

The plan also reflected DOD’s inability to settle on a path forward. The Navy’s report contained both a “Plan FY 45,” which had a specific number for each major fleet element, and a “future fleet architecture,” which had a range for each major fleet element.

15. For Navy costs, see Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020* (Washington, DC: DOD, March 2019), https://www.navy.mil/strategic/PB20_Shipbuilding_Plan.pdf; For CBO costs, see Eric Labs, “An Analysis of the Navy’s Fiscal Year 2020 Shipbuilding Plan,” Congressional Budget Office, October 2019, 3, <https://www.cbo.gov/system/files/2019-10/55685-CBO-Navys-FY20-shipbuilding-plan.pdf>. For the CRS analysis, see Ronald O’Rourke, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, CRS Report No. RL32665 (Washington, DC: Congressional Research Service, July 2019), <https://fas.org/sgp/crs/weapons/RL32665.pdf>.

16. Paul McLeary, “EXCLUSIVE SecDef Esper Seeks Detente with HASC; New Navy Plan This Summer,” *Breaking Defense*, February 28, 2020, <https://breakingdefense.com/2020/02/exclusive-secdef-esper-seeks-detente-with-hasc-new-navy-plan-this-summer/>.

17. “Defense Secretary Discusses National Defense Strategy,” (event, CSBA, Washington, DC, October 6, 2020), <https://www.defense.gov/Watch/Video/videoId/768646/>. For a detailed description of Esper’s future fleet, see Mark Cancian and Adam Saxton, “Sec. Esper Previews the Future Fleet,” CSIS, *Critical Questions*, October 8, 2020, <https://www.csis.org/analysis/secretary-esper-previews-future-navy>.

18. Brian Clark, Timothy Walton, and Seth Cropsey, *American Seapower at a Crossroads: A Plan to Restore the US Navy’s Maritime Advantage* (Washington, DC: Hudson Institute, September 29, 2020), <https://www.hudson.org/research/16406-american-sea-power-at-a-crossroads-a-plan-to-restore-the-us-navy-s-maritime-advantage>.

19. Office of the Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels* (Washington, DC: Department of the Navy, December 9, 2020), https://media.defense.gov/2020/Dec/10/2002549918/-1/-1/1/SHIPBUILDING%20PLAN%20DEC%202020_NAVY_OSD_OMB_FINAL.PDF.

CBO's analysis of this fleet concluded: "The December 2020 plan would require average annual shipbuilding appropriations almost 50 percent larger than the average over the past five years."²⁰ Larger numbers more than offset savings from procurement of smaller and less expensive ships.

THE EMERGING BIDEN FLEET

The Biden administration will not make a definitive statement about fleet architecture until it completes its various strategic reviews. However, it did publish a long-range shipbuilding plan with ranges for the various fleet elements.²¹ This fleet architecture looks a lot like that of the late Trump administration but with each fleet element squeezed to produce a smaller overall size.

The range may also reflect dueling architectures within DOD because the Navy is apparently conducting one assessment and the Office of Cost Assessment and Program Evaluation (CAPE) is conducting another. In the past, the Navy's architectures were larger, with some concern about day-to-day deployments, while CAPE's architectures were smaller and more tightly focused on China.²²

CBO estimated the cost of this plan as "\$25 billion-\$33 billion (in 2021 dollars) per year over 30 years compared with an average of about \$23 billion per year over the past five years."²³ At the low end of the range for fleet size, the larger proportion of small ships would almost offset the cost of the increased fleet size. At the high end of the range, the budget demands would be far more than what has recently been available.

CARRIERS

The carrier force has long been the centerpiece of the fleet, but recent force structure assessments have implied a reduction in the number of carriers. However, because of contractual commitments and political constraints, the Navy may be locked into the present carrier force for many years regardless of strategic considerations.

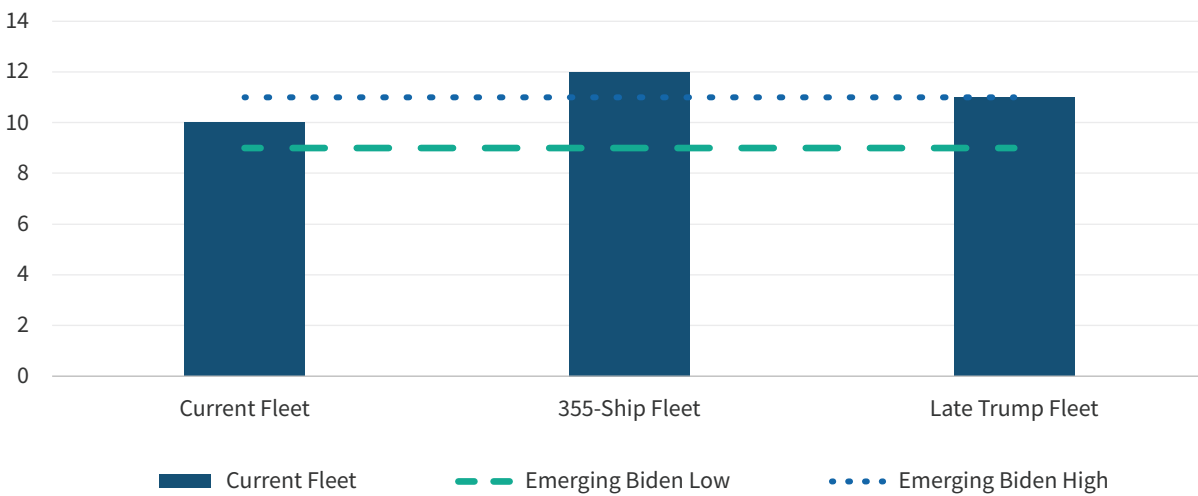
20. Congressional Budget Office, *An Analysis of the Navy's December 2020 Shipbuilding Plan* (Washington, DC: April 22, 2021), <https://www.cbo.gov/publication/57091>.

21. Office of the Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2022*.

22. Mallory Shelbourne and Sam LaGrone, "Pentagon, Navy Conducting Parallel Fleet Studies Ahead of Next National Defense Strategy," USNI News, September 21, 2021, <https://news.usni.org/2021/09/21/pentagon-navy-conducting-parallel-fleet-studies-ahead-of-next-national-defense-strategy>.

23. Labs, "An Analysis of the Navy's Fiscal Year 2022 Shipbuilding Plan."

Figure 8: Target Carrier Inventory



Source: Department of the Navy, *Highlights of the Department of the Navy FY 2022 Budget* (Washington, DC: Department of Defense, 2021), https://www.secnav.Navy.mil/fmc/fmb/Documents/22pres/Highlights_Book.pdf; Chief of Naval Operations, Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020* (Washington, DC: Department of the Navy, March 2019), https://www.navy.mil/strategic/PB20_Shipbuilding_Plan.pdf; Office of the Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels* (Washington, DC: Department of the Navy, December 2020), https://media.defense.gov/2020/Dec/10/2002549918/-1/-1/1/SHIPBUILDING%20PLAN%20DEC%2020_NAVY_OSD_OMB_FINAL.PDF; and Office of the Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2022* (Washington, DC: Department of the Navy, June 2021), https://media.defense.gov/2021/Jun/17/2002744915/-1/-1/0/PB22%20SHIPBUILDING%20PLAN%20JUNE%202021_FINAL.PDF.

Strategists have long criticized aircraft carriers because of their high cost and perceived vulnerability. Many strategists see large aircraft carriers as “legacy” systems, which the Biden administration has pledged to cut. A recent House Armed Services Committee study tentatively suggested to “shift funding from a single aircraft carrier and instead use multiple unmanned aerial vehicles.”²⁴

The many problems of the new Ford class have strengthened these criticisms. Although commissioned in 2017 and conducting at-sea operations, the Ford has not yet deployed. Although the Navy has resolved most technical problems and is confident that it can overcome the remaining challenges with the weapons elevators, the Ford’s inability to deploy casts a shadow over the program.²⁵

However, the highly visible usefulness of aircraft carriers for day-to-day crisis response and regional conflicts gives them a lot of support.²⁶ Pushed by Congress and an attractive offer from Huntington

24. House Armed Services Committee, *Future of Defense Task Force Report 2020* (Washington, DC: U.S. House, September 23, 2020), 67, https://armedservices.house.gov/_cache/files/2/6/26129500-d208-47ba-a9f7-25a8f82828b0/6D5C75605DE8DDF0013712923B4388D7.future-of-defense-task-force-report.pdf.

25. Ronald O’Rourke, *Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress*, CRS Report No. RS20643, (Washington, DC: Congressional Research Service, September 2021), <https://sgp.fas.org/crs/weapons/RS20643.pdf>.

26. Examples of the carrier debate this year: Dan Goure, “Why the Age of the Aircraft Carrier Isn’t Over Just yet,” Real Clear Defense, January 31, 2021, https://www.realcleardefense.com/articles/2021/02/01/why_the_age_of_the_aircraft_carrier_isnt_over_just_yet_658632.html; Talbot Manvel, “Aircraft Carriers: Bigger Is Better,” U.S. Naval Institute, *Proceedings*, September 2020, <https://www.usni.org/magazines/proceedings/2020/september/aircraft-carriers-bigger-better>; and Loren Thompson, “Why Nothing Can Replace Large Deck, Nuclear Powered Aircraft Carriers in US Strategy,” Forbes, September 14, 2021. The response: J. Vandenengel, “100,000 Tons of Inertia,” Naval Institute, *Proceedings*, May 2020, <https://www.usni.org/magazines/proceedings/2020/may/100000-tons-inertia>; Philip Pournelle, “Overemphasis on efficiency can endanger the fleet,” U.S. Naval Institute, *Proceedings*, Letter to the editor, October

Ingalls Industries (the carrier builder), the Navy executed a two-carrier procurement in January 2019.²⁷ This double procurement had the effect of locking in carrier construction for a decade regardless of what strategists might desire.

Because of contractual commitments and political constraints, the Navy may be locked into the present carrier force for many years regardless of strategic considerations.

The debate is important because the size of the carrier force drives Navy force structure and budgets: carriers and their escorts take up most of the shipbuilding budget and providing aircraft for the carriers takes most of the aviation budget.

Congress established a requirement for a minimum operational carrier force of 11. The Navy's "2016 Force Structure Assessment" ("355 ships") had a goal of 12, but this is nearly impossible to achieve because of the long lead time needed to build carriers.²⁸

Although the "late Trump" fleet goal gave a range of 8 to 11, Secretary Esper implied that the number would go down. Press reports indicated that the secretary's staff had recommended 9 carriers.²⁹ However, Admiral Gilday later stated, "when the report comes out, you'll see the same numbers for the supercarrier force."³⁰ The Navy and the Office of the Secretary of Defense seemed to be in different places here. The "emerging Biden" fleet goal shows a similar range of between 9 and 11 and offers the supportive description that aircraft carriers provide "the joint force's most survivable and adaptable aviation basing option."³¹

Faced with an institutional, political, and industrial need to continue building large nuclear-powered aircraft carriers, the Navy has periodically proposed retiring old carriers early, instead of doing a midlife extension, and may propose the same in the future. However, Congress rejected both previous proposals to do this, for the USS George Washington (CVN-74) and USS Harry Truman (CVN-75), and the Navy quickly backed down. The incongruity of buying new carriers while retiring old ones early was hard to justify. Further, such an approach constituted the highest-cost strategy for carrier procurement since a year of operational life gained from a midlife extension is much less costly than a year gained from new construction.³²

The Navy could propose building carriers on a slower timeline, for example, every eight years rather than every five years, but carrier advocates and the shipbuilding industry have prevailed against such a slowdown in the past.³³

2020, <https://www.usni.org/magazines/proceedings/2020/october/comment-discussion>.

27. For an extended discussion of the carrier debate, see Mark Cancian, *U.S. Military Forces in FY 2018: The Uncertain Buildup* (Washington, DC: CSIS, October 2017), 62, <https://www.csis.org/analysis/us-military-forces-fy-2018>.

28. Ronald O'Rourke, *Navy Ford Class (CVN-78) Aircraft Carrier Program: Background and Issues for Congress*, CRS Report No. RS20643 (Washington, DC: Congressional Research Service, September 2021), <https://sgp.fas.org/crs/weapons/RS20643.pdf>.

