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China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress

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Summary

China's military modernization effort, including its naval modernization effort, is the top focus of U.S. defense planning and budgeting. China's naval modernization effort has been underway for about 30 years, since the early to mid-1990s, and has transformed China's navy into a much more modern and capable force. China's navy is a formidable military force within China's near-seas region, and it is conducting a growing number of operations in the broader waters of the Western Pacific, the Indian Ocean, and waters around Europe.

China's navy is, by far, the largest of any country in East Asia, and sometime between 2015 and 2020 it surpassed the U.S. Navy in numbers of battle force ships (meaning the types of ships that count toward the quoted size of the U.S. Navy). DOD states that China's navy "is the largest navy in the world with a battle force of approximately 340 platforms, including major surface combatants, submarines, ocean-going amphibious ships, mine warfare ships, aircraft carriers, and fleet auxiliaries.... This figure does not include approximately 85 patrol combatants and craft that carry anti-ship cruise missiles (ASCM). The... overall battle force [of China's navy] is expected to grow to 400 ships by 2025 and 440 ships by 2030." The U.S. Navy, by comparison, included 294 battle force ships at the end of FY2021, and the Navy's FY2024 budget submission projects that the Navy will include 290 battle force ships by the end of FY2030. U.S. military officials and other observers are expressing concern or alarm regarding the pace of China's naval shipbuilding effort and resulting trend lines regarding the relative sizes and capabilities of China's navy and the U.S. Navy.

China's naval modernization effort encompasses a wide array of ship, aircraft, weapon, and C4ISR (command and control, communications, computers, intelligence, surveillance, and reconnaissance) acquisition programs, as well as improvements in logistics, doctrine, personnel quality, education and training, and exercises. China's navy currently has certain limitations and weaknesses, which it is working to overcome.

China's military modernization effort, including its naval modernization effort, is assessed as being aimed at developing capabilities for, among other things, addressing the situation with Taiwan militarily, if need be; achieving a greater degree of control or domination over China's near-seas region, particularly the South China Sea; defending China's commercial sea lines of communication (SLOCs), particularly those linking China to the Persian Gulf; displacing U.S. influence in the Western Pacific; and asserting China's status as the leading regional power and a major world power. Observers believe China wants its navy to be capable of acting as part of an anti-access/area-denial (A2/AD) force—a force that can deter U.S. intervention in a conflict in China's near-seas region over Taiwan or some other issue, or failing that, delay the arrival or reduce the effectiveness of intervening U.S. forces.

The U.S. Navy has taken a number of actions to counter China's naval modernization effort. Among other things, the U.S. Navy has shifted a greater percentage of its fleet to the Pacific; assigned its most-capable new ships and aircraft to the Pacific; maintained or increased general presence operations, training and developmental exercises, and engagement and cooperation with allied and other navies in the Indo-Pacific; increased the planned future size of the Navy; initiated, increased, or accelerated numerous programs for developing new military technologies and acquiring new ships, aircraft, unmanned vehicles, and weapons; developed new operational concepts for countering Chinese maritime A2/AD forces; and signaled that the Navy in coming years will shift to a more-distributed fleet architecture that will feature a substantially greater use of unmanned vehicles. The issue for Congress is whether to approve, reject, or modify the Biden Administration's proposed U.S. Navy plans, budgets, and programs for responding to China's naval modernization effort.

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Introduction

Issue for Congress

This report provides background information and issues for Congress on China's naval modernization effort and its implications for U.S. Navy capabilities. China's military modernization effort, including its naval modernization effort, is the top focus of U.S. defense planning and budgeting.[1] The issue for Congress is whether to approve, reject, or modify the Biden Administration's proposed U.S. Navy plans, budgets, and programs for responding to China's naval modernization effort. Congress's decisions on this issue could affect U.S. Navy capabilities and funding requirements, and the U.S. defense industrial base.

Sources and Terminology

This report is based on unclassified open-source information, such as the annual Department of Defense (DOD) report to Congress on military and security developments involving China,[2] a 2019 Defense Intelligence Agency (DIA) report on China's military power,[3] a 2015 Office of Naval Intelligence (ONI) report on China's navy,[4] published reference sources such as *IHS Jane's Fighting Ships*,[5] and press reports.

For convenience, this report uses the term *China's naval modernization effort* to refer to the modernization not only of China's navy, but also of Chinese military forces outside China's navy that can be used to counter U.S. naval forces operating in the Western Pacific, such as land-based anti-ship ballistic missiles (ASBMs), land-based surface-to-air missiles (SAMs), land-based Air Force aircraft armed with anti-ship cruise missiles (ASCMs), and land-based long-range radars for detecting and tracking ships at sea.

China's military is formally called the People's Liberation Army (PLA). Its navy is called the PLA Navy, or PLAN (also abbreviated as PLA[N]), and its air force is called the PLA Air Force, or PLAAF. The PLA Navy includes an air component that is called the PLA Naval Air Force, or PLANAF. China refers to its ballistic missile force as the PLA Rocket Force (PLARF).

This report uses the term *China's near-seas region* to refer to the Yellow Sea, East China Sea, and South China Sea—the waters enclosed by the so-called *first island chain*. The so-called *second island chain* encloses both these waters and the Philippine Sea that is situated between the Philippines and Guam.[6]

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[1] For an overview of China's military, see CRS Report R46808, *China's Military: The People's Liberation Army (PLA)*, by Caitlin Campbell. For more on China's military modernization effort being the top focus of U.S. defense planning and budgeting, see CRS Report R43838, *Great Power Competition: Implications for Defense—Issues for Congress*, by Ronald O'Rourke.

[2] Department of Defense, *Military and Security Developments Involving the People's Republic of China 2022, Annual Report to Congress*, released on November 29, 2022, 174 pp. Hereinafter *2022 DOD CMSD*.

[3] Defense Intelligence Agency, *China Military Power, Modernizing a Force to Fight and Win*, 2019, 125 pp. Hereinafter *2019 DIA CMP*.

[4] Office of Naval Intelligence, *The PLA Navy, New Capabilities and Missions for the 21st Century*, undated but released in April 2015, 47 pp.

[5] *IHS Jane's Fighting Ships 2021-2022*, and previous editions.

[6] For a map showing the first and second island chains, see *2022 DOD CMSD*, p. 67.

Background

Brief Overview of China's Naval Modernization Effort

Key overview points concerning China's naval modernization effort include the following:

- China's naval modernization effort, which forms part of a broader Chinese military modernization effort that includes several additional areas of emphasis,[7] has been underway for about 30 years, since the early to mid-1990s, and has transformed China's navy into a much more modern and capable force.
- China's navy is a formidable military force within China's near-seas region, and it is conducting a growing number of operations in more-distant waters, including the broader waters of the Western Pacific, the Indian Ocean, and waters around Europe.
- China's navy is, by far, the largest of any country in East Asia, and as shown in **Table 2,** sometime between 2015 and 2020, China's navy surpassed the U.S. Navy in numbers of battle force ships (meaning the types of ships that count toward the quoted size of the U.S. Navy), making China's navy the numerically largest in the world. DOD states that "the PLAN is the largest navy in the world with a battle force of approximately 340 platforms, including major surface combatants, submarines, ocean-going amphibious ships, mine warfare ships, aircraft carriers, and fleet auxiliaries.... This figure does not include approximately 85 patrol combatants and craft that carry anti-ship cruise missiles (ASCM). The PLAN's overall battle force is expected to grow to 400 ships by 2025 and 440 ships by 2030. Much of this growth will be in major surface combatants."[8] The U.S. Navy, by comparison, included 294 battle force ships at the end of FY2021, and the Navy's FY2024 budget submission projects that the Navy will include 290 battle force ships by the end of FY2030.[9]
- U.S. military officials and other observers are expressing concern or alarm regarding the pace of China's naval shipbuilding effort and resulting trend lines regarding the relative sizes and capabilities of China's navy and the U.S. Navy.[10]

[7] Other areas of emphasis in China's military modernization effort include space capabilities, cyber and electronic warfare capabilities, ballistic missile forces, and aviation forces, as well as the development of emerging military-applicable technologies such as hypersonics, artificial intelligence, robotics and unmanned vehicles, directed-energy technologies, and quantum technologies. For more on China's military modernization effort in general, see CRS Report R46808, *China's Military: The People's Liberation Army (PLA)*, by Caitlin Campbell. For a discussion of advanced military technologies, see CRS In Focus IF11105, *Defense Primer: Emerging Technologies*, by Kelley M. Sayler. U.S.-China competition in military capabilities in turn forms one dimension of a broader U.S.-China strategic competition that also includes political, diplomatic, economic, technological, and ideological dimensions.

[8] *2022 DOD CMSD*, p. 52. See also *2019 DIA CMP*, p. 63.

[9] For additional discussion, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[10] See, for example, Chris Bradford, "Point of No Return, US Navy Faces Being Totally Outgunned by China in Just Seven Years—We Need a Fleet Ready to Fight War Now, Says Expert," *U.S. Sun*, March 1, 2023; Keith Griffith, "China's Naval Fleet Is Growing and the US 'Can't Keep Up' with the Warship Buildup as Beijing Uses Its Sea Power to Project an 'Increasingly Aggressive Military Posture Globally,' Navy Secretary Warns," *Daily Mail (UK)*, February 23, 2023; Brad Lendon and Haley Britzky, "US Can't Keep Up with China's Warship Building, Navy Secretary Says," *CNN*, February 22, 2023; Meredith Roaten, "Shipyard Capacity, China's Naval Buildup Worries U.S. Military Leaders," *National Defense*, January 26, 2023; Oliver Parken and Tyler Rogoway, "Extremely Ominous Warning

China's navy is viewed as posing a major challenge to the U.S. Navy's ability to achieve and maintain wartime control of blue-water ocean areas in the Western Pacific—the first such challenge the U.S. Navy has faced since the end of the Cold War. China's navy forms a key element of a Chinese challenge to the long-standing status of the United States as the leading military power in the Western Pacific.

- China's naval ships, aircraft, and weapons are much more modern and capable than they were at the start of the 1990s, and are comparable in many respects to those of Western navies. DOD states that "as of 2021, the PLAN is largely composed of modern multi-role platforms featuring advanced anti-ship, anti-air, and anti-submarine weapons and sensors."[11] ONI states that "Chinese naval ship design and material quality is in many cases comparable to [that of] USN [U.S. Navy] ships, and China is quickly closing the gap in any areas of deficiency."[12]
- China's naval modernization effort encompasses a wide array of platform and weapon acquisition programs, including anti-ship ballistic missiles (ASBMs), anti-ship cruise missiles (ASCMs), submarines, surface ships, aircraft, unmanned vehicles (UVs),[13] and supporting C4ISR (command and control,

About China From US Strategic Command Chief, Admiral Richard Says 'The Big One' with China Is Coming and the 'Ship Is Slowly Sinking' in Terms of U.S. Deterrence," *The Drive*, November 6, 2022; Xiaoshan Xue, "As China Expands Its Fleets, US Analysts Call for Catch-up Efforts," *VOA*, September 13, 2022; Aidan Quigley, "Chinese Navy Narrowing Capability Gap with U.S., Analysts Say," *Inside Defense*, November 16, 2021; Alex Hollings, "Just How Big Is China's Navy? Bigger Than You Think," *Sandboxx*, July 28, 2021; Kyle Mizokami, "China Just Commissioned Three Warships in a Single Day, That's Almost Half as Many as the U.S. Will Induct in One Year," *Popular Mechanics*, April 27, 2021; Geoff Ziezulewicz, "China's Navy Has More Ships than the US. Does That Matter?" *Navy Times*, April 9, 2021; Dan De Luce and Ken Dilanian, "China's Growing Firepower Casts Doubt on Whether U.S. Could Defend Taiwan, In War Games, China Often Wins, and U.S. Warships and Aircraft Are Kept at Bay," *NBC News*, March 27, 2021; Brad Lendon, "China Has Built the World's Largest Navy. Now What's Beijing Going to Do with It?" *CNN*, March 5, 2021; Andrew S. Erickson, "A Guide to China's Unprecedented Naval Shipbuilding Drive," *Maritime Executi*ve, February 11, 2021; Stephen Kuper, "Beijing Steps Up Naval Shipbuilding Program with Eyes on Global Navy," *Defence Connect*, January 11, 2021; James E. Fanell, "China's Global Navy—Today's Challenge for the United States and the U.S. Navy," *Naval War College Review*, Autumn 2020, 32 pp.; Ryan Pickrell, "China Is the World's Biggest Shipbuilder, and Its Ability to Rapidly Produce New Warships Would Be a 'Huge Advantage' in a Long Fight with the US, Experts Say," *Business Insider*, September 8, 2020; Ryan D. Martinson, "Deciphering China's 'World-Class' Naval Ambitions," *U.S. Naval Institute Proceedings*, August 2020; Dave Makichuk, "China's Navy Shipbuilders Are 'Outbuilding Everybody,'" *Asia Times*, March 11, 2020; Jon Harper, "Eagle vs Dragon: How the U.S. and Chinese Navies Stack Up," *National Defense*, March 9, 2020; H. I. Sutton, "The Chinese Navy Is Building An Incredible Number Of Warships," *Forbes*, December 15, 2019; Nick Childs and Tom Waldwyn, "China's Naval Shipbuilding: Delivering on Its Ambition in a Big Way," International Institute for Strategic Studies (IISS), May 1, 2018; James R. Holmes and Toshi Yoshihara, "Taking Stock of China's Growing Navy: The Death and Life of Surface Fleets," *Orbis*, Spring 2017: 269-285.