29. David Larter, "Defense Department Study Calls for Cutting Two of the U.S. Navy's Aircraft Carriers," *Defense News*, April 20, 2020, <https://www.defensenews.com/naval/2020/04/20/defense-department-study-calls-for-cutting-2-of-the-us-navys-aircraft-carriers/>.

30. "CNO ADM. Michael Gilday," *Defense One* Podcast, October 14, 2020, <https://www.defenseone.com/ideas/2020/10/ep-79-cno-adm-michael-gilday/169236/>.

31. Office of the Chief of Naval Operations, *Construction of Naval Vessels for Fiscal Year 2022*, 4.

32. Mark Cancian, "Penny Wise and Pound Foolish: The Navy's Carrier Construction Strategy," U.S. Naval Institute, *Proceedings*, March 2019, <https://www.usni.org/magazines/proceedings/2019/march/penny-wise-and-pound-foolish-navys-carrier-construction-strategy>.

33. Unlike the construction of other ships, Navy carriers are incrementally funded over many years. Thus, the Navy refers to the

“Light” Carriers: The idea of a “light” carrier—something smaller than the large CVN—has been around for decades. Recently, a RAND study indicated that such carrier options might be attractive, as have many commentators.³⁴ Senator John McCain in 2017 proposed building smaller carriers on the America-class landing helicopter assault (LHA) design. Esper’s future Navy had “up to six” light carriers to supplement the CVN “supercarriers.” He similarly suggested using the USS *America* “as a model.”

If future fleet architectures include small carriers, using the LHA design as a basis makes sense. LHAs have large flight decks from which the short-takeoff and landing version of the F-35 (B model) can fly. This approach also makes sense from a budget perspective because it avoids the huge costs and resulting delays of a new ship design. Strategists have long proposed using these ships as aircraft carriers for non-amphibious missions such as power projection and sea control.

The uniformed Navy has never supported small carriers, arguing that large carriers are the most cost-effective to put aircraft to sea. Thus, the “late Trump” fleet and the “emerging Biden” fleet both show light carriers as “under discussion.” Rear Admiral Gregory Harris, the Navy’s director of air warfare, was blunt in his opposition: “It will be good for us to [study light aircraft carriers], but I’m confident that over the long run we will find there is not a compelling return on investment to make a small carrier.”³⁵ Admiral Gilday also signaled his opposition.³⁶ Unless the Biden administration forcefully pushes this concept, smaller carriers will recede into the background once again.

LARGE SURFACE COMBATANTS

Large surface combatants (LSCs) are destroyers and cruisers. Historically, these constituted the backbone of the fleet. However, new concepts for distributed operations and attritable platforms favor small surface combatants and unmanned platforms rather than the large, capable, and expensive LSCs.

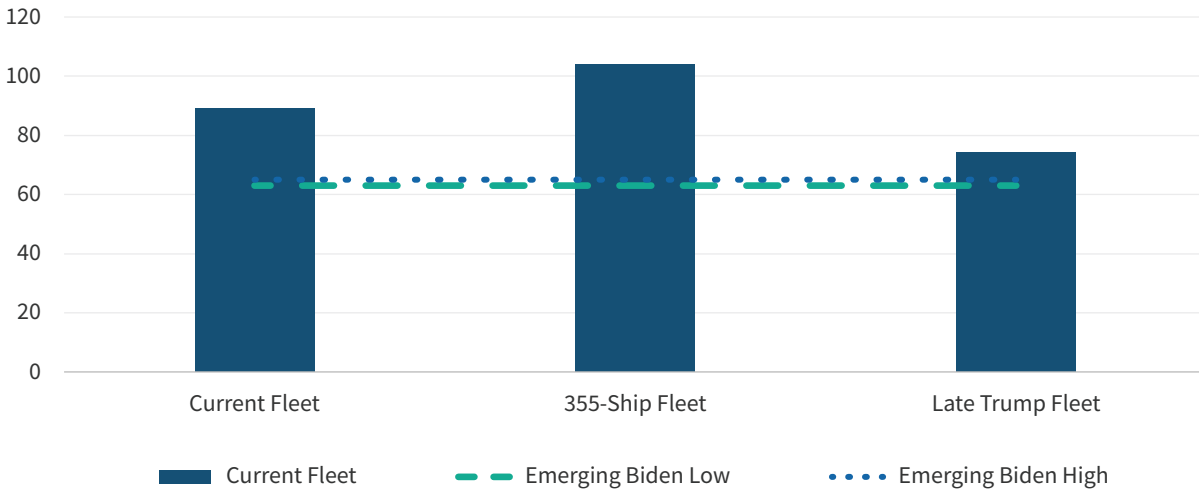
current carrier construction rate as “five-year centers” because there is no single year when the carrier is funded. However, Congress does officially authorize the carrier in an early year of that stream of funding.

34. Bradley Martin and Michael McMahon, *Future Aircraft Carrier Options* (Santa Monica, CA: RAND Corporation, 2017), https://www.rand.org/pubs/research_reports/RR2006.html; and Pete Pagano, “The CVL’s Time Has Come,” U.S. Naval Institute, *Proceedings*, September 2021, <https://www.usni.org/magazines/proceedings/2021/september/cvls-time-has-come>. For a sample of other commentary, Andrew Rucker, “The Little Carriers That Could,” U.S. Naval Institute, *Proceedings*, June 2021, <https://www.usni.org/magazines/proceedings/2021/june/little-carriers-could>; and Ens G.I. Heinemann, “Bring Back the CVLs,” U.S. Naval Institute, *Proceedings*, June 2019, <https://www.usni.org/magazines/proceedings/2019/june/bring-back-cvls>.

35. Aiden Quigley, “Harris: Navy Likely Doesn’t Need Light Aircraft Carriers, but Will Study Concept,” Inside Defense, March 31, 2021, <https://insidedefense.com/daily-news/harris-navy-likely-doesnt-need-light-carriers-will-study-concept>.

36. Patrick Tucker, “Chief of Naval Operations Outlines Plans for Drones, Many Carriers,” *Defense One*, October 13, 2020, <https://www.defenseone.com/policy/2020/10/chief-naval-operations-outlines-future-drones-minicarriers/169204/>.

Figure 9: Target Inventory for Large Surface Combatants



Source: Department of the Navy, *Highlights of the Department of the Navy FY 2022 Budget* (Washington, DC: Department of Defense, 2021), https://www.secnav.Navy.mil/fmc/fmb/Documents/22pres/Highlights_Book.pdf; Chief of Naval Operations, Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020* (Washington, DC: Department of the Navy, March 2019), https://www.navy.mil/strategic/PB20_Shipbuilding_Plan.pdf; Office of the Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels* (Washington, DC: Department of the Navy, December 2020), https://media.defense.gov/2020/Dec/10/2002549918/-1/-1/1/SHIPBUILDING%20PLAN%20DEC%2020_NAVY_OSD_OMB_FINAL.PDF; and Office of the Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2022* (Washington, DC: Department of the Navy, June 2021), https://media.defense.gov/2021/Jun/17/2002744915/-1/-1/0/PB22%20SHIPBUILDING%20PLAN%20JUNE%202021_FINAL.PDF.

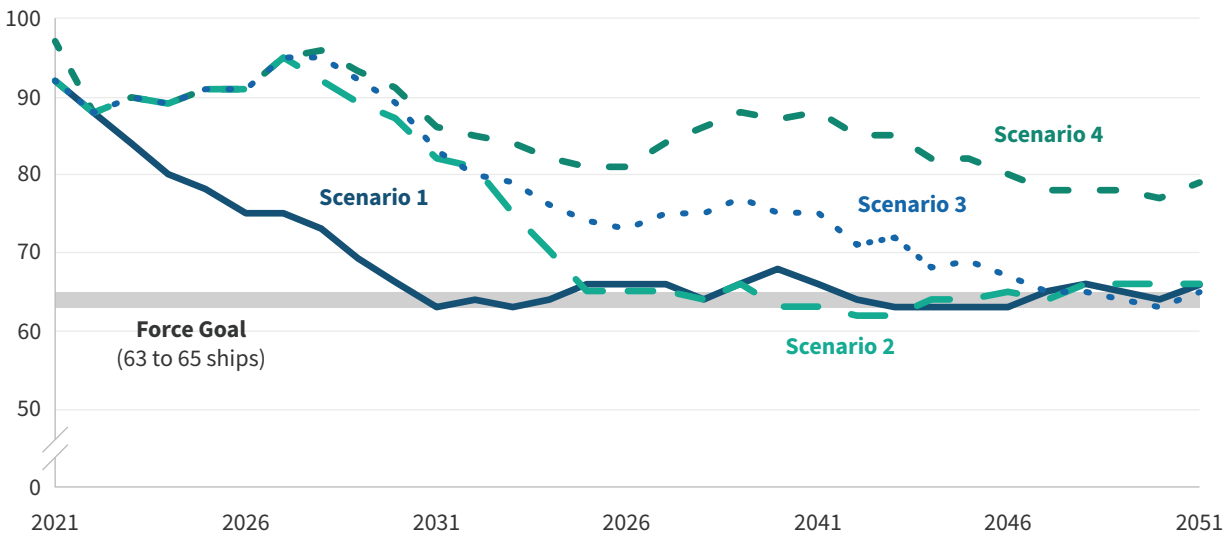
The current inventory is 94, and the Navy had been building toward the 355-ship goal of 104. The Biden administration’s goal is an extremely narrow band between 63 and 65, showing a high degree of certainty. The disparity between current inventory and fleet goals is so great that bringing them together will require brutal decisions on retirements and new builds.³⁷ This will produce a political firestorm.

To begin closing the gap in FY 2022, the Navy proposes to retire seven of the cruisers. The Navy will also not extend the service lives of the older DDG-51s. Concerned about a shrinking ship inventory, Congress has repeatedly balked at retiring these ships in the past.

CBO did an excellent analysis of Navy options, portions of which are reproduced below with permission.

37. See, for example, Craig Hooper, “Pentagon Plan Sets Navy Up to Quickly Shed 30% of Cruiser and Destroyer Fleet,” *Forbes*, June 23, 2021, <https://www.forbes.com/sites/craighooper/2021/06/23/dod-plan-sets-navy-up-to-quickly-shed-30-of-cruiserdestroyer-fleet/>.

Figure 10: Size of the LSC Force under Four Scenarios



Source: Eric Labs, “An Analysis of the Navy’s Fiscal Year 2022 Shipbuilding Plan,” Congressional Budget Office, September 2021, 5, https://www.cbo.gov/system/files/2021-09/57414-Shipbuilding_1.pdf. Reproduced with permission.

The Navy could reduce its large surface combatant force by shortening the service life of existing destroyers, by decreasing the rate at which it procures new destroyers, or by combining both methods.

Under Scenario 1, the Navy would retire ships quickly to meet force goals by 2030 and would maintain the size of the force with a steady-state build rate of 1.8 destroyers per year.³⁸

Maintaining the current building rate would make industry happy. However, this requires retiring about 35 ships 1 to 12 years early. As with aircraft carriers, there is an incongruence in retiring ships early and building similar ships at an undiminished rate.³⁹

Under Scenario 2, the Navy would maintain a steady-state build rate of 2 destroyers per year and would reduce the size of the force with retirements by 2035.⁴⁰

This has all the drawbacks of Scenario 1 but delays most of the pain to the 2030s. That is attractive politically because the pain falls in a later administration. The number of early retirements would be even larger than in Scenario 2 because of the continuing construction.

Under Scenario 3, the Navy would maintain the 35- to 40-year service life for destroyers and buy one new destroyer per year through 2036 and 2 new destroyers per year thereafter.⁴¹

This would be the most cost-effective way of getting to the target inventory. Ships already built would operate for their full service life while industry continues to build new destroyers, though at a slower rate.

38. Labs, “An Analysis of the Navy’s Fiscal Year 2022 Shipbuilding Plan.”

39. The number of retirements calculated from the December 9, 2020 shipbuilding plan, accelerating planned retirements to get from the projected FY 2030 level (100) to the target level (65).

40. Labs, “An Analysis of the Navy’s Fiscal Year 2022 Shipbuilding Plan.”

41. Ibid.

This mostly affects Maine (Bath Iron Works) and Mississippi (Huntington Ingalls Industries) because they are the prime contractors for destroyers, but suppliers are all over the country. At a building rate of one destroyer per year, these shipyards would have to alternate, resulting in a substantial reduction in activity and workforce. It would be particularly difficult for Bath Iron Works because destroyers are its principal output. Huntington Ingalls Industries produces other ships and thus could absorb the reduction more easily. However, Congress has viewed two a year as a minimum in the past.

In theory, the Navy could stop destroyer production altogether and get to the target level more quickly without retiring ships early. However, this is not viable from an industrial base and political perspective. The Navy needs to buy some destroyers every year.

Under Scenario 4, the Navy would maintain the 35- to 40-year service life for destroyers and buy two new destroyers per year (the current rate of purchase).⁴²

This is, essentially, the recent policy and would be comfortable for Congress and industry. However, it does not get close to the target goal.

Next-Generation LSC: Shipbuilding plans continue to show some version of a next-generation LSC (DDG(X)). The Navy envisions a larger ship with room to accommodate growth in combat systems.⁴³ However, most of the funding is in the future beyond the five-year planning period, indicating that such plans are in flux. Although the Navy will eventually need a new design for an LSC, the program will have a hard time competing for resources when the Navy is making such large reductions in the number of LSCs. Near-term resources for the DDG(X) are modest, with the Navy requesting \$122 million in FY 2022. Several earlier attempts to start a new cruiser/destroyer program faded away as the Navy focused on upgrading the DDG-51 class, now on its Flight III variant.

Fewer Missile Launchers: A major effect of cuts to the LSC force is that the number of missile launchers would decline. CBO concluded: “Under the Navy’s 2022 plan, the surface forces (manned and unmanned) would eventually have between 3 percent and 24 percent fewer vertical launch system cells than today’s fleet.”⁴⁴

This is a difficult trade-off because many naval observers identify missile capacity as a better measure of naval capability than ship numbers or tonnage and initial missile salvos are widely seen as potentially decisive in fleet engagements. Further, as described later in the unmanned surface vessel (USV) section, retirements of LSCs and their missile capacity may occur before large numbers of USVs join the fleet to replace the capacity.

SMALL SURFACE COMBATANTS

Small surface combatants (SSCs) are frigates, littoral combat ships (LCSs), and mine countermeasures ships.⁴⁵ Although smaller and less capable than cruisers and destroyers, they cost half as much. Their role dimmed with the end of the Cold War and the failure of the LCS class but has revived with the strategic interest in distributed operations and attritable platforms.

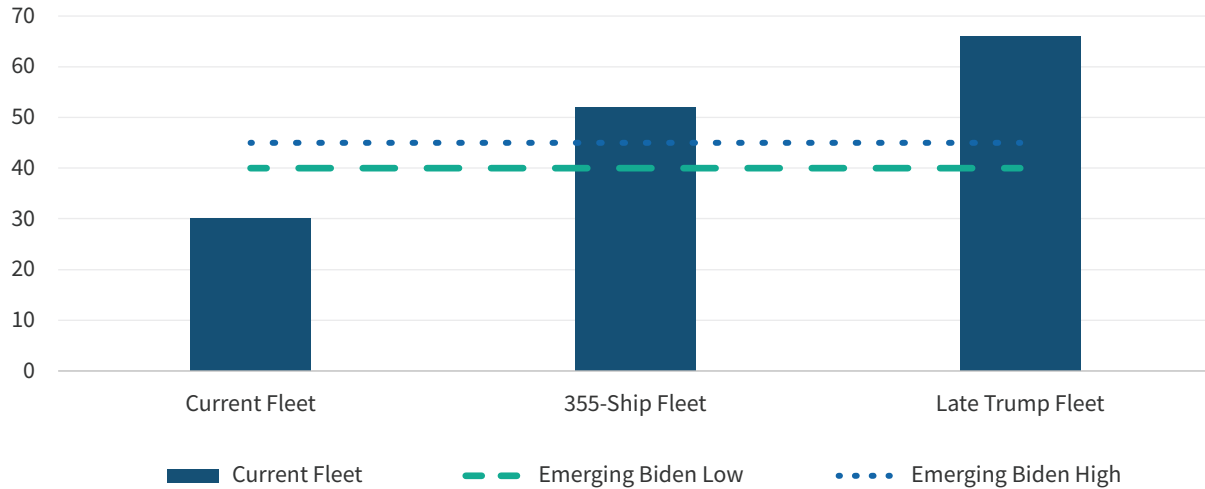
42. Ibid.

43. Ronald O'Rourke, “Navy DDG(X) Next – Generation Destroyer Program: Background and Issues for Congress,” Congressional Research Service, September 15, 2021, <https://crsreports.congress.gov/product/pdf/IF/IF11679/>.

44. Labs, “An Analysis of Navy’s FY 2022 Shipbuilding Plan,” 8.

45. The Navy includes patrol craft in this category but not in the battle force inventory, so they are excluded here. The general rule is that ships must be able to deploy overseas on their own to count, and patrol craft are too small.

Figure 11: Target Inventory for Small Surface Combatants



Source: Department of the Navy, *Highlights of the Department of the Navy FY 2022 Budget* (Washington, DC: Department of Defense, 2021), https://www.secnav.Navy.mil/fmc/fmb/Documents/22pres/Highlights_Book.pdf; Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020* (Washington, DC: Department of the Navy, March 2019), https://www.navy.mil/strategic/PB20_Shipbuilding_Plan.pdf; Office of the Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels* (Washington, DC: Department of the Navy, December 2020), https://media.defense.gov/2020/Dec/10/2002549918/-1/-1/1/SHIPBUILDING%20PLAN%20DEC%2020_NAVY_OSD_OMB_FINAL.PDF; and Office of the Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2022* (Washington, DC: Department of the Navy, June 2021), https://media.defense.gov/2021/Jun/17/2002744915/-1/-1/0/PB22%20SHIPBUILDING%20PLAN%20JUNE%202021_FINAL.PDF.

During the Cold War, SSCs had a wartime mission of escorting convoys. This mission disappeared after the Cold War, and SSCs went out of favor. However, interest has renewed in an environment of great power competition where adversaries can reach out extended distances and threaten U.S. sea lines of communication. SSCs are also useful for providing a more distributed naval force structure to operate within an adversary’s defensive zone and for conducting gray zone activities in peacetime when large naval forces would be inappropriate. They can operate in shallower waters such as the South China Sea and increase total fleet numbers, therefore allowing the Navy to be present in more places globally.

All the future fleet architectures show an increase in SSCs, the only question being by how much.

The LCS class is now entering the fleet in large numbers, typically two to three per year. However, the performance of this class is widely regarded as disappointing, and the Navy proposes retiring the first four ships instead of upgrading them. At the same time, the Navy also proposes to upgrade LCSs with naval strike missiles, antisubmarine modules, and anti-mine capabilities, all of which will improve their capabilities.⁴⁶ Nevertheless, whether to retire more LCSs early will be a continuing issue. In particular, the Navy may move to retire the Freedom-class LCSs, which have serious, class-wide problems with their propulsion plants.

Because LCSs with mine countermeasure modules are now entering the fleet, the Navy proposes to phase out the eight remaining mine countermeasures ships (MCM-1 Avenger-class), retiring all by 2024.

46. Paul McCleary, “Navy Unveils Surprise Plan for Littoral Combat Ships,” *Breaking Defense*, April 29, 2021, <https://breakingdefense.com/2021/04/navy-unveils-surprise-plan-for-littoral-combat-ships/>.

Replacing the LCS program is a follow-on frigate program, the FFG-62 Constellation class, which will be multi-mission like the earlier FFG-7 class and not single-mission like the LCSs. To speed introduction of the class and to reduce risk—both driven by the experience of the LCS program—the Navy required the use of an existing design. A team led by Fincantieri/Marinette Marine won the competition with a modified European design.⁴⁷

Table 4: Shipbuilding Plans for FFG-62 Class

	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026
FY 2021 Five-year Plan (February 2020)⁴⁸	1	1	2	2	3	-
Trump Administration’s Final Plan (December 9, 2020)⁴⁹	1	2	3	3	4	4
Biden FY 2022 Plan (June 2021)⁵⁰	1	2	3	3	4	4

Source: For more details, please reference the corresponding footnotes.

All these plans show a rapid increase in production. If implemented, the SSC fleet would reach the inventory goal relatively quickly. However, as noted earlier, the late Trump plan and the emerging Biden plan assume a large increase in shipbuilding resources, which may not materialize.

Using an existing design may mitigate technical risk, but there is also risk of cost growth. The CBO places the cost per ship at potentially 40 percent higher than the Navy is currently estimating. That would be a major challenge for the program.⁵¹

AMPHIBIOUS SHIPS

The amphibious fleet, like the LCSs, is in a state of flux as a result of new operational concepts and plans for smaller ships. If fully implemented, these plans will reduce the number of large amphibious ships that the Navy and Marine Corps have become accustomed to and disrupt the associated shipbuilding industry. However, long-range shipbuilding plans have not yet caught up with these planned changes.

47. Ronald O’Rourke, *Navy Constellation (FFG-62) Class Frigate (Previously FFG[X]) Program: Background and Issues for Congress*, CRS Report No. R44972 (Washington, DC: Congressional Research Service, September 2021), <https://sgp.fas.org/crs/weapons/R44972.pdf>.

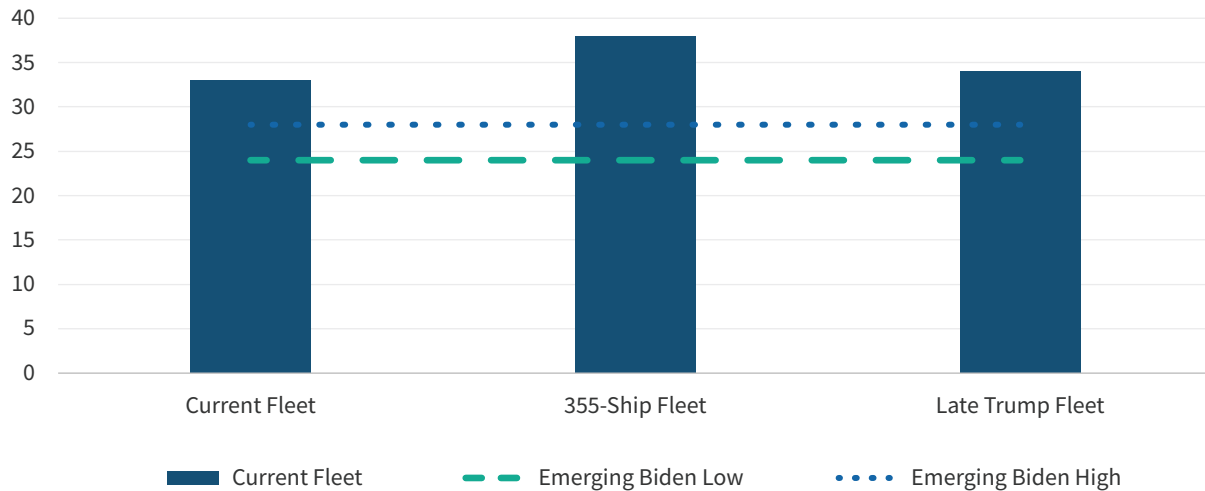
48. Ronald O’Rourke, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, CRS Report No. RL32665 Version 334 (Washington, DC: Congressional Research Service, April 22, 2021), 12, <https://crsreports.congress.gov/product/pdf/RL/RL32665/334>.

49. Deputy Chief of Naval Operations (Warfighting Requirements and Capabilities- OPNAV-N9), *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels* (Washington DC: Office of the Chief of Naval Operations, December 9, 2020), https://media.defense.gov/2020/Dec/10/2002549918/-1/-1/1/SHIPBUILDING%20PLAN%20DEC%2020_NAVY_OSD_OMB_FINAL.PDF.