For articles offering differing perspectives, see, for example, David Axe, "The Chinese Navy Can't Grow Forever—The Slowdown Might Start Soon," *Forbes*, November 12, 2020; Mike Sweeney, *Assessing Chinese Maritime Power*, Defense Priorities, October 2020, 14 pp.

[11] *2022 DOD CMSD*, p. 50.

[12] Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 3. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.

[13] See, for example, H. I. Sutton, "China Reveals New Heavily Armed Extra-Large Uncrewed Submarine," *Naval News*, February 23, 2023; Ryan Martinson, "Gliders With Ears: A New Tool in China's Subsea Surveillance Toolbox," *Maritime Executive*, March 21, 2022; Gabriel Honrada, "Underwater Drones Herald Sea Change in Pacific Warfare," *Asia Times*, January 12, 2022.

Ryan Fedasiuk, "Leviathan Wakes: China's Growing Fleet of Autonomous Undersea Vehicles," Center for

communications, computers, intelligence, surveillance, and reconnaissance) systems. China's naval modernization effort also includes improvements in logistics, doctrine, personnel quality, education and training, and exercises.[14]

- China's military modernization effort, including its naval modernization effort, is assessed as being aimed at developing capabilities for, among other things, addressing the situation with Taiwan militarily, if need be; achieving a greater degree of control or domination over China's near-seas region, particularly the South China Sea; enforcing China's view that it has the right to regulate foreign military activities in its 200-mile maritime exclusive economic zone (EEZ);[15] defending China's commercial sea lines of communication (SLOCs), particularly those linking China to the Persian Gulf; displacing U.S. influence in the Western Pacific; and asserting China's status as the leading regional power and a major world power.[16] Additional missions for China's navy include conducting maritime security (including antipiracy) operations, evacuating Chinese nationals from foreign countries when necessary, and conducting humanitarian assistance/disaster response (HA/DR) operations.
- Observers believe China wants its navy to be capable of acting as part of an anti-access/area-denial (A2/AD) force—a force that can deter U.S. intervention in a conflict in China's near-seas region over Taiwan or some other issue, or failing that, delay the arrival or reduce the effectiveness of intervening U.S. forces.
- The planned ultimate size and composition of China's navy is not publicly known. In contrast to the U.S. Navy, China does not release a navy force-level goal or detailed information about planned ship procurement rates, planned total ship procurement quantities, planned ship retirements, and resulting projected force levels.
- Although China's naval modernization effort has substantially improved China's naval capabilities, China's navy currently is assessed as having limitations or weaknesses in certain areas,[17] including joint operations with other parts of China's military,[18] anti-submarine warfare (ASW), long-range targeting, a limited capacity for carrying out at-sea resupply of combatant ships operating far from home waters,[19] a limited number of overseas bases and support facilities,[20] a need

International Maritime Security (CIMSEC), August 17, 2021.

[14] See, for example, Roderick Lee, "The PLA Navy's ZHANLAN Training Series: Supporting Offensive Strike on the High Seas," *China Brief*, April 13, 2020.

[15] For additional discussion, see CRS Report R42784, *U.S.-China Strategic Competition in South and East China Seas: Background and Issues for Congress*, by Ronald O'Rourke.

[16] For additional discussion, see Ryan D. Martinson, "Deciphering China's 'World-class' Naval Ambitions," *U.S. Naval Institute Proceedings*, August 2020.

[17] For a discussion focusing on these limitations or weaknesses, see Mike Sweeney, *Assessing Chinese Maritime Power*, Defense Priorities, October 2020, 14 pp. See also Tai Ming Cheung, "Russia's Ukraine Disaster Exposes China's Military Weakness," *Foreign Policy*, October 24, 2022.

[18] See, for example, Ben Noon and Chris Bassler, "Schrodinger's Military? Challenges for China's Military Modernization Ambitions," *War on the Rocks*, October 14, 2021.

[19] See, for example, Felix K. Chang, "Sustaining the Chinese Navy's Operations at Sea: Bigger Fists, Growing Legs," Foreign Policy Research Institute, May 3, 2023; Will Mackenzie, "Commentary: It's the Logistics, China," *National Defense*, June 10, 2020.

[20] See, for example, Kristin Huang, "Size of China's Navy May Be Closing Gap on US Fleet But What Can the PLA Do with Just One Overseas Naval Base?" *South China Morning Post*, March 14, 2021.

to train large numbers of personnel to crew its new ships,[21] and a lack of recent combat experience.[22] China is working to reduce or overcome such limitations and weaknesses.[23] Although China's navy has limitations and weaknesses, it may nevertheless be sufficient for performing missions of interest to Chinese leaders. As China's navy reduces its weaknesses and limitations, it may become sufficient to perform a wider array of potential missions.

- In addition to modernizing its navy, China has substantially increased the size and capabilities of its coast guard. DOD states that China's coast guard is "the largest maritime law enforcement fleet in the world."[24] China also operates a

[21] See, for example, Minnie Chan, "China's Navy Goes Back to Work on Big Ambitions but Long-Term Gaps Remain," *South China Morning Post*, August 22, 2020.

[22] Alastair Gale, "China's Military Is Catching Up to the U.S. Is It Ready for Battle?" *Wall Street Journal*, October 20, 2022; Benjamin Brimelow, "China's Military Is Growing Rapidly, But It Hasn't Been 'Tested' Like US Troops Have, Former Top US Admiral Says," *Business Insider*, March 29, 2022. See also Andrew Scobell, "Xi Jinping's Worst Nightmare: A Potemkin People's Liberation Army," *War on the Rocks*, May 1, 2023.

The use of a dual command structure in the crews of larger Chinese ships, involving both a commanding officer and a political officer, has been raised as a source of potential reduced command effectiveness in certain tactical situations. See "Leadership: China Cripples Naval Officers," *Strategy Page*, July 18, 2020.

Some observers argue that corruption in China's shipbuilding companies may be a source of weaknesses in China's naval modernization effort. See, for example, Zi Yang, "The Invisible Threat to China's Navy: Corruption," *Diplomat*, May 19, 2020. See also Frank Chen, "Ex-PLA Navy Chief in Deep Water Amid War on Graft," *Asia Times*, June 26, 2020.

[23] For example, China's naval shipbuilding programs were previously dependent on foreign suppliers for some ship components. ONI, however, states that "almost all weapons and sensors on Chinese naval ships are produced in-country, and China no longer relies on Russia or other countries for any significant naval ship systems." (Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, pp. 2-3. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.) Regarding the ASW capabilities of China's Navy, DOD states

> The PLAN is also improving its anti-submarine warfare (ASW) capabilities through the development of its surface combatants and special mission aircraft, but it continues to lack a robust deep-water ASW capability. By prioritizing the acquisition of ASW capable surface combatants, acoustic surveillance ships, and fixed and rotary wing ASW capable aircraft, the PLAN is significantly improving its ASW capabilities. However, it will still require several years of training and systems integration for the PLAN to develop a robust offensive deep water ASW capability.
>
> (*2022 DOD CMSD*, p. 53.)

See also Felix K. Chang, "Sustaining the Chinese Navy's Operations at Sea: Bigger Fists, Growing Legs," Foreign Policy Research Institute, May 3, 2023; Bryan Clark, "Submarines Will Not Solve America's Eroding Undersea Advantage," *Washington Examiner*, December 5, 2022; Ryan D. Martinson and Conor Kennedy, "Using the Enemy to Train the Troops—Beijing's New Approach to Prepare its Navy for War," *China Brief*, March 25, 2022; Samuel Cranny-Evans, "China's Maritime Surveillance Network: Bold Moves for Ocean Dominance," *Jane's International Defence Review*, February 17, 2022; Ma Xiu and Peter W. Singer, "How China Steals US Tech to Catch Up in Underwater Warfare," *Defense One*, June 8, 2021; Amanda Rivkin, "German Engine Technology Found in Chinese Warships—Report," *Deutsche Welle (dw.com)*, November 6, 2021.

[24] DOD states that

> The CCG's [China Coast Guard's] rapid expansion and modernization has made it the largest maritime law enforcement fleet in the world. Its newer vessels are larger and more capable than older vessels, allowing them to operate further offshore and remain on station longer. A 2019 academic study published by the U.S. Naval War College estimates the CCG has over 140 regional and oceangoing patrol vessels (of more than 1,000 tons displacement). Some of the vessels are former PLAN vessels, such as corvettes, transferred to the CCG and modified for CCG operations. The newer, larger vessels are equipped with helicopter facilities, high-capacity water cannons, interceptor boats, and guns ranging from 20 to 76 millimeters. In addition, the same academic study indicates the CCG operates more than 120 regional patrol combatants (500 to 999 tons), which can

sizeable maritime militia that includes a large number of fishing vessels. China relies primarily on its maritime militia and coast guard to assert and defend its maritime claims in its near-seas region, with the navy operating over the horizon as a potential backup force.[25]

Numbers of Ships; Comparisons to U.S. Navy

Overview

DOD states that "the PLAN is the largest navy in the world with a battle force of approximately 340 platforms, including major surface combatants, submarines, ocean-going amphibious ships, mine warfare ships, aircraft carriers, and fleet auxiliaries.... This figure does not include approximately 85 patrol combatants and craft that carry anti-ship cruise missiles (ASCM). The PLAN's overall battle force is expected to grow to 400 ships by 2025 and 440 ships by 2030. Much of this growth will be in major surface combatants."[26] DIA states that "the PLAN is rapidly retiring older, single-mission warships in favor of larger, multimission ships equipped with advanced antiship, antiair, and antisubmarine weapons and sensors and C2 [command and control] facilities."[27]

Ultimate Size and Composition of China's Navy Not Publicly Known

The planned ultimate size and composition of China's navy is not publicly known. The U.S. Navy makes public its force-level goal and regularly releases a 30-year shipbuilding plan that shows planned procurements of new ships, planned retirements of existing ships, and resulting projected force levels, as well as a five-year shipbuilding plan that shows, in greater detail, the first five years of the 30-year shipbuilding plan.[28] In contrast, China does not release a navy force-level goal or detailed information about planned ship procurement rates, planned total ship procurement quantities, planned ship retirements, or resulting projected force levels. The ultimate size and composition of China's navy might be an unsettled and evolving issue among Chinese military and political leaders. One observer states that "it seems the majority of past foreign projections of Chinese military and Chinese navy procurement scale and speed have been underestimates…. All military forces have a desired force requirement and a desired 'critical mass' to aspire toward. Whether the Chinese navy is close to its desired force or not, is of no small consequence."[29]

be used for limited offshore operations, and an additional 450 coastal patrol craft (100 to 299 tons). (*2022 DOD CMSD*, p. 78. See also *2019 DIA CMP*, p. 78.)

[25] For additional discussion, see *2022 DOD CMSD*, pp. 79-80, and CRS Report R42784, *U.S.-China Strategic Competition in South and East China Seas: Background and Issues for Congress*, by Ronald O'Rourke.