50. Deputy Chief of Naval Operations (Warfighting Requirements and Capabilities- OPNAV N9), *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2022* (Washington DC: Office of the Chief of Naval Operations, June 2021), https://media.defense.gov/2021/Jun/17/2002744915/-1/-1/0/PB22%20SHIPBUILDING%20PLAN%20JUNE%202021_FINAL.PDF.

51. Eric Labs, “The Cost of the Navy’s New Frigate,” Congressional Budget Office, October 2020, <https://www.cbo.gov/system/files/2020-10/56669-New-Frigate-Program.pdf>.

Figure 12: Target Inventory for Large Amphibious Ships (LSD/LPD/LHA/LHD)



Note: Numbers for “late Trump” fleet were estimated because the plan used different categories.

Source: Department of the Navy, *Highlights of the Department of the Navy FY 2022 Budget* (Washington, DC: Department of Defense, 2021), https://www.secnav.Navy.mil/fmc/fmb/Documents/22pres/Highlights_Book.pdf; Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020* (Washington, DC: Department of the Navy, March 2019), https://www.navy.mil/strategic/PB20_Shipbuilding_Plan.pdf; Office of the Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels* (Washington, DC: Department of the Navy, December 2020), https://media.defense.gov/2020/Dec/10/2002549918/-1/-1/1/SHIPBUILDING%20PLAN%20DEC%2020_NAVY_OSD_OMB_FINAL.PDF; and Office of the Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2022* (Washington, DC: Department of the Navy, June 2021), https://media.defense.gov/2021/Jun/17/2002744915/-1/-1/0/PB22%20SHIPBUILDING%20PLAN%20JUNE%202021_FINAL.PDF.

The Biden administration’s fleet would have 8 to 9 landing helicopter assault/docks (LHAs/LHDs) and 16 to 19 dock landing platforms (LPDs), for a total of 24 to 28 large amphibious ships. Figure 12 shows the problem: target fleet size is smaller than the current fleet and previous fleet architectures.

This situation arose because the Marine Corps radically changed its plans for amphibious operations. For many years, the Navy and Marine Corps goal was 38 large ships. Driving this goal was the need to launch an amphibious operation of two Marine expeditionary brigades (17 ships each) plus a 10 percent margin for maintenance.

Marine Commandant General David Berger rejected this methodology in his initial commandant’s guidance (described in detail in the Marine Corps chapter). He argued that large amphibious ships were vulnerable in a great power conflict and that the ability of the Navy and Marine Corps to execute a classic landing in the high-threat environment foreseen by the NDS seemed doubtful: “Visions of a massed naval armada nine nautical miles off-shore in the South China Sea preparing to launch the landing force in swarms of ACVs [amphibious combat vehicles], LCUs [landing craft utilities], and LCACs [landing craft air cushions] are impractical and unreasonable.”⁵²

Instead, he proposed smaller amphibious ships that would focus on the narrow mission of moving forces into China’s “weapons engagements zone” in the Western Pacific. Increased numbers would also make the

52. General David Berger, *Commandant’s Planning Guidance* (Washington, DC: Department of the Navy, 2019), 5, https://www.hqmc.marines.mil/Portals/142/Docs/%2038th%20Commandant%27s%20Planning%20Guidance_2019.pdf?ver=2019-07-16-200152-700.

loss of any individual ship less catastrophic. This approach would reverse a long-standing trend toward larger and more capable amphibious ships, which are more efficient for moving Marine forces and for peacetime presence but expensive and limited in number.

The Marine Corps originally planned that these small amphibious ships would be in addition to the planned number of large amphibious ships, an assumption reflected in the Esper and the late Trump fleet architectures. However, a trade-off was inevitable. The FY 2022 shipbuilding plan states, “the overall number of amphibious warships grows to support the more distributed expeditionary force design, with light amphibious warships (LAWs) complementing a smaller number of traditional amphibious warships.”

The shipbuilding problem is that the fleet already includes nearly all the large amphibious ships that the new plan requires. Completed or under construction are 8 LHDs/LHAs, 13 LPDs, and 2 LPD Flight IIs—a total of 23 of the needed 24 to 28.⁵³

As a previous CSIS analysis concluded:

At the low end of the range [8], the Navy would stop building LHDs for about a decade because the current inventory is sufficient. At the high end [9], the Navy would build an LHD every four to five years. Neither level requires replacing the Bonhomme Richard (LHD-6), which was destroyed in a fire. That is just a loss to the fleet.

The [Biden administration’s] plan implies curtailing the LPD-17 Flight-II program at three to six ships, far below the expected 13 ships. Indeed, at the lower level, the Navy would build just one more LPD-17 Flight-II in addition to the two already under construction.

This is bad news for HII [Huntington Ingalls Industries], which builds both the LHDs and the LPDs. The company has wisely proposed a multi-year buy of LPDs and an LHD, seeking to lock in the programs for the near term.⁵⁴

As with the LSCs, industrial base and constituency interests will clash with the new shipbuilding goals.

The [amphibious] shipbuilding problem is that the fleet already includes nearly all the large amphibious ships that the new plan requires.

The new class of light amphibious warships has its own set of issues. The 2022 shipbuilding plan cites a range of 24 to 35, roughly comparable to what the late Trump administration had shown.⁵⁵ The Navy is still considering designs and probably will not build the first LAW until FY 2023 at the earliest.

53. Ronald O’Rourke, *Navy LPD-17 Flight II and LHA Amphibious Ship Programs: Background and Issues for Congress*, CRS Report No. R43543 (Washington, DC: Congressional Research Service, September 2021), Table I, 8, <https://fas.org/sgp/crs/weapons/R43543.pdf>.

54. Mark Cancian, “Stormy Waters Ahead for Amphibious Shipbuilding Plan,” *Breaking Defense*, July 1, 2021, <https://breakingdefense.com/2021/07/stormy-waters-ahead-for-amphibious-shipbuilding-plan/>.

55. The Marine Corps says that its analysis sets “a minimum of 35 [LAW] ships.” *Force Design 2030: Annual Update* (U.S. Marine Corps, April 2021), 6, <https://www.marines.mil/Portals/1/Docs/2021%20Force%20Design%20Annual%20Update.pdf>.

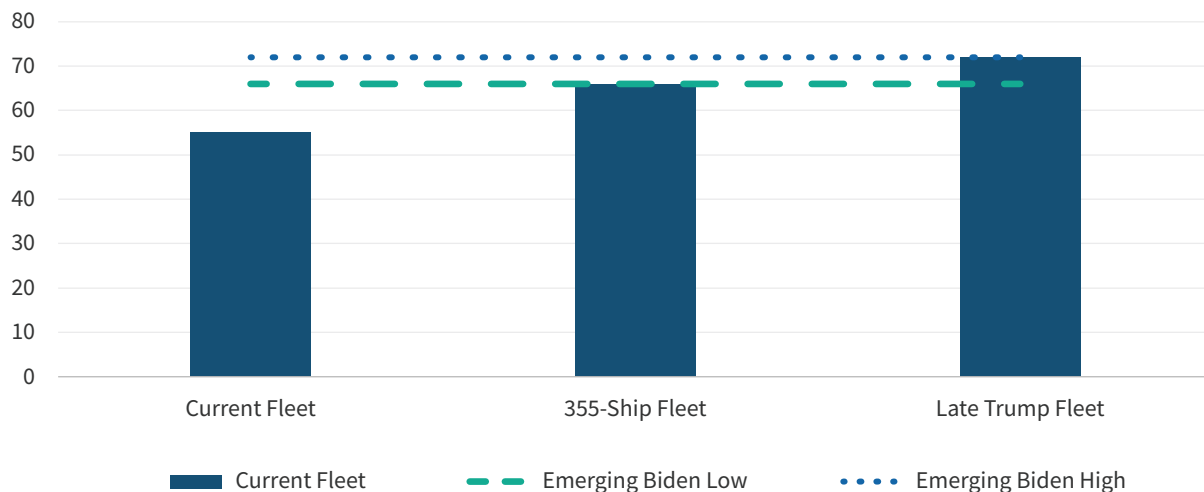
These LAWs would indeed be small, carrying 30 to 40 crew and 70 Marines. This would make them about the size of a World War II landing craft infantry (LCI), much smaller than the De Soto County-class tank landing ship (LSTs) of the 1960s to 1990s, and even smaller than World War II LSTs.⁵⁶

If the Navy diverted some LHAs/LHDs to operations as light carriers, the amphibious force would look even more different in the future, but as noted in the carrier discussion, the fielding of light carriers, at least officially, is looking increasingly unlikely.

ATTACK SUBMARINES

Attack submarines (SSNs) and cruise missile submarines (SSGNs) receive strong support from strategists because their firepower and covertness are useful in great power conflicts. However, submarines are expensive (about \$3.5 billion each in the current Block V version), and the submarine industrial base is producing at its maximum rate, so increasing the size of the submarine fleet is difficult.

Figure 13: Target Inventory for Attack Submarines (SSNs and SSGNs)



Source: Department of the Navy, *Highlights of the Department of the Navy FY 2022 Budget* (Washington, DC: Department of Defense, 2021), https://www.secnav.Navy.mil/fmc/fmb/Documents/22pres/Highlights_Book.pdf; Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020* (Washington, DC: Department of the Navy, March 2019), https://www.navy.mil/strategic/PB20_Shipbuilding_Plan.pdf; Office of the Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels* (Washington, DC: Department of the Navy, December 2020), https://media.defense.gov/2020/Dec/10/2002549918/-1/-1/1/SHIPBUILDING%20PLAN%20DEC%202020_NAVY_OSD_OMB_FINAL.PDF; and Office of the Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2022* (Washington, DC: Department of the Navy, June 2021), https://media.defense.gov/2021/Jun/17/2002744915/-1/-1/0/PB22%20SHIPBUILDING%20PLAN%20JUNE%202021_FINAL.PDF.

Figure 13 shows how support for submarines has increased. The current fleet reflects the lower production rates of the 1990s and 2000s when the focus was on regional conflicts and the Navy built one or fewer submarines a year. The large inventory from the Cold War kept the fleet size high. The increased SSN goal in the 355-ship fleet reflected a renewed focus on great power conflict. The “late Trump” administration goal and the “emerging Biden” administration goals are even higher.

56. Paul McLeary, “If It Floats, It Fights: Navy’s New Small Ship Strategy,” *Breaking Defense*, August 28, 2020, <https://breakingdefense.com/2020/08/if-it-floats-it-fights-navys-new-small-ship-strategy>; and Joseph Trevithick, “Navy Wants to Buy 30 New Light Amphibious Warships to Support Radical Shift in Marine Ops,” *The Drive*, May 5, 2020, <https://www.thedrive.com/the-war-zone/33299/navy-wants-to-buy-30-new-light-amphibious-warships-to-support-radical-shift-in-marine-ops>.

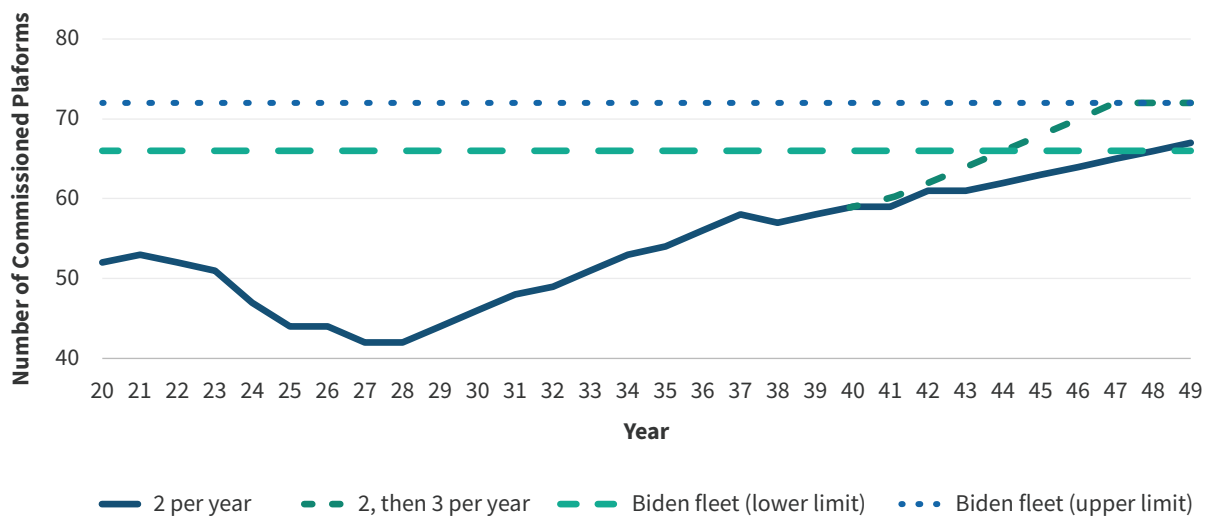
The problem is getting to these higher goals. The obvious solution is to build more submarines, but having two submarine construction programs operating simultaneously (Columbia-class SSBNs and Virginia-class SSNs) puts pressure on the shipbuilding account and the submarine industrial base.

Building two SSNs and one SSBN per year costs about \$13 billion in a Navy’s shipbuilding account that totals \$18.1 billion for new construction in FY 2022.

Further, there were only two yards that build submarines, Electric Boat in Groton, Connecticut, and Huntington Ingalls Industries in Norfolk, Virginia.⁵⁷ The FY 2020 Navy 30-year shipbuilding plan showed a capacity for three total submarines per year, SSNs or SSBNs.⁵⁸ The FY 2022 shipbuilding plan states: “We continue to evaluate the industrial base capacity increase required for more consistent delivery of two SSNs per year during the Columbia serial production and subsequent potential increases to SSN procurement.”⁵⁹ In other words, the Navy needs to invest money in the shipyards, both for facilities and workforce, just to achieve the planned building rate of two SSNs and one SSBN per year. Expanding production capacity beyond this would be even more expensive, and having made that expansion, the Navy would be committed to funding the higher level of production.⁶⁰

The recently announced Australia-United Kingdom-United States agreement to build nuclear submarines for the Australian Navy could put additional pressure on the U.S. submarine industrial base, depending on what arrangements come out of the 18-month planning phase.⁶¹

Figure 14: Projected Attack Submarine Fleet, FY 2020–FY 2049



Source: Data from Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020* (Washington, DC: Department of the Navy, March 2019), https://www.navy.mil/strategic/PB20_Shipbuilding_Plan.pdf; and Ronald O’Rourke, *Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress*, CRS Report No. RL32418 (Washington, DC: Congressional Research Service, September 14, 2021), <https://sgp.fas.org/crs/weapons/RL32418.pdf>.

57. Ronald O’Rourke, *Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress*, CRS Report No. RL32418 (Washington, DC: Congressional Research Service, September 14, 2021), <https://sgp.fas.org/crs/weapons/RL32418.pdf>.

58. This analysis of shipbuilding capacity appeared only in the FY 2020 shipbuilding plan. Subsequent plans do not include that exhibit.

59. Deputy Chief of Naval Operations (Warfighting Requirements and Capabilities- OPNAV N9), “Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2022,” 4.

60. The Navy has a plan for improving public shipyards, which do maintenance, but no current plan for expanding private yards.

61. “Remarks by President Biden, Prime Minister Morrison of Australia, and Prime Minister Johnson of the United Kingdom Announcing the Creation of AUKUS,” The White House, September 15, 2021, <https://www.whitehouse.gov/briefing-room/speeches-remarks/2021/09/15/remarks-by-president-biden-prime-minister-morrison-of-australia-and-prime-minister-johnson-of-the-united-kingdom-announcing-the-creation-of-aucus/>.

In the near term, the attack submarine fleet is stable, with numbers staying in the fifties. The problem is longer term. Numbers dip in the mid-2020s, bottoming at 42 boats as Los Angeles-class boats built during the 1980s retire.⁶²

To mitigate this trough, the Navy will extend the service life of some older Los Angeles-class submarines and may expand that program. However, the Navy tends to retire old ships early in order to buy new ships, and the Biden administration’s “divest to invest” strategy would drive them in this direction.⁶³

This prospective submarine shortfall will happen when Russian and Chinese submarines are becoming more capable and active.⁶⁴ Retirement of the Ohio-class SSGNs (converted ballistic missile submarines with 154 tactical missiles each) in the late 2020s greatly reduces the undersea strike capability and exacerbates the numbers shortfall. The missile compartments of the newest Virginia-class submarines, with the Virginia Payload Module, will mitigate the capability shortfall but not fully replace it for many years.

Figure 14 shows two alternative futures. One line assumes that the Navy builds two SSNs per year, which has been its target level for many years (solid line). Fleet size recovers as these new ships join the fleet, reaching the bottom of the Biden target range in the late 2040s.

The alternative (dotted line) assumes that the Navy builds three SSNs per year once production of the Columbia class ends. Under these circumstances, the submarine fleet reaches the lower level of the Biden fleet four years earlier and at the upper level of the range in the late 2040s.

The fundamental problem is that neither approach gets to the target size until far into the future. Regardless of what strategists may want, the submarine fleet has severe limits on its size.

Regardless of what strategists may want, the submarine fleet has severe limits on its size.

BALLISTIC MISSILE SUBMARINES

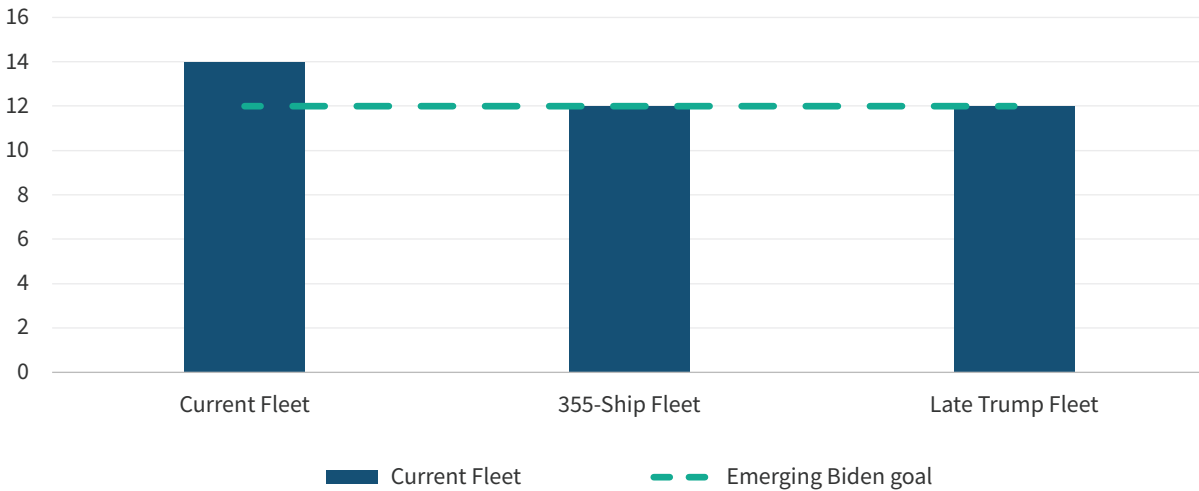
The Columbia-class SSBN program (SSBN 826)—which will replace the existing Ohio-class submarines—continues as planned. Because the program is the Navy’s highest priority, enjoys strong bipartisan support, and has little schedule slack, it will likely be unaffected by any changes in future shipbuilding plans. All the different fleet architectures—the 355-ship, late Trump, and emerging Biden administration plans—have the same goal of 12. (This is lower than the current inventory of 14 because the Columbia class will spend less time in overhaul. Thus, 12 Columbia-class boats will have the same operational coverage as the current 14 Trident boats.)

62. Chief of Naval Operations, *Construction of Naval Vessels for Fiscal Year 2020*.

63. The December 9, 2020, shipbuilding plan assumed an extended service life for many Los Angeles-class submarines and a higher building rate for submarines—three SSNs per year in some years. Since neither of these initiatives were reflected in the Trump administration’s final five-year program, the projection here uses the earlier shipbuilding plan.

64. For example, Kathleen H. Hicks et al., *Undersea Warfare in Northern Europe* (Washington, DC: CSIS, July 2016), <https://www.csis.org/analysis/undersea-warfare-northern-europe>.

Figure 15: Target Inventory for Ballistic Missile Submarines (SSBNs)



Source: Department of the Navy, *Highlights of the Department of the Navy FY 2022 Budget* (Washington, DC: Department of Defense, 2021), https://www.secnav.Navy.mil/fmc/fmb/Documents/22pres/Highlights_Book.pdf; Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020* (Washington, DC: Department of the Navy, March 2019), https://www.navy.mil/strategic/PB20_Shipbuilding_Plan.pdf; Office of the Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels* (Washington, DC: Department of the Navy, December 2020), https://media.defense.gov/2020/Dec/10/2002549918/-1/-1/1/SHIPBUILDING%20PLAN%20DEC%202020_NAVY_OSD_OMB_FINAL.PDF; and Office of the Chief of Naval Operations, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2022* (Washington, DC: Department of the Navy, June 2021), https://media.defense.gov/2021/Jun/17/2002744915/-1/-1/0/PB22%20SHIPBUILDING%20PLAN%20JUNE%202021_FINAL.PDF.

Despite the program’s strong position, it has three challenges: affordability, funding mechanisms, and potential cost growth.

The affordability challenge comes from the substantial budget demands—\$5.0 billion in FY 2022 (procurement plus research, development, testing, and evaluation [RDT&E])—and these demands have more than doubled from FY 2020.⁶⁵ Affordability of the \$110 billion program, long identified as a challenge for Navy shipbuilding, has become a near-term, rather than long-term, issue. The Navy has gained permission to incrementally fund the class, which spreads the costs over more years, but the bill must still be paid eventually.

There have been proposals to find other funding mechanisms for the Columbia class, for example, through a National Sea-based Deterrence Fund. However, none of these mechanisms have resulted in substantially increased funds for Navy shipbuilding.⁶⁶

CBO has questioned the Navy’s cost estimates, noting that the cost per ton for submarines has been higher than what the Navy is planning. CBO’s cost estimate is 10 percent higher, or \$700 million, per Columbia-class submarine than the Navy’s estimate. The Government Accountability Office has similarly questioned

65. Office of the Under Secretary of Defense Comptroller, *Program Acquisition Cost by Weapon System for FY 2022* (Washington, DC: Department of Defense, May 2021), 6-3, https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2022/FY2022_Weapons.pdf.

66. Ronald O’Rourke, *Navy Columbia Class (SSBN-826) Ballistic Missile Submarine Program: Background and Issues for Congress*, CRS Report No. R41129 (Washington, DC: Congressional Research Service, Updated September 14, 2021), <https://sgp.fas.org/crs/weapons/R41129.pdf>.

DOD's cost estimate.⁶⁷ Problems with welds and electric motors caused some program delays. So far, the Navy has acknowledged \$637 million in design cost increases but has not changed cost estimates for production, although it acknowledges the risk. Reports that the Navy is looking at ways to extend the Ohio-class submarines for a few years indicate possible schedule problems with the Columbia class. With schedule delays come cost increases.⁶⁸

Because of this program's high priority, it will be fully funded. However, any substantial cost growth here would severely disrupt every other shipbuilding program as resources flow from them to the Columbia class. This would, in turn, affect the structure of the future fleet.

UNMANNED SHIPS

Unmanned systems, both surface and undersea, currently exist in various forms, from essentially conceptual to working prototypes. However, none (with one minor exception) yet constitute a program of record whereby the Navy commits to a certain number and builds all the needed support and infrastructure. How unmanned systems will operate in the fleet, whether the network can handle the bandwidth, and where these vessels will be based are all unanswered questions.

The Navy released its *Unmanned Campaign Framework* in March 2021, delineating its priorities for all forms of unmanned systems. The goal is to move to a more "distributed system" in which unmanned systems will perform the "three D" missions: "dangerous, dirty, and dull."⁶⁹ In this campaign framework, the Navy breaks its unmanned systems into four domains: air, surface, undersea, and ground. While both the ground and air domains have unmanned vehicles that have passed into regular serial production, unmanned surface vehicles (USVs) and unmanned undersea vehicles (UUVs) remain at the prototype phase.