[26] *2022 DOD CMSD*, p. 52. See also *2019 DIA CMP*, p. 63.

[27] *2019 DIA CMP*, p. 69.

[28] For more information on the U.S. Navy's force-level goal, 30-year shipbuilding plan, and five-year shipbuilding plan, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[29] Rick Joe, "Hints of Chinese Naval Procurement Plans in the 2020s," *Diplomat*, December 25, 2020.

Number of Ships Is a One-Dimensional Measure, but Trends in Numbers Can Be of Value Analytically

Relative U.S. and Chinese naval capabilities are sometimes assessed by showing comparative numbers of U.S. and Chinese ships. Although the total number of ships in a navy (or a navy's aggregate tonnage) is relatively easy to calculate, it is a one-dimensional measure that leaves out numerous other factors that bear on a navy's capabilities and how those capabilities compare to its assigned missions. As a result, as discussed in further detail in **Appendix A**, comparisons of the total numbers of ships in China's navy and the U.S. Navy are highly problematic as a means of assessing relative U.S. and Chinese naval capabilities and how those capabilities compare to the missions assigned to the two navies. At the same time, however, an examination of *trends over time in these relative numbers of ships* can shed some light on how the relative balance of U.S. and Chinese naval capabilities might be changing over time.

Three Tables Showing Numbers of Chinese and U.S. Navy Ships

Table Showing Figures from Annual DOD Reports

Table 1 shows numbers of certain types of Chinese navy ships—those that might be thought of as the principal combat ships of China's navy—from 2005 to the present, along with the number of China coast guard ships from 2017 to the present, as presented in DOD's annual reports on military and security developments involving China. As can be seen in **Table 1**, every type of Chinese navy ship shown in the table has increased numerically since 2005.

As can be seen in **Table 1**, about 61% of the increase since 2005 in the total number of Chinese navy ships shown in the table (a net increase of 83 ships out of a total net increase of 135 ships) resulted from increases in missile-armed fast patrol craft starting in 2009 (a net increase of 33 ships) and corvettes starting in 2014 (50 ships). These are the smallest surface combatants shown in the table. The net 33-ship increase in missile-armed fast patrol craft was due to the construction between 2004 and 2009 of about 60 new *Houbei* (Type 022) fast attack craft[30] and the retirement of about 27 older fast attack craft. The 50-ship increase in corvettes is due to the *Jingdao* (Type 056) corvette program discussed later in this report. ONI states that "a significant portion of China's Battle Force consists of the large number of new corvettes and guided-missile frigates recently built for the PLAN."[31] As can also be seen in the table, most of the remaining increase since 2005 in the number of Chinese navy ships shown in the table is accounted for by increases in cruisers and destroyers (21 ships) and amphibious ships (14 ships).

Table 1 lumps together less capable older Chinese ships with more capable modern Chinese ships. In examining the numbers in the table, it can be helpful to keep in mind that for many of the types of Chinese ships shown in the table, the percentage of the ships accounted for by more capable modern designs was growing over time, even if the total number of ships for those types was changing little.

For reference, **Table 1** also shows the total number of ships in the U.S. Navy (known technically as the total number of battle force ships), and compares it to the total number of the types of

[30] The Type 022 program was discussed in the August 1, 2018, version of this CRS report, and earlier versions.

[31] Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 4. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.

Chinese ships that are shown in the table.[32] The result is an apples-vs.-oranges comparison, because the Chinese figures exclude certain ship types, such as auxiliary and support ships, while the U.S. Navy figure includes auxiliary and support ships but excludes patrol craft. Changes over time in this apples-vs.-oranges comparison, however, can be of value in understanding trends in the comparative sizes of the U.S. and Chinese navies.

On the basis of the figures in **Table 1**, it might be said that in 2015, the total number of principal combat ships in China's navy surpassed the total number of U.S. Navy battle force ships (a figure that includes not only the U.S. Navy's principal combat ships, but also other U.S. Navy ships, such as auxiliary and support ships). It is important, however, to keep in mind the differences in composition between the two navies. The U.S. Navy, for example, has many more aircraft carriers, nuclear-powered submarines, and cruisers and destroyers, while China's navy has many more diesel attack submarines, frigates, and corvettes.

Table Showing ONI Figures from February 2020

Table 2 shows comparative numbers of Chinese and U.S. battle force ships (and figures for certain types of ships that contribute toward China's total number of battle force ships) from 2000 to 2030, with the figures for 2025 and 2030 being projections. The figures for China's ships are taken from an ONI information paper of February 2020. Battle force ships are the types of ships that count toward the quoted size of the U.S. Navy. For China, the total number of battle force ships shown excludes the missile-armed coastal patrol craft shown in **Table 1**, but includes auxiliary and support ships that are not shown in **Table 1**. Compared to **Table 1**, the figures in **Table 2** come closer to providing an apples-to-apples comparison of the two navies' numbers of ships, although it could be argued that China's missile-armed coastal patrol craft can be a significant factor for operations within the first island chain.

As shown in **Table 2**, China's navy surpassed the U.S. Navy in terms of total number of battle force ships sometime between 2015 and 2020. As mentioned earlier in connection with **Table 1**, however, it is important to keep in mind the differences in composition between the two navies. The U.S. Navy, for example, currently has many more aircraft carriers, nuclear-powered submarines, and cruisers and destroyers, while China's navy currently has many more diesel attack submarines, frigates, and corvettes.

Table Showing U.S. Navy Figures from October 2020

Table 3 shows numbers of certain types of Chinese navy ships in 2020, and projections of those numbers for 2025, 2030, and 2040, along with the total number of U.S. Navy battle force ships in 2020, and projections of those numbers for 2025, 2030, and 2040. The figures for China's ships were provided by the Navy at the request of CRS. As with **Table 1**, the result is an apples-vs.-oranges comparison between the Chinese navy and U.S. Navy totals, because the Chinese total excludes certain ship types, such as auxiliary and support ships, while the U.S. Navy total includes auxiliary and support ships.

[32] The DOD report generally covers events of the prior calendar year. Thus, the 2021 edition covers events during 2020, and so on for earlier years. Similarly, for the U.S. Navy figures, the 2021 column in **Table 1** shows the figure for the end of FY2020, and so on for earlier years.

Table 1. Numbers of Certain Types of Chinese and U.S. Ships Since 2005

Figures for Chinese ships taken from annual DOD reports on military and security developments involving China for the years 2005-2022

Year of DOD report	SSB	SSN	SS	CV	CG	DD	FF	FFL	PC	LST/ LPD	LSM	Total PLAN ship types shown to right	CCG	U.S. total	U.S. vs. PLAN ship types shown
2005	1	6	51	0	0	21	43	0	51	20	23	**216**	*n/a*	**292**	**+76**
2006	1	5	50	0	0	25	45	0	45	25	25	**221**	*n/a*	**281**	**+60**
2007	1	5	53	0	0	25	47	0	41	25	25	**222**	*n/a*	**281**	**+59**
2008	1	5	54	0	0	29	45	0	45	26	28	**233**	*n/a*	**279**	**+46**
2009	2	6	54	0	0	27	48	0	70	27	28	**262**	*n/a*	**282**	**+20**
2010	2	6	54	0	0	25	49	0	85	27	28	**276**	*n/a*	**285**	**+9**
2011	2	5	49	0	0	26	53	0	86	27	28	**276**	*n/a*	**288**	**+12**
2012	2	5	48	0	0	26	53	0	86	28	23	**271**	*n/a*	**284**	**+13**
2013	3	5	49	1	0	23	52	0	85	29	26	**273**	*n/a*	**287**	**+14**
2014	3	5	51	1	0	24	49	8	85	29	28	**283**	*n/a*	**285**	**+2**
2015	4	5	53	1	0	21	52	15	86	29	28	**294**	*n/a*	**289**	**-5**
2016	4	5	57	1	0	23	52	23	86	30	22	**303**	*n/a*	**271**	**-32**
2017	4	5	54	1	0	21	56	23	88	34	21	**317**	*185*	**275**	**-42**
2018	4	5	57	1	0	28	51	28	86	33	23	**306**	*240*	**279**	**-27**
2019	4	6	50	1	0	33	54	42	86	37	22	**335**	*248*	**286**	**-49**
2020	4	6	46	2	1	32	49	49	86	37	21	**333**	*255*	**290**	**-43**
2021	6	9	56	2	1	32	48	51	86	57		**348**	*223*	**296**	**-52**
2022	6	9	56	2	6	36	45	50	84	57		**351**	*224*	**294**	**-57**
2022: change since 2005	+5	+3	+5	+2	+6	+15	+2	+50	+33	+14		**+135**	*n/a*	**+2**	**-133**

Sources: Table prepared by CRS based on 2005-2022 editions of annual DOD report to Congress on military and security developments involving China (known for 2009 and prior editions as the report on China military power), and (for U.S. Navy ships) U.S. Navy data as presented in CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke. Consistent with the DOD report, which shows data for China for the year prior to the report's publication date, the U.S. Navy data here shows data for the year prior to the prior to the DOD report's publication date. For example, the figure of 294 shown for the U.S. Navy for 2022 shows the number of U.S. Navy ships at the end of FY2021.

Key to abbreviations: n/a = data not available in annual DOD report. **SSB** = ballistic missile submarines. **SSN** = nuclear-powered attack submarines. **SS** = diesel attack submarines. **CV** = aircraft carriers. **CG** = cruisers. **DD** = destroyers. **FF** = frigates. **FFL** = corvettes (i.e., light frigates). **PC** = missile-armed coastal patrol craft. **LST** = amphibious tank landing ship. **LPD** = amphibious transport dock ship. **LSM** = amphibious medium landing ship. (Starting with the 2021 edition, the annual DOD report shows a combined figure for LST/LPD and LSM.) Column for **Total PLAN ship types shown to right**, which shows what might be thought of as the principal combat ships of China's navy, does not include other PLAN ship types not shown to right, such as auxiliary and support ships. **CCG** = China Coast Guard ships. **U.S. total** = Total U.S. Navy battle force ships, which includes

auxiliary and support ships but excludes patrol craft. **U.S. vs. PLAN ship types shown** = total U.S. Navy battle force ships compared to the column for **Total PLAN ship types shown to right**.

Notes: The DOD report generally covers events of the prior calendar year. Thus, the 2021 edition covers events during 2020, and so on for earlier years. Similarly, for the U.S. Navy figures, the 2021 column shows the figure for the end of FY2020, and so on for earlier years.

Table 2. Numbers of Chinese and U.S. Navy Battle Force Ships, 2000-2030

Figures for Chinese ships taken from ONI information paper of February 2020

	2000	2005	2010	2015	2020	2025	2030
Selected ship types							
Ballistic missile submarines	1	1	3	4	4	6	8
Nuclear-powered attack submarines	5	4	5	6	7	10	13
Diesel attack submarines	56	56	48	53	55	55	55
Aircraft carriers, cruisers, destroyers	19	25	25	26	43	55	65
Frigates, corvettes	38	43	50	74	102	120	135
Total number of China navy battle force ships, including types not shown above	**210**	**220**	**220**	**255**	**360**	**400**	**425**
Total U.S. Navy battle force ships	***318***	***282***	***288***	***271***	***296***	***286***	***290***
U.S. total above compared to China total above	***+108***	***+62***	***+68***	***+16***	***-64***	***-114***	***-135***

Sources: Table prepared by CRS. Source for China's navy: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, 4 pp. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission. Figures are for end of calendar year. Source for figures for U.S. Navy: U.S. Navy data; figures are for end of fiscal year.

Note: In the column for the year 2000, the ONI information paper showed a figure for the total number of China navy battle force ships of 110, but the Navy later stated that this was a typo, and that the correct figure is 210.