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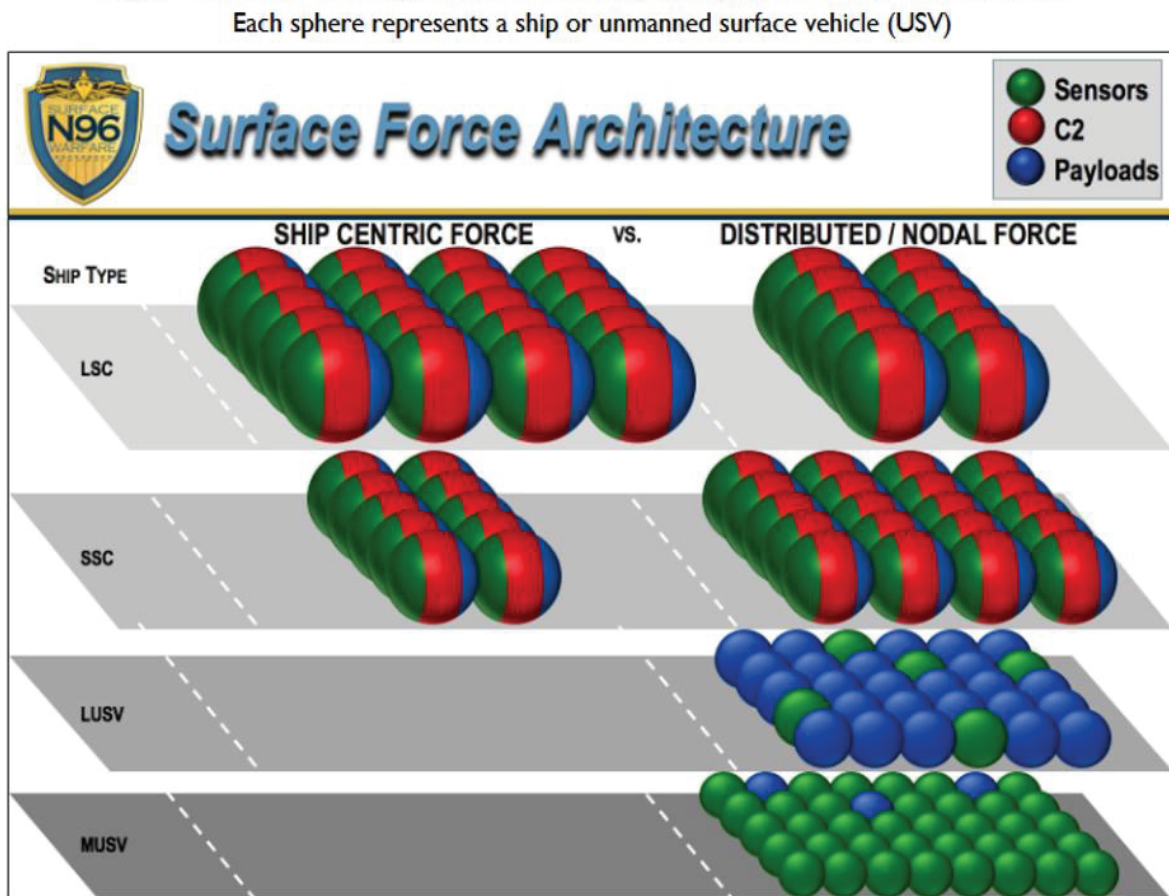
Unmanned Surface Vehicles: The Navy envisions this technology as an important element of its "distributed maritime operations," moving from a fleet of large combatant ships to a mixture of large combatants, small combatants, and unmanned vessels. This move will distribute sensors and payloads broadly, providing both remote sensors and "mobile magazines" to the larger combatants.

67. Labs, "Navy's Fiscal Year 2020 Shipbuilding Plan," 19–21. CBO has not changed its estimate. Government Accountability Office, *Columbia-Class Submarine Overly Optimistic Cost Estimate Will Likely Lead to Budget Increases* (Washington, DC: April 2019), <https://www.gao.gov/products/GAO-19-497>.

68. Megan Eckstein, "Navy May Extend the Life of Ohio SSBNs to Provide Cushion for Introduction of Columbia Class," USNI News, November 16, 2020, <https://news.usni.org/2020/11/16/navy-may-extend-life-of-ohio-ssbns-to-provide-cushion-for-introduction-of-columbia-class>.

69. Ronald O'Rourke, *Very Large Unmanned and Undersea Vehicles: Background and Issues for Congress*, CRS Report No. R45757 (Washington, DC: Congressional Research Service, September 15, 2021), 1, <https://crsreports.congress.gov/product/pdf/R/R45757>.

Figure 16: Navy Surface Force Architecture



Source: Casey Moton, “Designing & Building the Surface Fleet: Unmanned and Small Combatants,” (presentation, American Society of Naval Engineers, June 20, 2019), slide 2. Cited in Ronald O’Rourke, “Future Force Structure Requirements for the United States Navy,” House Armed Services Committee, Subcommittee on Seapower and Projection Forces, 116th Cong, 2nd sess., June 4, 2020, <https://crsreports.congress.gov/product/pdf/TE/TE10057>.

This also implies a reduction in large surface combatants as small surface combatants and unmanned vessels replace sensors and magazines.⁷⁰ All future naval architectures reflect this shift, as noted earlier. The challenge for the Navy is that it may retire the large surface combatants before large numbers of unmanned vessels are available to replace their capabilities.

Navy efforts in developing USVs focus on large (LUSV) and medium (MUSV) USVs.⁷¹

An LUSV is defined as a vehicle 200 to 300 feet in length, about the size of a corvette. The Navy plans to use them as “mobile adjunct magazines,” adding their missile loads to those of regular surface forces in the strike warfare and anti-surface warfare missions.⁷²

70. Reproduced from Ronald O’Rourke, “Future Force Structure Requirements for the United States Navy,” Written Testimony before Committee on Armed Service, Subcommittee on Seapower and Projection Forces, 116th Cong., 2nd sess., June 4, 2020, 27, <https://docs.house.gov/meetings/AS/AS28/20200604/110772/HRG-116-AS28-Wstate-ORourkeR-20200604.pdf>.

71. “Department of the Navy Unmanned Campaign Framework,” Department of the Navy, March 16, 2021, 15, https://www.navy.mil/Portals/1/Strategic/20210315%20Unmanned%20Campaign_Final_LowRes.pdf?ver=LtCZ-BPIWki6vCBTdgtDMA%3D%3D.

72. Ibid., 15.

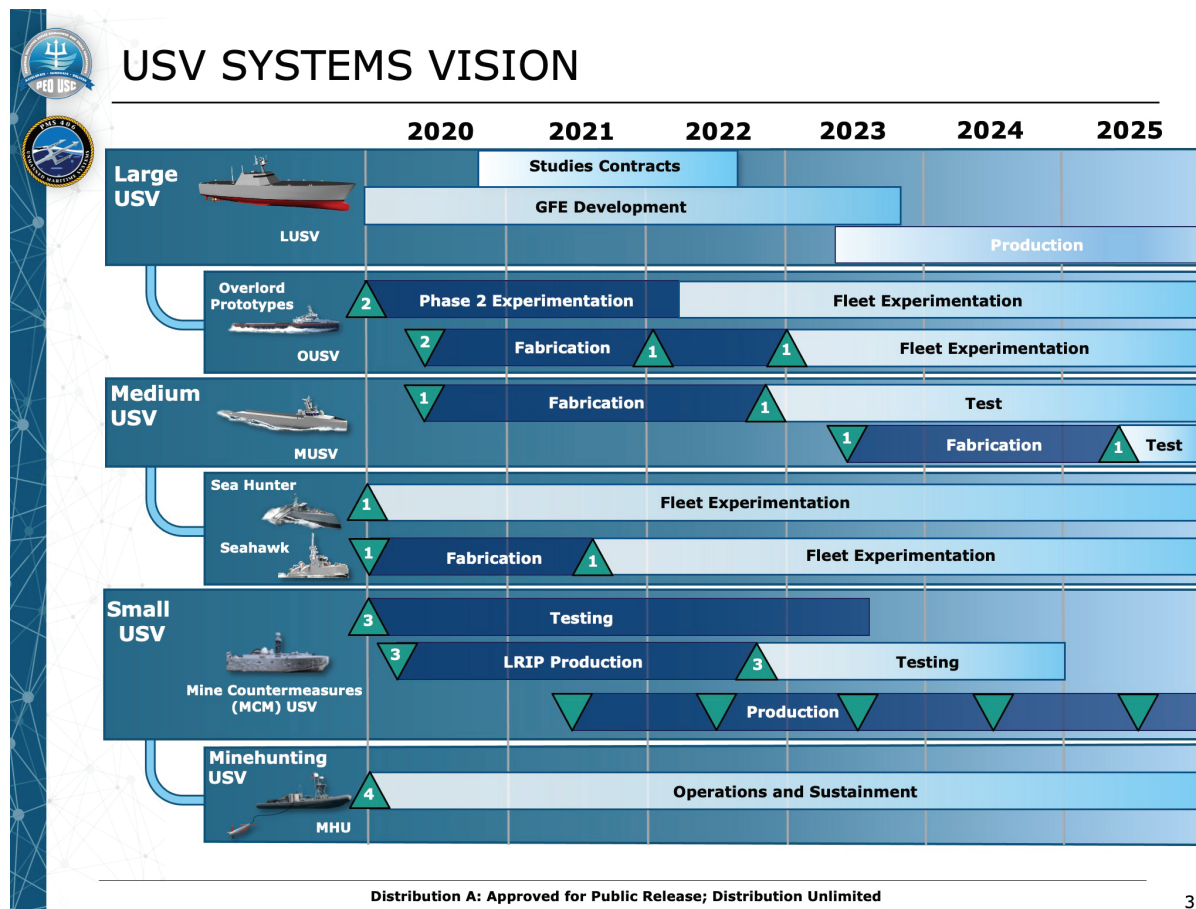
An MUSV is 45 to 190 feet long, about the size of a patrol craft.⁷³ The MUSV and smaller platforms will act as remote sensor platforms, focusing on antisubmarine and mine warfare applications. The prototype *Sea Hunter* is an example; the Navy requested funds for a second prototype in the FY2022 budget.

The large and medium USVs remain in an experimental phase for the foreseeable future, structured as “build, test, learn.”

There are also small USVs, the primary mission of which is mine warfare, with the platform forming an integral part of the LCS’s mine countermeasures (MCM) mission module. However, the Navy is exploring other uses and applications for these small USVs apart from the LCS mission. The Marine Corps is developing a long-range USV “to enhance maritime reconnaissance and long-range precision fires.”⁷⁴

Figure 17 shows the planned acquisition timeline for unmanned surface warfare platforms.⁷⁵

Figure 17: Navy Architecture for Unmanned Surface Vessels



Source: Pete Small, “PMS 406 Unmanned Maritime Systems,” (briefing, NDIA Undersea Warfare Conference, March 24, 2021), slide 3. Cited in Ronald O’Rourke, *Very Large Unmanned and Undersea Vehicles: Background and Issues for Congress*, CRS Report No. R45757 (Washington, DC: Congressional Research Service, September 2021), 1, <https://crsreports.congress.gov/product/pdf/R/R45757>.

73. O’Rourke, *Very Large Unmanned and Undersea Vehicles*, 1.

74. “Department of the Navy Unmanned Campaign Framework,” Department of the Navy.

75. Small, “PMS 406 Unmanned Maritime Systems,” 3.

The Navy calls this experimentation program Ghost Fleet Overlord, a partnership with DOD’s Strategic Capabilities Office. The program uses converted civilian vessels as testbeds. During this past summer, for example, Ghost Fleet Overlord ships completed a mostly autonomous crossing of the Pacific Ocean, conducting 98 percent of a 4,421 nautical mile journey without human intervention.⁷⁶ To facilitate this experimentation process, the Navy set up a new operational command, Unmanned Surface Vessel Division.⁷⁷

Table 5 below describes each USV program and its funding status. The “FY 2022 (Projected)” column represents the amount that was planned for FY 2022 in the FY 2021 budget. The “FY 2022 (Requested)” represents the amount in the FY 2022 budget. All funding for these systems is in the RDT&E account since the systems are still experimental.