As shown in **Table 3**, the U.S. Navy projects that between 2020 and 2040, the total number of Chinese ships of the types shown in the table will increase by 94, or about 39%, with most of that increase (77 ships out of 94) coming from roughly equal increases in numbers of large surface combatants (cruisers and destroyers—39 ships) and small surface combatants (frigates and corvettes—38 ships). Numbers of ballistic missile submarines and nuclear-powered attack submarines are each projected to more than double between 2020 and 2040, and the total number of diesel attack submarines is projected to remain almost unchanged. The number of large surface combatants is projected to almost double, and the number of small surface combatants is projected to increase by more than one-third. Numbers of larger (LHA- and LPD-type) amphibious ships are projected to increase, and the number of smaller (LST-type) amphibious ships is projected to decline, with the result that the total number of amphibious ships of all kinds is projected to decline slightly.

Table 3. Numbers of Chinese and U.S. Navy Ships, 2020-2040

Figures for Chinese ships are from U.S. Navy, reflecting data as of October 2020

Ship type	2020	2025	2030	2040	2040 change from 2020
Ballistic missile submarines	4	6	8	10	+6
Nuclear-powered attack submarines	6	10	14	16	+10
Diesel attack submarines	47	47	46	46	-1
Aircraft carriers	2	3	5	6	+4
Cruisers and destroyers	41	52	60	80	+39
Frigates and corvettes	102	120	135	140	+38
LHA-type amphibious assault ships	0	4	4	6	+6
LPD-type amphibious ships	7	10	14	14	+7
LST-type amphibious tank landing ships	30	24	24	15	-15
TOTAL for China of types shown above	**239**	**276**	**310**	**333**	**+94**
TOTAL number of U.S. Navy battle force ships	***297***	***286***	***290***	***329 or 331 or 352***	***+32 or +34 or +55***
U.S. total above compared to China total above	***+58***	***+10***	***-20***	***-4 or -2 or +19***	***-62 or -60 or -39***

Source: For Chinese navy ships: U.S. Navy data provided to CRS by Navy Office of Legislative Affairs, reflecting data as of October 26, 2020.

Note: The figures for the U.S. Navy for 2040 show different alternatives presented in the Navy's FY2024 budget submission.

Selected Elements of China's Naval Modernization Effort

This section provides a brief overview of elements of China's naval modernization effort that have attracted frequent attention from observers.

Anti-Ship Missiles

Anti-Ship Ballistic Missiles (ASBMs)

China is fielding two types of land-based ballistic missiles with a capability of hitting ships at sea at extended ranges—the DF-21D (**Figure 1**), a road-mobile anti-ship ballistic missile (ASBM) with a range of more than 1,500 kilometers (i.e., more than 910 nautical miles), and the DF-26 (**Figure 2**), a road-mobile, multi-role intermediate range ballistic missile (IRBM) with a maximum range of about 3,000 kilometers (i.e., about 1,620 nautical miles) that DOD says is "capable of conducting both conventional and nuclear precision strikes against ground targets as well as conventional strikes against naval targets."[33]

[33] *2022 DOD CMSD*, p. 64. A map on page 67 of the report shows the DF-26 with a range of 4,000 kilometers (about 2,160 nautical miles).

Figure 1. DF-21D Anti-Ship Ballistic Missile (ASBM)

Source: Cropped version of photograph accompanying Andrew S. Erickson, "China's DF-21D Anti-Ship Ballistic Missile (ASBM)—Officially Revealed at 3 September Parade—Complete Open Source Research Compendium," AndrewErickson.com, September 10, 2015, accessed August 28, 2019.

Figure 2. DF-26 Multi-Role Intermediate-Range Ballistic Missile (IRBM)

Source: Cropped version of photograph accompanying Missile Defense Project, "Dong Feng-26 (DF-26)," Missile Threat, Center for Strategic and International Studies, January 8, 2018, last modified January 15, 2019, accessed August 28, 2019.

Until 2020, reported test flights of DF-21s and SDF-26s had not involved attempts to hit moving ships at sea. A November 14, 2020, press report stated that an August 2020 test firing of DF-21 and DF-26 ASBMs into the South China resulted in the missiles successfully hitting a moving target ship south of the Paracel Islands.[34] A December 3, 2020, press report stated that Admiral

[34] Kristin Huang, "China's 'Aircraft-Carrier Killer' Missiles Successfully Hit Target Ship in South China Sea, PLA Insider Reveals," *South China Morning Post*, November 14, 2020. See also Peter Suciu, "Report: China's 'Aircraft-Carrier Killer' Missiles Hit Target Ship in August," *National Interest*, November 15, 2020; Andrew Erickson, "China's DF-21D and DF-26B ASBMs: Is the U.S. Military Ready?" *Real Clear Defense*, November 16, 2020.

Philip Davidson, the commander of U.S. Indo-Pacific Command, "confirmed, for the first time from the U.S. government side, that China's People's Liberation Army has successfully tested an anti-ship ballistic missile against a moving ship."[35]

Observers have expressed strong concerns about China's ASBMs, because such missiles, in combination with broad-area maritime surveillance and targeting systems, would permit China to attack aircraft carriers, other U.S. Navy ships, or ships of allied or partner navies operating in the Western Pacific. The U.S. Navy has not previously faced a threat from highly accurate ballistic missiles capable of hitting moving ships at sea. For this reason, some observers have referred to ASBMs as a "game-changing" weapon.

In April 2022, it was reported that China may have developed a new type of ASBM, perhaps designated the YJ-21, that is small enough to fit into the vertical launch tube of a surface combatant, and that China had test fired such a weapon from a Type 055 cruiser (or large destroyer).[36]

China reportedly is developing hypersonic glide vehicles that, if incorporated into Chinese ASBMs, could make Chinese ASBMs more difficult to intercept. A February 2, 2023, press report states:

> For the first time, the PLA has officially revealed the performance of its advanced anti-ship hypersonic missile, sending a warning to the US amid high tensions in the Taiwan Strait, Chinese analysts said.
>
> China's YJ-21, or Eagle Strike-21, has a terminal speed of Mach 10, cannot be intercepted by any anti-missile weapons system in the world and can launch lethal strikes towards enemy ships, according to an article posted by the official Weibo account of the People's Liberation Army Strategic Support Force on Monday [January 30]....
>
> The article declares that the missile travels six times the speed of sound all the way, and has a terminal speed of 10 times the speed of sound, meaning a speed of 3,400 metres per second (11,155 feet per second) when it hits the target.
>
> "Such a terminal speed cannot be intercepted by any anti-missile weapon system at this stage. Even if it is dropped directly at this terrifying speed [hitting the target] without an explosion it will cause a fatal strike to the enemy ship," the article stated.
>
> The debut of its export variant, the YJ-21E, at last year's Airshow China "shows that the domestic version of the Eagle Strike-21 ship-borne hypersonic missile is no longer the navy's most advanced ship-borne hypersonic missile, and more advanced ship-borne hypersonic missiles are likely to have appeared," it said.
>
> The article was first published on the website of China Science Communication, Guangming Online last year, but it was reposted by an official PLA account for the first time, a development experts described as a clear message for the US.[37]

[35] Josh Rogin, "China's Military Expansion Will Test the Biden Administration," *Washington Post*, December 3, 2020.

[36] Rick Fisher, "China Deploys New Missiles Against the US Navy," Epoch Times, April 29, 2022; Minnie Chan, "Chinese Navy Shows Off Hypersonic Anti-Ship Missiles In Public," *South China Morning Post*, April 20, 2022; Tyler Rogoway, "Mysterious New Missile Launched By China's Giant Type 055 Destroyer," *The Drive*, April 20.

[37] Amber Wang, "Chinese Military Announces YJ-21 Missile Abilities in Social Media Post Read as Warning to US Amid Tension in Taiwan Strait," *South China Morning Post*, February 2, 2023. Material in brackets as in original. See also Gabriel Honrada, "China's Hypersonic Triad Pressing Down on US," *Asia Times*, April 4, 2023.

Anti-Ship Cruise Missiles (ASCMs)

China's extensive inventory of anti-ship cruise missiles (ASCMs) (see **Figure 3**, **Figure 4**, and **Figure 5** for examples of reported images) includes both Russian- and Chinese-made designs, including some advanced and highly capable ones, such as the Chinese-made YJ-18.[38]

Figure 3. Reported Image of Anti-Ship Cruise Missile (ASCM)

Source: Detail of photograph accompanying Pierre Delrieu, "China Promotes Export of CM-302 Supersonic ASCM," *Asian Military Review*, July 3, 2017. (The article states "This is an article published in our December 2016 Issue.") The article states "According to Chinese news media reports, the China Aerospace Science and Industry Corporation (CASIC) CM-302 missile is being marketed for export as "the world's best anti-ship missile." The missile was showcased at the Zhuhai air show in the southern People's Republic of China (PRC) in early November [2016], and is advertised as [a] supersonic Anti-Ship Missile (AShM) [ASCM] which can also be used in the land attack role. The report, published by the national newspaper *China Daily*, suggest[s] that the CM-302 is the export version of CASIC's YJ-12 supersonic AShM, which is in service with the PRC's armed forces.")

Although China's ASCMs do not always receive as much press attention as China's ASBMs (perhaps because ASBMs are a more recent development), observers are nevertheless concerned about them. As discussed later in this report, the relatively long ranges of certain Chinese ASCMs have led to concerns among some observers that the U.S. Navy is not moving quickly enough to arm U.S. Navy surface ships with similarly ranged ASCMs.

Press reports in April 2019 and December 2021 stated that China might be developing a YJ-18 launcher that can be packaged inside a standard commercial shipping container, for the potential

[38] *2022 DOD CMSD*, p. 54. See also Dmitry Filipoff, "Fighting DMO, PT. 8: China's Anti-Ship Firepower And Mass Firing Schemes," Center for International Maritime Security (CIMSEC), May 1, 2023 (the acronym DMO refers to distributed maritime operations); Sam Goldsmith, *Vampire Vampire Vampire, The PLA's Anti-Ship Cruise Missile Threat to Australian and Allied Naval Operations*, Australian Strategic Policy Institute (ASPI), April 2022, 43 pp.; Michael Peck, "Chinese Scientists Say They're Working on an Anti-Ship Missile that Can Fly as High as an Airliner and Dive as Deep as a Submarine," *Business Insider*, October 20, 2022; "China Is Developing a New Supersonic Anti-Ship Missile," *Naval News*, September 19, 2022.

purpose of surreptitiously deploying YJ-18s on merchant ships (**Figure 6**),[39] a capability that, if implemented, could violate the law of naval warfare.[40]

Figure 4. Reported Image of Anti-Ship Cruise Missile (ASCM)

Source: Photograph accompanying "YJ-18 Eagle Strike CH-SS-NX-13," GlobalSecurity.org, updated October 1, 2019. The article states, "A grand military parade was held in Beijing on 01 October 2019 to mark the People's Republic of China's 70th founding anniversary.… One weapon featured was a new generation of anti-ship missiles called YJ-18. China unveiled YJ-18/18A anti-ship cruise missiles in the National Day military parade in central Beijing."

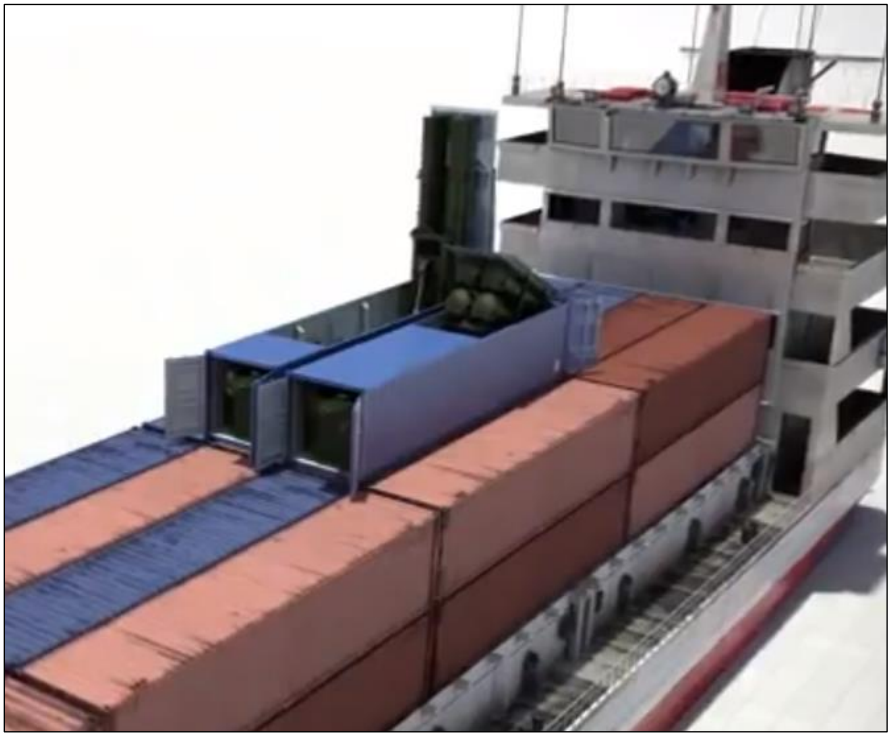
[39] See, for example, Bill Gertz, "China Building Long-Range Cruise Missile Launched From Ship Container," *Washington Free Bea*con, March 27, 2019; Alex Hollings, "China's New Long-Range Cruise Missiles Are Built to be Fired from Containers on Merchant Ships," *SOFREP (Special Operations Forces Report)*, April 4, 2019; "China Is Building Long-Range Cruise Missiles Launched from Ship Containers," *Navy Recognition,* April 8, 2019; Rajesh Uppal, "Threat of Concealed Weapon and Missiles Systems on Standard International Shipping Container," International Defense, Security & Technology, October 20, 2021; Tariq Tahir, "China Feared to be Hiding Missiles in Shipping Containers for Trojan Horse-Style Plan to Launch Attack Anywhere in World," *U.S. Sun*, December 6, 2021. See also Fan Wei and Cao Siqi, "China Debuts Container-Type Missile Launch System; Weapon Can 'Effectively Improve Defense Capabilities of Coastal Countries,'" *Global Times*, November 12, 2022.

[40] Raul (Pete) Pedrozo, "China's Container Missile Deployments Could Violate the Law of Naval Warfare," *International Law Studies (U.S. Naval War College)*, vol. 97, 2021: 1160-1170.

Figure 5. Reported Image of Anti-Ship Cruise Missile (ASCM)

Source: Dennis M. Gormley, Andrew S. Erickson, and Jingdong Yuan, *A Low-Visibility Force Multiplier, Assessing China's Cruise Missile Ambitions*, Published by National Defense University Press for the Center for the Study of Chinese Military Affairs, Institute for National Strategic Studies, Washington, DC, 2014. The image appears on an unnumbered page following page 14. The caption to the photograph states, "YJ-83A/C-802A ASCM on display at 2008 Zhuhai Airshow." The photograph is credited to Associated Press/Wide World Photos.

Figure 6. Illustration of Reported Potential Containerized ASCM Launcher



Source: Illustration accompanying Tariq Tahir, "China Feared to be Hiding Missiles in Shipping Containers for Trojan Horse-Style Plan to Launch Attack Anywhere in World," *U.S. Sun*, December 6, 2021.

Submarines

Overview

China has been steadily modernizing its submarine force, and most of its submarines are now built to relatively modern Chinese and Russian designs.[41] Qualitatively, China's newest submarines might not be as capable as Russia's newest submarines,[42] but compared to China's earlier submarines, which were built to antiquated designs, its newer submarines are much more capable.[43]

Types and Numbers

Most of China's submarines are non-nuclear-powered attack submarines (SSs). China also operates a small number of nuclear-powered attack submarines (SSNs) and a small number of nuclear-powered ballistic missile submarines (SSBNs). The number of SSNs and SSBNs may grow in coming years, but the force will likely continue to consist mostly of SSs. DOD states that "the PLAN has placed a high priority on modernizing its submarine force, but its force structure continues to grow modestly as it works to mature its force, integrate new technologies, and expand its shipyards.... The PLAN will likely maintain between 65 and 70 submarines through the 2020s, replacing older units with more capable units on a near one-to-one basis."[44]

ONI states that "China's submarine force continues to grow at a low rate, though with substantially more-capable submarines replacing older units. Current expansion at submarine production yards could allow higher future production numbers." ONI projects that China's submarine force will grow from a total of 66 boats (4 SSBNs, 7 SSNs, and 55 SSs) in 2020 to 76 boats (8 SSBNs, 13 SSNs, and 55 SSs) in 2030.[45] A November 27, 2022, press report states "The dry-docks at China's nuclear submarine facility at Huludao, Liaoning province, show increased activity. New construction halls are primed. Another dry dock is ready to go. International

[41] For a discussion of Russian military transfers to China, including transfers of submarine technology, see Paul Schwartz, *The Changing Nature and Implications of Russian Military Transfers to China*, Center for Strategic and International Studies (CSIS), June 2021, 8 pp. See also Joseph Trevithick, "Top Russian Submarine Design Bureau Hit By Cyber Attack With Chinese Characteristics," *The Drive*, May 10, 2021.

[42] Observers have sometimes characterized Russia's submarines as being the most capable faced by the U.S. Navy. See, for example, Joe Gould and Aaron Mehta, "US Could Lose a Key Weapon for Tracking Chinese and Russian Subs," *Defense News*, May 1, 2019; Dave Majumdar, "Why the U.S. Navy Fears Russia's Submarines," *National Interest*, October 12, 2018; John Schaus, Lauren Dickey, and Andrew Metrick, "Asia's Looming Subsurface Challenge," *War on the Rocks*, August 11, 2016; Paul McLeary, "Chinese, Russian Subs Increasingly Worrying the Pentagon," *Foreign Policy*, February 24, 2016; Dave Majumdar, "U.S. Navy Impressed with New Russian Attack Boat," *USNI News*, October 28, 2014.

[43] For an additional overview of China's submarine force, see U.S. Naval War College, China Maritime Studies Institute, Quick Look Report "Chinese Undersea Warfare: Development, Capabilities, Trends," undated, 2 pp., which summarizes an academic conference on China's udersea warfare capabilities that was held by the China Maritime Studies Institute on April 11-13, 2023.

[44] *2022 DOD CMSD*, p. 52.

[45] Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 1. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission. See also H. I. Sutton, "China Increases Production Of AIP Submarines With Massive New Shipyard," *Naval News*, February 16, 2021; H. I. Sutton, "First Image Of China's New Nuclear Submarine Under Construction," *Naval News*, February 1, 2021.

analysts point to this as evidence Beijing is gearing up for the mass production of a new generation of nuclear-powered attack and ballistic missile submarines."[46]

China's newest series-built SS design is the Yuan-class (Type 039) SS (**Figure 7**), its newest SSN class is the Shang-class (Type 093) SSN (**Figure 8**), and its newest SSBN class is the Jin (Type 094) class SSBN (**Figure 9**).

Figure 7.Yuan (Type 039) Attack Submarine (SS)

Source: Photograph accompanying "Type 039A Yuan class," SinoDefence.com, July 10, 2018, accessed August 28, 2019.

DOD states that

> the PRC continues to increase its inventory of conventional submarines capable of firing advanced anti-ship cruise missiles (ASCM). Between the mid-1990s and mid-2000s, the PLAN purchased 12 Russian-built KILO class SS units, eight of which are capable of launching ASCMs. China's shipyards have delivered 13 SONG class SS (Type 039) and 17 YUAN class diesel-electric air-independent propulsion attack submarine[s] (SSP) (Type 039A/B). The PRC is expected to produce a total of 25 or more YUAN class submarines by 2025. In late 2021, the PLAN retired the first two KILO-class submarines purchased from Russia in the 1990s.[47]

[46] Jamie Seidel, "Satellite Photos Reveal China's Hypocrisy After Dig to Australia," *News.com.au*, November 27, 2022. See also H. I. Sutton, "Further Expansion Of China's Nuclear Submarine Shipyard," HISutton.com, January 5, 2023.

[47] *2022 DOD CMSD*, pp. 52-53.

Figure 8. Shang (Type 093) Attack Submarine (SSN)

Source: Photograph accompanying SinoDefence.com, "Type 093 Shang Class," July 1, 2018, accessed August 27, 2019, at http://sinodefence.com/type093_shang-class/.

Figure 9. *Jin* (Type 094) Ballistic Missile Submarine (SSBN)

Source: Cropped version of photograph accompanying Minnie Chan, "China Puts a Damper on Navy's 70th Anniversary Celebrations As It Tries to Allay Fears Over Rising Strength," *South China Morning Post*, April 23, 2019. The article credits the photograph to Xinhua.

DOD states further that

> Over the past 15 years, the PLAN has constructed twelve nuclear submarines—two SHANG I class SSNs (Type 093), four SHANG II class SSNs (Type 093A), and six JIN

> class SSBNs (Type 094). Equipped with the CSS-N-14 (JL-2) submarine-launched ballistic missile (SLBM) (7,200KM), the PLAN's six operational JIN class SSBNs represent the PRC's first credible sea-based nuclear deterrent.
>
> By the mid-2020s, the PRC will likely build the SHANG class (Type 093B) guided-missile nuclear-powered attack submarine (SSGN). This new SHANG class variant will enhance the PLAN's anti-surface warfare capability and could provide a clandestine land-attack option if equipped with land-attack cruise missiles (LACM).[48]

In February 2022, the first of a new class of SS, smaller than the Yuan design, was reported, but it is not clear whether this design is intended for China's navy, for export to other countries, or both.[49]

A May 16, 2022, press report states

> A submarine seen in a satellite photo of a Chinese shipyard shows what could be a new class or subtype of a nuclear-powered attack sub with a new stealthy propulsion system and launch tubes for cruise missiles.
>
> The satellite photo of the shipyard at Huludao in Liaoning province, northern China, which was provided to Defense News by Planet Labs, was taken May 3 and shows a submarine on a drydock.
>
> The unidentified boat's presence at the yard was first noted in an April 29 satellite image by geospatial intelligence outfit AllSource Analysis. The organization said the submarine is possibly a new class undergoing construction by China.[50]

An April 3, 2023, press report states the following in connection with the 2022 edition of DOD's annual report to Congress on military and security developments involving China:

> China is for the first time keeping at least one nuclear-armed ballistic missile submarine constantly at sea, according to a Pentagon report—adding pressure on the United States and its allies as they try to counter Beijing's growing military.
>
> The assessment of China's military said China's fleet of six Jin-class ballistic missile submarines were operating "near-continuous" patrols from Hainan Island into the South China Sea. Equipped with a new, longer-range ballistic missile, they can hit the continental United States, analysts say.
>
> The note in the 174-page report drew little attention when it was released in late November [2022], but shows crucial improvements in Chinese capabilities, according to four regional military attaches familiar with naval operations and five other security analysts.[51]

Submarine Weapons

China's submarines are armed with one or more of the following: ASCMs, wire-guided and wake-homing torpedoes, and mines. Wake-homing torpedoes can be very difficult for surface

[48] *2022 DOD CMSD*, p. 53.

[49] H. I. Sutton, "China's New Submarine Is Unlike Anything In Western Navies," *Naval News*, February 15, 2022; Gabriel Honrada, "China Offers a Glimpse of New Type Mini-Submarine," *Asia Times*, February 10, 2022.

[50] Mike Yeo, "Satellite Photo Shows Possible New Chinese Nuclear Submarine Able to Launch Cruise Missiles," *Defense News*, May 16, 2022. See also Gabriel Honrada, "Satellite Reveals China's New Nuclear Attack Sub," *Asia Times*, May 16, 2022; John Feng, "China's New Nuclear Submarine May Just Have Been Revealed," *Newsweek*, May 10, 2022; Greg Torode, "Satellite Images Raise Prospect of New Class of Chinese Submarine," *Reuters*, May 10, 2022.

[51] Greg Torode and Eduardo Baptista, "Analysis: China's Intensifying Nuclear-Armed Submarine Patrols Add Complexity for U.S., Allies," *Reuters*, April 3, 2023. See also Anders Hagstrom, "China's New Role for Its Nuclear Submarines Has the Pentagon's Attention," *Fox News*, April 4, 2023.

ships to decoy. DOD states that each Jin-class SSBN is equipped to carry 12 JL-2 or JL-3 nuclear-armed submarine-launched ballistic missiles (SLBMs).[52] The JL-3 is a new SLBM with a range longer than that of the JL-2. A May 2, 2021, press report stated that China's latest Jin-class SSBN is armed with JL-3s.[53]

Aircraft Carriers

Overview[54]

China's first aircraft carrier, *Liaoning* (Type 001) (**Figure 10**), entered service in 2012. China's second aircraft carrier (and its first fully indigenously built carrier), *Shandong* (Type 002) (**Figure 11**) entered service on December 17, 2019. *Liaoning* and *Shandong* launch fixed-wing aircraft using a "ski ramp" at the ship's bow.