Table 5: Budget and Status of Unmanned Surface Vessels

Program	Mission	FY 2021	FY 2022 (Projected)	FY 2022 (Requested)	Notes
LUSV	“Adjunct Magazine”	69.6	377.2	144.8	Four development units have been acquired, with further production delayed until FY 2027.
MUSV	“Distributed Sensor”	55.5	30.0	60.0	One vessel was acquired in FY 2019, and another is scheduled to be acquired in FY 2023, with option for additional units as they become technically feasible.
SUSV	Mine Countermeasure/ Mine Hunting	19.1	16.3 (As minesweeping replacement)	20.3	This a key component of the LCS MCM mission package, along with the Knifefish UUV. Currently, it is pending a full-rate production decision.

Source: Department of Defense, *Fiscal Year (FY) 2022 Budget Estimates: Justification Book Volume 2 of 5: Research, Development, Test, & Evaluation, Navy* (Washington, DC: May 2021), https://www.secnav.navy.mil/fmc/fmb/Documents/22pres/RDTEN_BA4_Book.pdf.

Funding for the LUSV is down substantially from what was planned (-\$233 million), reflecting congressional skepticism about the proposed speed of acquisition and its \$341 million (60 percent) cut in the program’s FY 2021 budget.⁷⁸ The new plan is to use the four Ghost Fleet Overlord units already appropriated as testbeds to ensure the maturity of core technologies before further production. This is a major change from last year’s planning, which projected buying 10 units over a five-year period.

76. “Ghost Fleet Overlord Unmanned Surface Vessel Program Completes Second Autonomous Transit,” U.S. Department of Defense, press release, June 7, 2021, <https://www.defense.gov/News/Releases/Release/Article/2647818/ghost-fleet-overlord-unmanned-surface-vessel-program-completes-second-autonomou/>.

77. Paul McLeary, “New Navy Command to Oversee Unmanned Ships As They Work with the Fleet,” *Breaking Defense*, March 25, 2021, <https://breakingdefense.com/2021/03/navys-unmanned-ships-plans-teaming-with-zumwalt-in-major-new-test>.

78. David Larter, “Unclear on Unmanned: the Navy’s Plans for Robot Ships Are on the Rocks,” *Defense News*, January 10, 2021 <https://www.defensenews.com/digital-show-dailies/surface-navy-association/2021/01/10/unclear-on-unmanned-the-us-navys-plans-for-robot-ships-are-on-the-rocks/>.

Although the platform budgets may be down overall, development of USV “enabling technologies” would increase to \$170 million in FY 2022, up from \$22 million in FY 2021.

Also apparent from the table is that, despite the attention that USVs receive in discussions about the future Navy, the amount of funding is remarkably small.

Despite the attention that USVs receive in discussions about the future Navy, the amount of funding is remarkably small.

Unmanned Undersea Vehicles: The Navy is approaching UUVs similarly to USVs, with a variety of programs, a robust program of experimentation but no immediate production plans for the larger vessels, a measured pace, and relatively little funds invested.

A key difference is that there seems to be a different philosophy on how UUVs will be used. Whereas USVs will supplant some manned systems, UUVs will be a force multiplier for their motherships, which will not decrease in numbers.

UUVs come in four sizes, from extra large to small. Extra-large UUVs (XLUUVs), vehicles with a diameter larger than 84 inches, are unique in being pier launched from a forward port rather than launched from a mothership, which is characteristic of all smaller UUVs. The Orca project, the only XLUUV program, will initially provide a minelaying capability, with the platform deploying a successor version of the CAPTOR antisubmarine mine.⁷⁹

Large UUVs (LUUVs) are defined as platforms between 21 inches and 54 inches in diameter, too large for heavyweight torpedo tubes, necessitating launch from submarines equipped with a dry dock shelter or a surface ship boat davit. The only LUUV system is the Snakehead, designed to provide intelligence preparation of the ocean environment (IPOE).⁸⁰

Medium UUVs (MUUVs) are systems with a diameter larger than 10 inches but less than 21 inches, allowing torpedo tube deployment. The two MUUV missions are IPOE and MCM.

Last are the Small UUVs, which are smaller than 10 inches and perform simple sensor functions, generally on a tether.

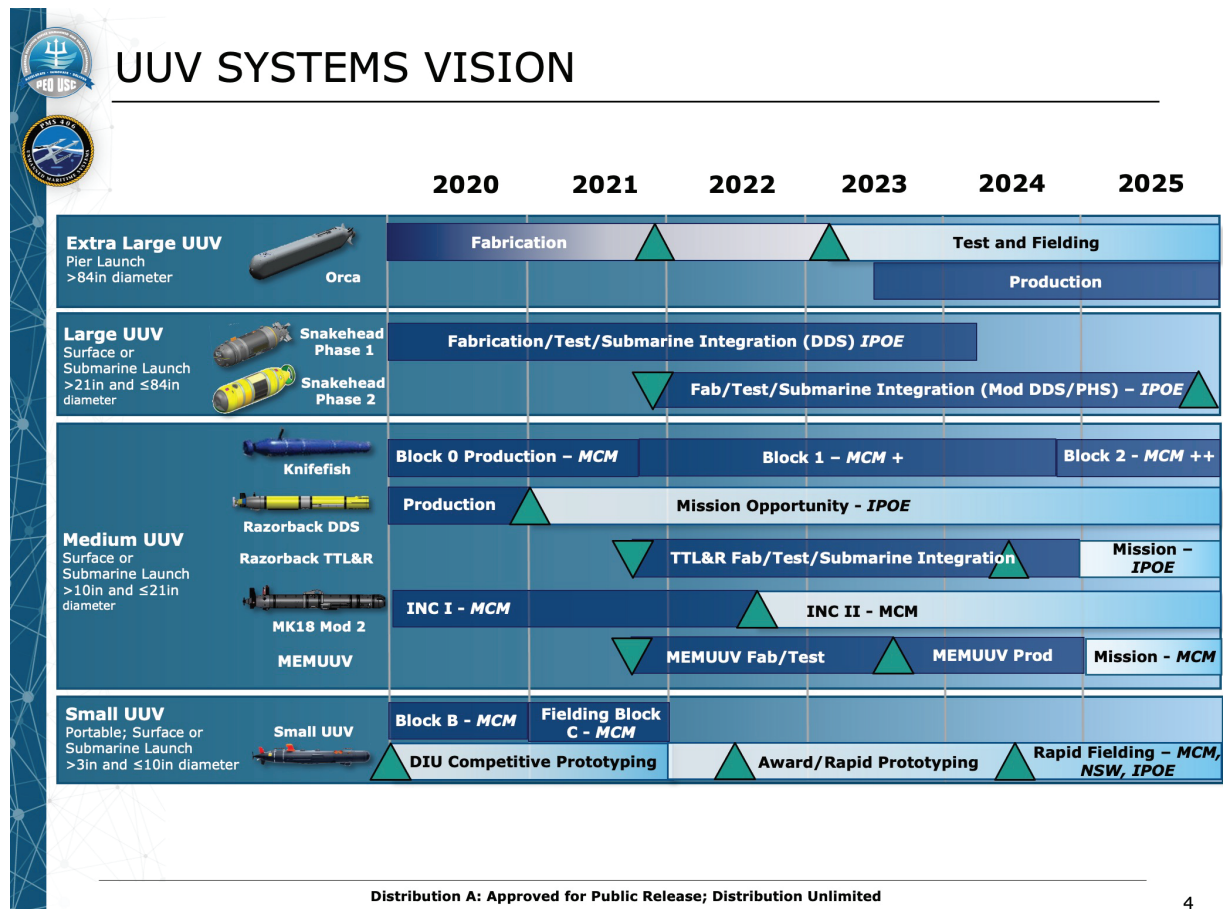
Figure 18 shows current plans for Navy UUV programs.⁸¹ As with the USVs, the larger UUVs remain in an experimental stage for the foreseeable future, funded in the RDT&E appropriation. Some of the smaller UUVs have entered production.

79. O'Rourke, *Very Large Unmanned and Undersea Vehicles*, 16.

80. IPOE is the process of reconnoitering a section of ocean during an extended period. This is designed to establish “cycle of life” for the ocean environment, shipping traffic density, and biosphere.

81. Small, “PMS 406 Unmanned Maritime Systems,” 4.

Figure 18: Navy Architecture for Unmanned Undersea Vessels



Source: Pete Small, “PMS 406 Unmanned Maritime Systems,” (briefing, NDIA Undersea Warfare Conference, March 24, 2021), slide 4. Cited in Ronald O’Rourke, *Very Large Unmanned and Undersea Vehicles: Background and Issues for Congress*, CRS Report No. R45757 (Washington, DC: Congressional Research Service, September 2021), 1, <https://crsreports.congress.gov/product/pdf/R/R45757>.

Table 6 shows funding and status for the larger systems. The “FY 2022 (Projected)” column represents the amount planned for FY 2022 in the FY 2021 budget. The “FY 2022 (Requested)” represents the amount in the FY 2022 budget. All funding for these systems is RDT&E since the systems are still experimental. Funding for the smaller systems, not shown, are individually below \$20 million each.

FY 2022 funding is roughly in line with what had been planned last year. However, as with the USVs, the total amount of funding is small compared with, for example, the \$3.3 billion cost of a single Virginia-class submarine.

Table 6: Funding and Status of Larger Unmanned Undersea Vessels

Program	Mission	Funding (\$, millions)			Notes
		FY 2021	FY 2022 (Projected)	FY 2022 (Requested)	
Orca	Multi-mission, initially mine warfare	89.3	43.0	58.5	5 test and evaluation units in production
Snakehead	Intelligence preparation of the ocean environment (IPOE)	62.2	88.4	88.1	Undergoing competitive bidding process, prototype developed by government

Source: Department of Defense, *Fiscal Year (FY) 2022 Budget Estimates: Justification Book Volume 2 of 5: Research, Development, Test, & Evaluation, Navy* (Washington, DC: May 2021), https://www.secnav.navy.mil/fmc/fmb/Documents/22pres/RDTEN_BA4_Book.pdf.

Naval Aviation Modernization: The Future Air Wing

Navy aircraft provide the striking power of the aircraft carrier, the central weapon system in the U.S. Navy, and thus play a larger role in the U.S. Navy than in other navies. For the U.S. Marine Corps, aviation provides firepower and heavy lift for its ground forces. (Marine aviation will be discussed in detail in the next chapter.)

In FY 2022, naval aviation (Navy and Marine Corps) proposes to procure 107 aircraft of all kinds, down from 144 in FY 2021. Naval aviation is in generally good shape. Inventories have been stable, the average age for most elements is good, and the Navy has been buying enough aircraft to maintain its inventory.

The bad news is that the Navy needs to increase aircraft procurement in the future to maintain current inventories, faces ever higher costs to maintain its aircraft inventory, and has been slow to field unmanned aerial vehicles (UAVs).

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FY 2022 PROCUREMENT

Table 7: Department of the Navy Aircraft Procurement in FY 2022

Fixed Wing	FY 2022 (Proposed)	First Procurement	Last Procurement
F-35C (CV)	20	2011	~2031
F-35B (STOVL)	17	2008	~2031
FA-18E/F	0	1995	2021 (Congress may add some aircraft in 2022 to keep the line going)
E-2D Advanced Hawkeye	5	2014	2023 (planned)
KC-130J	6	2005	TBD
Rotary Wing			
CH-53K (HLR)	9	2018	~2028
MV-22B / CMV-22B	8	1997	2022 (planned small buys in 2023 and 2024)
TH-73	36	2020	2024
UAV			
MQ-4C Triton	0	(2023 production restart)	TBD
MQ-25 Stingray	0	(2023 planned)	TBD
MQ-9A Reaper (USMC)	6	2020	TBD
Total	107		

Note: Year of first/last procurement is the budget year.