Compared with *Liaoning* and *Shandong*, U.S. Navy aircraft carriers are larger (about 100,000 tons full load displacement), nuclear powered (giving them greater cruising endurance than a conventionally powered ship), able to embark and operate a larger number of aircraft (60 or more), and launch fixed-wing aircraft using catapults, which can give those aircraft a range/payload capability greater than that of aircraft launched with a ski ramp.

China's third carrier, *Fujian* (Type 003) (**Figure 12**, **Figure 13**, and **Figure 14**), was launched (i.e., put into the water for the final stages of its construction) in on June 17, 2022.[55] ONI expects the ship to enter service by 2024.[56] The ship is expected to be conventionally powered, closer in

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[52] *2022 DOD CMSD*, pp. 94, 96. DOD estimates the range of the JL-2 at 7,200 km (*2022 DOD CMSD*, p. 53). Such a range could permit Jin-class SSBNs to attack targets in Alaska (except the Alaskan panhandle) from protected bastions close to China, targets in Hawaii (as well as targets in Alaska, except the Alaskan panhandle) from locations south of Japan, targets in the western half of the 48 contiguous states (as well as Hawaii and Alaska) from mid-ocean locations west of Hawaii, or targets in all 50 states from mid-ocean locations east of Hawaii. DOD states that

> The current range limitations of the JL-2 will require the JIN to operate in areas north and east of Hawaii if the PRC seeks to target the east coast of the United States. The fielding of newer, more capable, and longer ranged SLBMs such as the JL-3 gives the PLAN the ability to target the continental United States from littoral waters[,] allowing the PLAN to consider bastion operations to enhance the survivability of its sea-based deterrent. The South China Sea and Bohai Gulf are probably the PRC's preferred options for employing this concept.
>
> (*2022 DOD CMSD*, p. 96.)

See also Kyle Mizokami, "China's New Submarine-Launched Missile Can Reach the Western U.S., The JL-3 Nuclear-Tipped Missile Can Only Hit About a Third of the United States, But It's Enough," Popular *Mechanics*, November 28, 2022.

[53] Minnie Chan, "China's New Nuclear Submarine Missiles Expand Range in US: Analysts," *South China Morning Post*, May 2, 2021. The article states that the JL-3 has a "range [of] over 10,000km (6,200 miles), a source close to the [Chinese] navy said." Such a range could permit Jin-class SSBNs to attack larger portions of the United States from the locations described in the previous footnote.

[54] For an article providing a review of developments in China's aircraft carrier and carrier-based aircraft programs, see Rick Joe, "003 and More: An Update on China's Aircraft Carriers," *Diplomat*, September 29, 2020. Consistent with the discussion in that article, this CRS report uses the following updated designations of China's carriers: China's second aircraft carrier, previously referred to as the Type 001A, is now referred to as the Type 002; the next aircraft carrier design after that, previously referred to as the Type 002, is now referred to as the Type 003, and the potential design that could follow, previously referred to as the Type 003, is now referred to as the Type 004.

[55] See, for example, Alexandra Stevenson, "China Launches Third Aircraft Carrier in Major Milestone for Xi Jinping," *New York Times*, June 17, 2022; Chun Han Wong, "China Launches Third Aircraft Carrier, Advancing Naval Ambitions," *Wall Street Journal*, June 17, 2022; Jack Lau, "China Launches Fujian, PLA Navy's 3rd Aircraft Carrier," *South China Morning Post*, June 17, 2022.

[56] Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED

size to U.S. Navy aircraft carriers, and equipped with catapults rather than a ski ramp for launching aircraft. China's fourth carrier reportedly may have begun construction as early as 2021.[57]

Observers have speculated that China may eventually field a force of four to six (or possibly more than six) aircraft carriers. In late November 2019, it was reported that the Chinese government, while deciding to proceed with the construction of the fourth carrier, had put on hold plans to build a fifth carrier, which was to be nuclear-powered, due to budgetary and technical considerations.[58] Observers expect that it will be some time before China masters carrier-based aircraft operations on a substantial scale.[59]

Liaoning (Type 001)

Liaoning is a refurbished ex-Ukrainian aircraft carrier that China purchased from Ukraine in 1998 as an unfinished ship.[60] It is conventionally powered, has an estimated full load displacement of 60,000 to 66,000 tons, and reportedly can accommodate an air wing of 30 or more fixed-wing airplanes and helicopters, including 24 fighters. The *Liaoning* lacks aircraft catapults and instead launches fixed-wing airplanes off the ship's bow using an inclined ski ramp.

Some observers have referred to the *Liaoning* as China's "starter" carrier. China has been using *Liaoning* in part for pilot training. In May 2018, China reportedly announced that the aircraft carrier group formed around *Liaoning* had reached initial operational capability (IOC),[61] although that term might not mean the same as it does when used by DOD in connection with U.S. weapon systems.

Shandong (Type 002)

Shandong is a modified version of the *Liaoning* design that incorporates some design improvements, including features that reportedly will permit it to embark and operate a larger air

China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 4. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.

[57] Minnie Chan, "Chinese Navy Set to Build Fourth Aircraft Carrier, but Plans for a More Advanced Ship Are Put on Hold," *South China Morning Post,* November 28, 2019.

[58] Minnie Chan, "Chinese Navy Set to Build Fourth Aircraft Carrier, but Plans for a More Advanced Ship Are Put on Hold," *South China Morning Post*, November 28, 2019. See also Steven Stashwick, "Technical Problems, Slowing Economy Cut China's Carrier Ambitions," *Diplomat*, December 4, 2019; Sebastien Roblin, "China Cancels Plans for Two Nuclear-Powered Super Aircraft Carriers," *National Interest*, December 7, 2019; Minnie Chan, "China's Navy is Being Forced to Rethink Its Spending Plans as Cost of Trade War Rises," *South China Morning Post,* May 26, 2019.

[59] For additional discussion, see Michael Dahm, "Lessons from the Changing Geometry of PLA Navy Carrier Ops," *U.S. Naval Institute Proceedings*, January 2023; Michael Peck, "China Is Scrambling to Find Pilots to Fly From Its Growing Aircraft Carrier Fleet," *Business Insider,* March 8, 2023.

[60] Prior to the dissolution of the Soviet Union in December 1991, Ukraine was a part of the Soviet Union and the place where the Soviet Union built its aircraft carriers.

[61] Andrew Tate, "Liaoning Carrier Group Reaches Initial Operational Capability, *IHS Jane's Defence Weekly,* June 4, 2018. See also Travis Fedschun, "China Says Carrier Group Reaches 'Initial' Combat Capability," *Fox News,* May 31, 2018; "China's First Aircraft Carrier Formation Capable of Systemic Combat Operation," CGTV.com, May 31, 2018; *Global Times*, "Chinese Aircraft Carrier Forming All-Weather Combat Capability with Successful Night Takeoff and Landing," *People's Daily Online*, May 29, 2018.

wing of 40 aircraft that includes 36 fighters.[62] Its displacement is estimated at 66,000 to 70,000 tons.

Figure 10. *Liaoning* (Type 001) Aircraft Carrier

Source: Cropped version of photograph accompanying China Power Team, "How Does China's First Aircraft Carrier Stack Up?" China Power (Center for Strategic and International Studies), December 9, 2015, updated December 14, 2018, accessed August 28, 2019.

Figure 11. *Shandong* (Type 002) Aircraft Carrier

Source: Cropped version of photograph accompanying Daniel Brown, "China's Newest Aircraft Carrier Is Actually Very Outdated—But Its Next One Should Worry the US Navy A Lot," *Business Insider*, July 18, 2018. The article credits the photograph to Reuters.

[62] See, for example, Liu Xuanzun, "China's Second Aircraft Carrier Can Carry 50% More Fighter Jets Than Its First," *Global Times*, August 13, 2019; Liu Zhen, "China's New Aircraft Carrier to Pack More Jet Power Than the Liaoning," *South China Morning Post*, August 15, 2019.

Fujian (Type 003)

A May 4, 2023, press report states that *Fujian* has an estimated full load displacement of more than 79,000 tons and is equipped, as observers had expected, with electromagnetic catapults rather than a ski ramp, which will improve the range/payload capability of the fixed-wing aircraft that it operates.[63]

Figure 12. *Fujian* (Type 003) Aircraft Carrier

Source: Photograph accompanying Brad Lendon, "Never Mind China's New Aircraft Carrier, These Are the Ships the US Should Worry About," CNN, June 26, 2022.

[63] Naval News, "3rd China Navy's Aircraft Carrier Fujian Holds Propulsion Tests," *Navy Recognition*, May 4, 2023. The article states that the ship has "a normal displacement of 71,875 tons (70,740 long tons) and a full load displacement of over 80,000 [metric] tons (79,000 long tons). She measures 300 meters (984 feet 3 inches) in length at the waterline and 316 meters (1,036 feet 9 inches) overall, with a beam of 39.5 meters (129 feet 7 inches) at the waterline and 76 meters (249 feet 4 inches) overall. Its propulsion system consists of steam turbines, 8 boilers, and 4 shafts, providing over 220,000 horsepower (164MW).... Equipped with an electromagnetic aircraft launch and arrest system, it allows for more efficient and effective aircraft operations compared to its predecessors, the Liaoning and the Shandong." By comparison, U.S. Navy aircraft carriers are nuclear powered and have a full load displacement of about 97,000 tons (Nimitz class) or 100,000 tons (Gerald R. Ford class), a length overall of 1,092 feet, a beam of 134 feet at the waterline, and a flight deck width of 252 feet (Nimitz class) or 256 feet (Gerald R. Ford class). (U.S. Navy, "Aircraft Carriers—CVN," updated November 12, 2021.)

Figure 13. *Fujian* (Type 003) Aircraft Carrier

Source: Cropped version of photograph accompanying Minnie Chan, "China's Fujian aircraft carrier doesn't have radar and weapon systems yet, photos show," *South China Morning Post*, July 19, 2022.

Figure 14. *Fujian* (Type 003) Aircraft Carrier

Source: Cropped version of photograph accompanying "Power, Mooring Tests of Aircraft Carrier Fujian Successfully Underway," *China Military Online*, April 23, 2023. The caption to the photograph identifies it as a screen shot from a China Central Television video report.

China's Fourth Carrier

A May 1, 2022, press report states, "Recent images of a stealth fighter jet at a naval airbase suggest China has begun pilot training preparations for a fourth aircraft carrier, defence experts say."[64] Some sources have stated that China's fourth aircraft carrier would be built to the Type 003 design. Press reports from October 10, 2022, and March 13, 2021, however, suggest that the ship may be nuclear-powered rather than conventionally powered.[65]

Possible Type 076 Catapult-Equipped Amphibious Assault Ship

See also the discussion of the possible catapult-equipped Type 076 amphibious assault ship (**Figure 26** and **Figure 27**) in the section on China's amphibious ships.

Commercial Heavy-Lift Ship Reportedly Used in Exercise as Helicopter Carrier

In August 2020, it was reported that China had used a commercial heavy-lift ship in a military exercise as a platform for operating at least two PLA Army helicopters.[66]

Carrier-Based Aircraft[67]

China's primary carrier-based fighter aircraft is the J-15 or Flying Shark (**Figure 15** and **Figure 16**), an aircraft derived from the Russian Su-33 Flanker aircraft design that can operate from carriers equipped with a ski ramp rather than catapults, but which some observers have critiqued for its range/payload limitations in operations from carriers equipped with ski ramps rather than catapults.[68] December 2021 press reports stated that China has developed an upgraded, catapult-capable version of the J-15 that could have improved range/payload when operated from a catapult-equipped carrier.[69]

China reportedly plans to develop a carrier-capable variant of its J-20 fifth-generation stealth fighter and/or a carrier-capable variant of its FC-31/J-31 fifth-generation stealth fighter to complement or succeed the J-15 on catapult-equipped Chinese carriers.[70] China reportedly is also

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[64] Minnie Chan, "Is China Ready for Aircraft Carrier No 4? Talk Swirls Over Stealth Fighter Jets at PLA Naval Base," *South China Morning Post*, May 1, 2022.