Source: Department of the Navy, *Highlights of the Department of the Navy FY 2022 Budget* (Washington, DC: Department of Defense, 2021), Figure 2.3, https://www.secnav.Navy.mil/fmc/fmb/Documents/22pres/Highlights_Book.pdf; last procurement from respective program's selected acquisition reports.

For many years, naval aviation has been procuring mature systems with predictable costs and schedules (with the significant exception of the F-35). As Table 7 shows, that stability is coming to an end. Long-established production lines have recently finished (UH-1Y/AH-1Z, P-8, MQ-8B/C, VH-92A) or soon will (FA-18, E-2D, V-22, highlighted in gray); new systems will eventually replace them, but there will be a gap.

Particularly striking is the plan to end F-18 production after nearly 40 years, a long-forecasted change. F-35 production does not increase enough to make up for lost F-18 production. According to Navy statements, the planned end to F-18 procurement reflects a reduction in planned fighter/attack inventories as a result of smaller numbers onboard each aircraft carrier, extended service lives, and mission shifts that free up fighter/attack aircraft. It may also reflect an expectation that there will be fewer carriers in the future. Despite the Navy's justification, Congress has been skeptical and will likely add aircraft in its final action on the FY 2022 budget.⁸²

Although there is a next-generation fighter in development (Next Generation Air Dominance, or NGAD), procurement is not expected until the 2030s. (See Air Force chapter for further discussion of NGAD.)

82. Justin Katz, "Navy Lays out Plan to Close the Strike Fighter Gap Four Years Early," *Breaking Defense*, July 14, 2021, <https://breakingdefense.com/2021/07/navy-lays-out-plan-to-close-the-strike-fighter-gap-four-years-early/>; and Justin Katz, "House Panel Rejects Navy's Math on Closing Strike Fighter Gap; Funds New F/A-18s," *Breaking Defense*, August 26, 2021, <https://breakingdefense.com/2021/08/house-panel-rejects-navys-math-on-closing-strike-fighter-gap-funds-new-f-a-18s>.

The other challenge is that the total number of aircraft procured goes down. In part, this reflects the fact that Congress routinely adds aircraft to the Navy budget. In FY 2021, for example, Congress added 20 aircraft above the Navy’s request. The Senate and House National Defense Authorization Acts would add 12 to 17 aircraft, but there is no final bill yet and the additions depend on a higher top line, which the appropriations committees might not support.⁸³

Table 8: Aircraft Inventory Replacement Rate

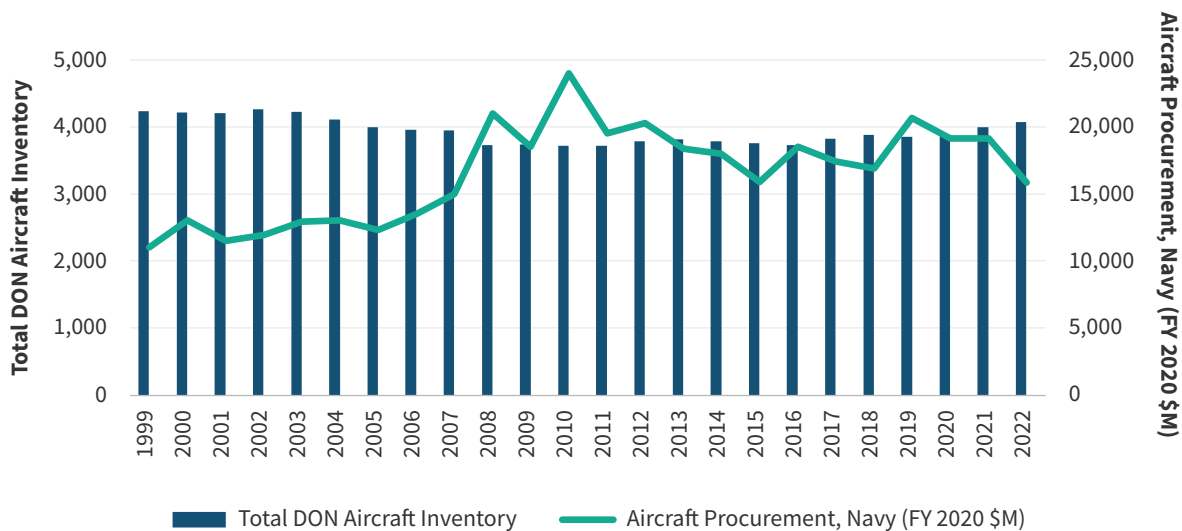
Total Inventory to be Replaced	Number of Aircraft Procured	Years Required to Replace Inventory
4,053	144 (FY 2021 actual)	28 years
	107 (FY 2022 proposed)	38 years
	162	25 years

Source: Department of the Navy, *Highlights of the Department of the Navy FY 2022 Budget* (Washington, DC: Department of Defense, 2021), 4-8 (inventory), 2-6 (procurements), https://www.secnav.Navy.mil/fmc/fmb/Documents/22pres/Highlights_Book.pdf.

Table 8 shows the number of years required to replace the current aircraft inventory at various procurement rates. The FY 2022 level is far below that required to maintain the target average age of the fleet. The rate would need to increase to 162 aircraft procured per year to get to a target of 25 years. Congress has routinely added enough aircraft to maintain fleet age, a practice which may not continue in the future.

THE HIGH COST OF STABLE INVENTORIES

Figure 19: Department of the Navy (DON) Aircraft Inventory



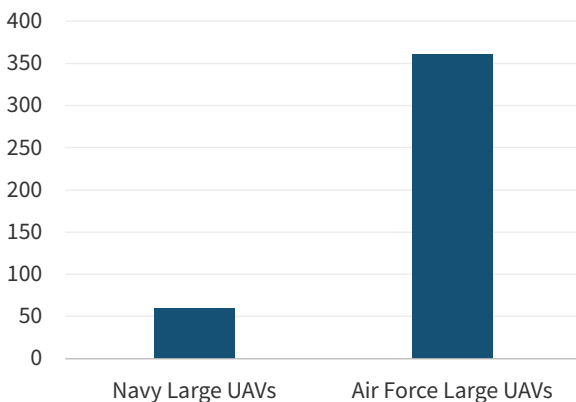
Source: Department of the Navy, *FY 2017 Budget Estimates Data Book* (Washington, DC: Department of Defense, April 2016), 64, https://www.secnav.Navy.mil/fmc/fmb/Documents/17pres/FY17_Data_Book.pdf. Updated with data from Department of the Navy, *Highlights of the Department of the Navy FY 2019* (Washington, DC: Department of Defense, 2018), https://www.secnav.Navy.mil/fmc/fmb/Documents/19pres/Highlights_book.pdf; and Department of Defense, *Fiscal Year (FY) 2022 Budget Estimates: Justification Book Volume 1 of 3: Aircraft Procurement, Navy* (Washington, DC: March 2019), https://www.secnav.Navy.mil/fmc/fmb/Documents/20pres/APN_BA1-4_BOOK.pdf.

83. Although both chambers would add aircraft, their lists do not overlap. The Senate NDAA adds 12 aircraft, including 5 F-35s but no F-18s. The house adds F-18s but no F 35s.

Threatening the long-term health of Navy aviation (and Marine Corps and Air Force aviation, as described later) is the high cost of sustaining fleet numbers. As the chart above shows, funding for procurement of naval aviation has increased by about 50 percent since the early 2000s to maintain a somewhat smaller inventory.

The reason is that each generation of aircraft costs more than the generation before it. For example, the E-2C costs \$116 million per aircraft (in FY 2021 dollars) when last procured in the early 2000s. Its replacement, the E-2D, has a more powerful radar and enhanced command linkages but costs \$227 million (FY 2021 dollars).⁸⁴

Figure 20: Navy and Air Force Medium/Large UAV Inventories



Source: Air Force data from Department of the Air Force, *Air Force Budget Highlights for FY 2022* (Washington, DC: DOD, 2020), appendix, https://www.saffm.hq.af.mil/Portals/84/documents/FY22/SUPPORT_/FY22%20Budget%20Overview%20Book.pdf?ver=Reck2JzBUzoZmGByl9Zm-Q%3d%3d; Navy data from Department of the Navy, *Department of Defense Fiscal Year (FY) 2022 Budget Estimates Aircraft Procurement, Navy, Book 1* (Washington, DC: May 2021), 1-189 and 1-207, https://www.secnav.Navy.mil/fmc/fmb/Documents/22pres/APN_BA1-4_Book.pdf.

THE (SLOW) FIELDING OF UAVS

Rhetorically, the Navy puts great emphasis on UAVs, stating that they could someday comprise 40 percent of the aircraft in a carrier air wing.⁸⁵ However, the Navy’s actions do not support its rhetoric.

The Navy’s FY 2022 procurement of large UAVs (6) is more than the Air Force’s (0), but this low procurement is a problem for both services. The Navy’s inventory of medium and large UAVs (60, MQ-8 and MQ-4) is far behind the Air Force’s (361, MQ-9 and RQ-4). The Air Force’s UAVs are also larger and more capable in general. This reflects the Navy’s relative emphasis on manned systems and, in the view of some, a lack of interest in unmanned systems. The Navy’s tepid action with unmanned aviation systems stands in contrast to its aggressive experimentation with unmanned surface and subsurface systems.

The Marine Corps MQ-8B/C Fire Scout program, an autonomous reconnaissance helicopter, has completed its procurement at 60. The Marine Corps will divest the disappointing RQ-21s, a small reconnaissance UAV.

84. Procurement funding only; E-2D costs from DOD, *E-2D Advanced Hawkeye Aircraft Selected Acquisition Report* (Washington, DC: December 2018), https://www.esd.whs.mil/Portals/54/Documents/FOID/Reading%20Room/Selected_Acquisition_Reports/FY_2018_SARS/19-F-1098_DOC_29_E-2D_AHE_SAR_Dec_2018.pdf. E-2C costs from Obaid Younossi et al., *The Eyes of the Fleet: An Analysis of the E-2C Aircraft Acquisition Options* (Santa Monica, CA: RAND Corporation, 2002), https://www.rand.org/content/dam/rand/pubs/monograph_reports/2009/MR1517.pdf. Escalation factors from Undersecretary of Defense (Comptroller), *National Defense Budget Estimates for FY 2021* (Washington, DC: Department of Defense, April 2020), https://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2019/FY19_Green_Book.pdf.

85. Patrick Tucker, “Drones Could One Day Make up 40% of the Carrier Air Wing, Navy Says,” *Defense One*, March 19, 2021, <https://www.defenseone.com/technology/2021/03/drones-could-one-day-make-40-carrier-air-wing-navy-says/172799/>.

The Navy's tepid action with unmanned aviation systems stands in contrast to its aggressive experimentation with unmanned surface and subsurface systems.

The MQ-4C Triton long-range surveillance UAV (a relative of the Air Force's RQ-4 Global Hawk), which began production in FY 2020, continues its pause in production until FY 2023. The Navy will divest its remaining four BAMS-Ds, the MQ-4C predecessor/prototype.

The MQ-25 is the Navy's first carrier-capable unmanned aircraft, growing out of a series of experimental programs such as the Unmanned Carrier Launched Aerial Surveillance and Strike (UCLASS) program. In 2017, the Navy announced its plan to develop the aircraft as a tanker with some intelligence, reconnaissance, and surveillance (ISR) capabilities, rather than as a strike platform. The program remains stable, with advance procurement funding in FY 2022 and first procurement planned for FY 2023. Nevertheless, controversy lingers about the program because many observers see it as having been sidelined to a support mission when it should constitute a frontline attack capability.⁸⁶ ■

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This report is made possible by general support to CSIS. No direct sponsorship contributed to this report.

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86. Called "strategic malpractice" in Robert Martinage and Shawn Brimley, "The Navy's New Museum Drone and Strategic Malpractice," War on the Rocks, April 28, 2015, <http://warontherocks.com/2015/04/the-navys-new-museum-drone-and-strategic-malpractice>. Similar criticisms have come from Bryan McGrath of the Hudson Institute and Jerry Hendrix of the Center for New American Security.