[65] Gabriel Honrada, "China's Next Aircraft Carrier Likely to Be Nuclear," *Asia Times*, October 10, 2022; Minnie Chan, "Chinese Military: Fourth Aircraft Carrier Likely to Be Nuclear Powered, Sources Say," *South China Morning Post*, March 13, 2021. See also EurAsian Times Desk, "China Aims To Deploy First-Ever 'Nuclear-Powered Aircraft Carrier' By 2025–Reports," *EurAsian Times*, March 13, 2021.

[66] David Axe, "Surprise! The Chinese Navy Just Transformed This Cargo Ship Into An Instant Helicopter Carrier," *Forbes*, August 22, 2020; Dave Makichuk, "PLA Army Tests Commercial Ships as Wartime Flight Decks," *Asia Times*, August 25, 2020; John Dotson, "Semi-Submersible Heavy Lift Vessels: A New "Maritime Relay Platform" for PLA Cross-Strait Operations?" Jamestown Foundation, August 31, 2020.

[67] For an overview of PLA naval aviation forces, see "PLA Navy Aerospace Forces" in *PLA Aerospace Power: A Primer on Trends in China's Military Air, Space, and Missile Forces*, 3rd Edition, Air University, China Aerospace Studies Institute (CASI), undated, posted August 15, 2022, pp. 38-52. See also Akhil Kadidal, "Armed to the Teeth: China's New Aircraft Carrier Provides Unprecedented Strike Power," *Jane's Defence Weekly*, January 5, 2023.

[68] For a discussion of the J-15, see, for example, Rick Joe, "China's J-15 Carrierborne Fighter: Sizing up the Competition," *Diplomat*, May 20, 2021.

[69] Andreas Rupprecht Mainz and Jon Grevatt, "Shenyang Produces First Catapult-Capable J-15," *Jane's Defence Weekly*, December 16, 2021; David Axe, "China's Next Carrier Fighter Is A Lighter, Meaner J-15," *Forbes*, December 20, 2021.

[70] See *2022 DOD CMSD*, p. 60; Daniel Salisbury, *PRC Navy Likely Testing Carrier-Based Stealth Fighters*, China Aerospace Studies Institute, January 2022, 3 pp.; Mike Yeo, "New Variants of Chinese Stealth Fighters Break Cover,"

developing a carrier-based airborne early warning (AEW) aircraft, called the KJ-600, that is similar to the U.S. Navy's carrier-based E-2 Hawkeye AEW aircraft,[71] and stealth drone aircraft.[72]

Figure 15. J-15 Flying Shark Carrier-Capable Fighter

Source: Photograph accompanying "China Developing Elite New Variants of the J-15 Flying Shark to Deploy from EMALS Equipped Future Carriers; Implications for the Balance of Power at Sea," *Military Watch Magazine*, August 17, 2018, accessed August 28, 2019.

Defense News, October 29, 2021; Ryan Pickrell, "China Is Working on a Next-Generation Fighter Jet for Its Growing Fleet of Aircraft Carriers and Could Unveil It This Year," *Business Insider*, September 30, 2021; Zhao Lei, "New AVIC Fighter Jet to Appear 'Before Year's End,'" *China Daily*, September 30, 2021; Reuben Johnson, "China's J-35 Carrier Fighter Appears; Step To 'Most Powerful Navy'?" *Breaking Defense*, July 1, 2021; Reuben Johnson, "COVID, Hacking, and Spying Helped China Develop a New Stealth Fighter in Record Time," *Bulwark*, June 23, 2021; Mike Yeo, "Stealth Fighter Mock-up Appears at China's Aircraft Carrier Testing Facility," *Defense News*, June 9, 2021; H. I. Sutton, "First Sighting Of New Stealth Fighter For Chinese Navy's Aircraft Carriers," *Naval News*, June 8, 2021; Rick Joe, "The FC-31, China's 'Other' Stealth Fighter, A Look at the Jet with Many Names—and Its Carrier-Based Future," *Diplomat*, February 18, 2021; Kris Osborn, "Is China Building Its Own F-35 Fighter Jets for its Aircraft Carriers?" *National Interest*, July 3, 2020; Caleb Larson, "FC-31: China's Next Carrier Jet is Stolen and Stealthy," *National Interest*, April 18, 2020; Sebastien Roblin, "China's New Aircraft Carriers Are Getting Stealth Fighters," *National Interest*, October 26, 2019; Rick Joe, "Beyond China's J-20 Stealth Fighter," *Diplomat*, September 20, 2019; Minnie Chan, "China's Navy 'Set to Pick J-20 Stealth Jets for Its Next Generation Carriers,'" *South China Morning Post*, August 27, 2019. See also Thomas Newdick, "New Images Of China's Elusive Catapult-Capable J-15T Carrier Fighter Emerge," *The Drive*, November 18, 2020.

[71] *2022 DOD CMSD*, p. 55. See also, for example, Liu Zhen, "China's Military Steps Up Development of Ship-Based Warplanes to Keep Up with Aircraft Carrier Advances," *South China Morning Post*, July 30, 2022; Liu Xuanzun, "China's First Carrier-Based Early Warning Plane Continues Flight Tests: Report," *Global Times*, February 22, 2021; H. I. Sutton, "First Image Of China's New Carrier-Based AEW Plane," *Forbes*, August 29, 2020; Liu Xuanzun, "China's First Carrier-Based, Fixed-Wing Early Warning Aircraft Makes Maiden Flight: Reports," *Global Times*, September 1, 2020; Peter Suciu, "The Xian KJ-600 Could Make China's Aircraft Carriers Far More Powerful," *National Interest*, September 5, 2020; Kris Osborn, "KJ-600: China's New Surveillance Plane Will Make Their Aircraft Carriers Even More Deadly," *National Interest*, September 8, 2020.

[72] Minnie Chan, "China to Deploy Sharp Sword Stealth Drone for New Type 001A Aircraft Carrier," *South China Morning Post*, September 17, 2019. See also Joseph Trevithick, "Chinese Aircraft Carrier Seen With A Fleet Of Drones On Its Deck," *The Drive*, June 2, 2022.

Figure 16. J-15 Flying Shark Carrier-Capable Fighter

Source: Photograph accompanying Mike Yeo, "Footage Shows Domestic Engine on China's J-15 Fighter Jet," Defense News, November 28, 2022. The article credits the photograph to the Chinese Defense Ministry.

Roles and Missions

Although aircraft carriers might have some value for China in Taiwan-related conflict scenarios, they are not considered critical for Chinese operations in such scenarios, because Taiwan is within range of land-based Chinese aircraft. Consequently, most observers believe that China is acquiring carriers primarily for their value in other kinds of operations, and to demonstrate China's status as a leading regional power and major world power. Chinese aircraft carriers could be used for power-projection operations, particularly in scenarios that do not involve opposing U.S. forces, and to impress or intimidate foreign observers.[73]

Chinese aircraft carriers could also be used for humanitarian assistance and disaster relief (HA/DR) operations, maritime security operations (such as antipiracy operations), and noncombatant evacuation operations (NEOs). Politically, aircraft carriers could be particularly valuable to China for projecting an image of China as a major world power, because aircraft carriers are viewed by many as symbols of major world power status. In a combat situation involving opposing U.S. naval and air forces, Chinese aircraft carriers would be highly vulnerable

[73] For a discussion, see, for example, Bryan McGrath and Seth Cropsey, "The Real Reason China Wants Aircraft Carriers, China's Carrier Plans Target U.S. Alliances, Not Its Navy," *Real Clear Defense* (*www.realcleardefense.com*), April 10, 2014; Sebastien Roblin, "All of the Reasons Why the World Should Fear China's Aircraft Carriers," *National Interest*, October 24, 2017.

to attack by U.S. ships and aircraft, but conducting such attacks could divert U.S. ships and aircraft from performing other missions in a conflict situation with China.

Surface Combatants

Overview

China since the early 1990s has put into service numerous new classes of indigenously built surface combatants, including a new cruiser (or large destroyer), several classes of destroyers and frigates, a new class of corvettes (i.e., light frigates), and a new class of missile-armed patrol craft.

These new classes of surface combatants demonstrate a significant modernization of PLA Navy surface combatant technology. DOD states that China's navy "remains engaged in a robust shipbuilding program for surface combatants. At the close of 2021, the PLAN was building an aircraft carrier, a new batch of guided-missile destroyers (DDG), and a new batch of guided missile frigates (FFG). These assets will significantly upgrade the PLAN's air defense, anti-ship, and anti-submarine capabilities, and will be critical as the PLAN expands its operations beyond the range of the PLA's shore-based air defense systems."[74] DIA states that "the era of past designs has given way to production of modern multimission destroyer, frigate, and corvette classes as China's technological advancement in naval design has begun to approach a level commensurate with, and in some cases exceeding, that of other modern navies."[75] China is also upgrading its older surface combatants with new weapons and other equipment.[76]

Type 055 Cruiser/Large Destroyer

China is building a new class of cruiser (or large destroyer), called the Renhai-class or Type 055 (**Figure 17**, **Figure 18**, and **Figure 19**), that reportedly displaces between 12,000 and 13,000 tons.[77] A March 7, 2021, press report by a Chinese media outlet states that the ship displaces more than 12,000 tons.[78] By way of comparison, the U.S. Navy's Ticonderoga (CG-47) class cruisers and Arleigh Burke (DDG-51) class destroyers (aka the U.S. Navy's Aegis cruisers and destroyers) displace about 10,100 tons and 9,700 tons, respectively, while the U.S. Navy's three Zumwalt (DDG-1000) class destroyers displace about 15,700 tons.

[74] *2022 DOD CMSD*, p. 53.

[75] *2019 DIA CMP*, p. 70.

[76] See, for example, H. I. Sutton, "China Increases Potency Of Anti-Carrier Capabilities," *Forbes*, May 1, 2020; Peter Suciu, "Chinese Warships Are Now Armed with Supersonic Anti-Ship Missiles," *National Interest*, May 10, 2020.

[77] One article from a Chinse media outlet, for example, states, "This ship class has a displacement of more than 12,000 tons." (Liu Xuanzun, "Chinese PLA's Two Newly Commissioned Large Destroyers 'Ready for Combat' with Latest Drills," *Global Times*, August 22, 2022.) See also China Daily, "2nd Type 055 Destroyer Enters Service," *People's Daily Online*, March 10, 2021.) For a discussion of the Type 055 design, see Sidharth Kaushal, "The Type 055: A Glimpse into the PLAN's Developmental Trajectory," Royal United Services Institute (RUSI), October 19, 2020.

[78] Liu Xuanzun, "China's 2nd Type 055 Large Destroyer Enters Naval Service," *Global Times*, March 7, 2021.

Figure 17. *Renhai* (Type 055) Cruiser (or Large Destroyer)

Source: Cropped version of photograph accompanying Marielle Descalsota, "Take a Look at China's Biggest Destroyer, a $920 Million Cruiser That's Said to Be the 2nd Most Powerful in the World after the USS Zumwalt," Business Insider, June 22, 2022. The photograph is credited to Sun Zifa/China News Service/Getty Images.

Figure 18. *Renhai* (Type 055) Cruiser (or Large Destroyer)

Source: Photograph accompanying Peter Suciu, "Chinese Navy to Launch 8th New Type 055 'Stealth' Destroyer," *National Interest*, August 22, 2020. The article credits the photograph to "Chinese Internet."

ONI states that Type 055 ships are being built by two shipyards.[79] The first Type 055 ship was reportedly commissioned into service in January 2020,[80] and the eighth was reportedly

[79] Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 4. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission.

[80] Liu Xuanzun, "China's 2nd Type 055 Large Destroyer Enters Naval Service," *Global Times*, March 7, 2021. See also China Daily, "2nd Type 055 Destroyer Enters Service," *People's Daily Online*, March 10, 2021; Xavier Vavasseur, "China's 2nd Type 055 Destroyer 'Lhasa' 拉萨 Commissioned With PLAN," *Naval News*, March 7, 2021; Xavier

commissioned into service in March 2023.[81] A January 2022 press report stated that in addition to the first eight ships, at least two more were under construction.[82]

Figure 19. Renhai (Type 055) Cruiser (or Large Destroyer)

Unofficial illustration by *Naval News*

Source: Illustration accompanying H. I. Sutton, "Bigger Than A U.S. Navy AEGIS Cruiser: China Is Building More Type-055s," *Naval News*, January 12, 2022.

Type 052 Destroyer

China since the early 1990s has put into service multiple new classes of indigenously built destroyers, the most recent of which is the Luyang III (Type 052D) class (**Figure 20**), which displaces about 7,500 tons and is equipped with phased-array radars and vertical launch missile systems that outwardly are broadly similar to those on U.S. Navy cruisers and destroyers. Press reports in March 2021 stated that China is now commissioning an upgraded version of the Type 052D, informally called the Type 052DL, that incorporates an extended-length helicopter flight deck and a new radar.[83]

Vavasseur, "China Commissions A Type 055 DDG, A Type 075 LHD And A Type 094 SSBN In A Single Day," *Naval News*, April 24, 2021.

[81] "The Eighth Type 055 Destroyer Officially Commissioned to PLA Navy," *China Military Online*, April 23, 2023. See also Curtis Lee, "China Now Has 8 Type 055 Destroyers In Active Service," *Naval News*, April 27, 2023.

[82] H. I. Sutton, "Bigger Than A U.S. Navy AEGIS Cruiser: China Is Building More Type-055s," *Naval News*, January 12, 2022. Regarding an improved air defense missile called the HQ-26 that Type 055 ships reportedly do not yet carry, see Thomas Corbett and Peter W. Singer, "China's Big New Warship Is Missing an Important New Weapon," *Defense One*, January 23, 2023.

[83] "Chinese Navy Commissions Upgraded Variation of the Type 052D Destroyer," *Navy Recognition*, March 3, 2021; Liu Xuanzun, "PLA's 4th Improved Type 052D Destroyer Makes Maiden Appearance in Maritime Exercise," *Global Times*, March 30, 2021; Liu Zhen, "Chinese Navy Sails New Destroyers in South China Sea Amid Military Shipbuilding Spree," *South China Morning Post*, June 15, 2021.

Type 052D ships have been in serial production for some time; a March 12, 2023, press report states that the 27th and the 28th Type 052D ships had been launched (i.e., put into the water for the final phase of their construction), and that three additional Type 052D ships were under construction at the same shipyard.[84]

Figure 20. *Luyang III* (Type 052D) Destroyer

Source: Cropped version of photograph accompanying "Type 052D Luyang-III Class," SinoDefence.com, September 3, 2017, accessed August 28, 2019.

Type 054 Frigate

China since the early 1990s has also put into service multiple new classes of indigenously built frigates, the most recent of which is the Jiangkai II (Type 054A) class (**Figure 21**), which displaces about 4,000 tons. ONI stated in February 2020 that 30 Type 054As entered service between 2008 and 2019, and that no additional Type 054As were then under construction.[85] An August 2021 press report from a Chinse media outlet, however, stated that "China is reportedly building another batch of Type 054A frigates for the People's Liberation Army Navy (PLA Navy) after it had launched two new ships of this class over the past few months." The press report noted that a report from the *Jane's* organization had stated that the 32nd Type 054A ship had recently been launched (i.e., put into the water for the final stages of its construction).[86]

[84] Tayfun Ozberk, "China Launches Two More Type 052DL Destroyers In Dalian," *Naval News*, March 12, 2023. See also Liu Xuanzun, "China Launches Two New Type 052D Destroyers: Media," *Global Times*, March 12, 2023; John Hill, "China's Navy Launches New Destroyers at Dalian Shipyard," *Naval Technology*, March 14, 2023. An August 21, 2022, press report (Xavier Vavasseur, "Five Type 052D Destroyers Under Construction In China," *Naval News*, August 21, 2022) referred to a photograph of five Type 05D ships under construction at a shipyard at Dalian, China. The article stated, "Contacted by Naval News, two Chinese military observers confirmed that there are currently 25 destroyers of the class (13 Type 052D and 12 Type 052DL) currently in service with the PLAN. They will soon be joined by the five under construction at Dalian and (at least) one more being built at the Jiangnan Changxing Shipbuilding and Heavy Industry Corporation (the other Chinese shipyard building large surface combatants, located North East of Shanghai)."

[85] Source: Unclassified ONI information paper prepared for Senate Armed Services Committee, subject "UPDATED China: Naval Construction Trends vis-à-vis U.S. Navy Shipbuilding Plans, 2020-2030," February 2020, p. 4. Provided by Senate Armed Services Committee to CRS and CBO on March 4, 2020, and used in this CRS report with the committee's permission. For a press article discussing the potential features of China's next frigate design beyond the Type 054A, see Rick Joe, "What Will the Chinese Navy's Next Frigate Look Like?" *Diplomat*, May 15, 2020.

[86] Liu Xuanzun, "Type 054A Frigate Good Choice to Expand PLA Naval Fleet and Boost Combat Preparedness:

Other press reports, citing satellite images of Chinese shipyards, state that China's frigate production may be shifting to a new, larger frigate that some observers refer to as the Type 054B.[87]

Figure 21. *Jiangkai II* (Type 054A) Frigate

Source: Cropped version of photograph from Chinese Military Review, "Type 054A (Jiangkai II class) FFG-546 Yancheng Guided Missile Frigate in Mediterranean," undated (but with a URL suggesting that it was posted in February of 2014), accessed August 29, 2018.

Type 056 Corvette

China also built—in large numbers over a relatively short time period—a new type of corvette (i.e., a light frigate, or FFL) called the Jiangdao class or Type 056 (**Figure 22**), which reportedly displaces 1,300 tons to 1,500 tons.[88] Type 056 ships were built at a high annual rate in four shipyards—the first was commissioned in 2013, and the 72nd and final ship of the type was reportedly commissioned in early 2021, implying an average commisisoning rate of about eight ships per year. DOD states that China's navy "commissioned the 72nd JIANGDAO [class corvette] in February 2021, completing the production run. The PLAN also transferred the early

Experts," *Global Times*, August 12, 2021.

[87] Alex Luck, "China's Type 054B Next-Gen Frigate Under Construction?" *Naval News*, January 30, 2023; Minnie Chan, "China Makes Progress on Advanced Warship Bigger than Type 054A Frigate, According to New Satellite Images," *South China Morning Post*, January 27, 2023; "China Makes Progress on Advanced Warship Bigger than Type 054A Frigate, According to New Satellite Images," Pakistan Defence, January 27, 2023; Minnie Chan, "China Naval Steel Order Sparks Speculation over Bigger, Faster Frigate," *South China Morning Post*, May 7, 2022.

[88] For an overview of the Type 056 corvette, see Eric Wertheim, "China's Jiangdao-class Corvette: Mainstay of the First Island Chain," *U.S. Naval Institute Proceedings*, September 2022.

flight JIANGDAO variants, likely 22 ships total, to the China Coast Guard in 2021, probably due to the models' lack of [a] towed-array sonar. The 056A FFLs are equipped with a towed-array sonar and are thus capable ASW ships."[89] As shown in **Table 1**, the rapid growth in the number of Type 056 corvettes since 2013 accounts for a substantial share of the net increase in the total number of ships in China's navy since 2013.

Figure 22. *Jingdao* (Type 056) Corvette

Source: Cropped version of image included at Chinese Military Review, "Random Images of Chinese Type 056 Jiangdao Class Light Corvette," undated (but with a URL suggesting that it was posted in October 2013), accessed August 29, 2018.

Amphibious Ships[90]

Type 071 Amphibious Ship

China's new *Yuzhao* or Type 071 amphibious ships (**Figure 23**) have an estimated displacement of more than 19,855 tons,[91] compared to about 25,900 tons for the U.S. Navy's new San Antonio (LPD-17) class amphibious ships. A May 6, 2021, press report states that the eighth Type 071 ship "recently made its first publicly known maritime exercise appearance."[92]

[89] *2022 DOD CMSD*, p. 53.

[90] For an article providing a brief overview of China's amphibious shipbuilding programs, see Yasmin Tadjdeh, "China Building Formidable Amphibious Fleet," *National Defense*, June 25, 2021.

[91] Unless otherwise indicated, displacement figures cited in this report are full load displacements. *IHS Jane's Fighting Ships 2017-2018*, p. 156, does not provide a full load displacement for the Type 071 class design. Instead, it provides a standard displacement of 19,855 tons. Full load displacement is larger than standard displacement, so the full load displacement of the Type 071 design is more than 19,855 tons.

[92] Liu Xuanzun, "China's Newly Commissioned Amphibious Landing Ship Joins Exercises, 'to Form Powerful Partnership with Amphibious Assault Ship,'" *Global Times*, May 6, 2021.

Figure 23. *Yuzhao* (Type 071) Amphibious Ship

Source: Cropped version of photograph from Chinese Military Review, "Jinggang Shan (999) Type 071 YUZHAO Class Amphibious Transport Dock," undated (but with a URL suggesting that it was posted in February 2012), accessed August 29, 2018.

Type 075 Amphibious Assault Ship

In April 2021, China commissioned into service the first of a new type of amphibious assault ship,[93] called the *Yushen* or Type 075 (**Figure 24** and **Figure 25**), that has an estimated displacement of about 35,000 tons, compared to 41,000 to 45,000 tons for U.S. Navy LHA/LHD-type amphibious assault ships.[94] In March 2022, it was reported that the first Type 075 ship had achieved initial operational capability (IOC),[95] although that term might not mean the same as it does when used by DOD in connection with U.S. weapon systems.

The second Type 075 ship reportedly was commissioned into service in late December 2021.[96] The third was reportedly commissioned on or perhaps a few days prior to October 1, 2022.[97]

[93] Amphibious assault ships, also referred to as helicopter carriers or (in British parlance) commando carriers, look like medium-sized aircraft carriers. U.S. Navy amphibious assault ships are designated LHA or LHD.

[94] See, for example, Mike Yeo, "China simultaneously commissions three warships on Navy anniversary," *Defense News*, April 26, 2021. For an in-depth discussion of the Type 075 design, see Conor M. Kennedy and Daniel Caldwell, *The Type 075 LHD: Development, Missions, and Capabilities*, China Maritime Studies Institute (CMSI), U.S. Naval War College, China Maritime Report No. 23, October 2022, 45 pp.

[95] Liu Xuanzun, "China's 1st Amphibious Assault Ship Reaches Initial Operating Capability, To Make World Tour," *Global Times*, March 2, 2022; Ridzwan Rahmat, "China's First Type 075 Amphibious Assault Ship Achieves Initial Operating Capability," *Jane's Defence Weekly*, March 4, 2022.

[96] Xavier Vavasseur, "China's 2nd Type 075 LHD Guangxi 广西 Commissioned With PLAN," *Naval News*, December 30, 2021.

[97] Xavier Vavasseur, "China's 3rd Type 075 LHD Anhui 安徽 Commissioned With PLAN," *Naval News*, October 1, 2022.

Figure 24. Type 075 Amphibious Assault Ship

Source: Photograph accompanying David Axe, "China Is Finishing Its First Large Helicopter Assault Ship," *National Interest*, October 29, 2019.

In July 2020, it was reported that China might be planning to build the first of a new class of amphibious assault ships, called the Type 076 by observers (**Figure 26** and **Figure 27**), that would be equipped with electromagnetic catapults, which would enhance its ability to support operations by fixed-wing aircraft and make it somewhat more like an aircraft carrier.[98]

Amphibious Ship Roles and Missions

Although larger amphibious ships such as the Type 071 and Type 075 would be of value for conducting amphibious landings in Taiwan-related conflict scenarios, some observers believe that China is building such ships as much for their value in conducting other operations, such as operations for asserting and defending China's claims in the South and East China Seas, humanitarian assistance/disaster relief (HA/DR) operations, maritime security operations (such as antipiracy operations), and noncombatant evacuation operations (NEOs). Politically, amphibious ships can also be used for naval diplomacy (i.e., port calls and engagement activities) and for impressing or intimidating foreign observers.[99]

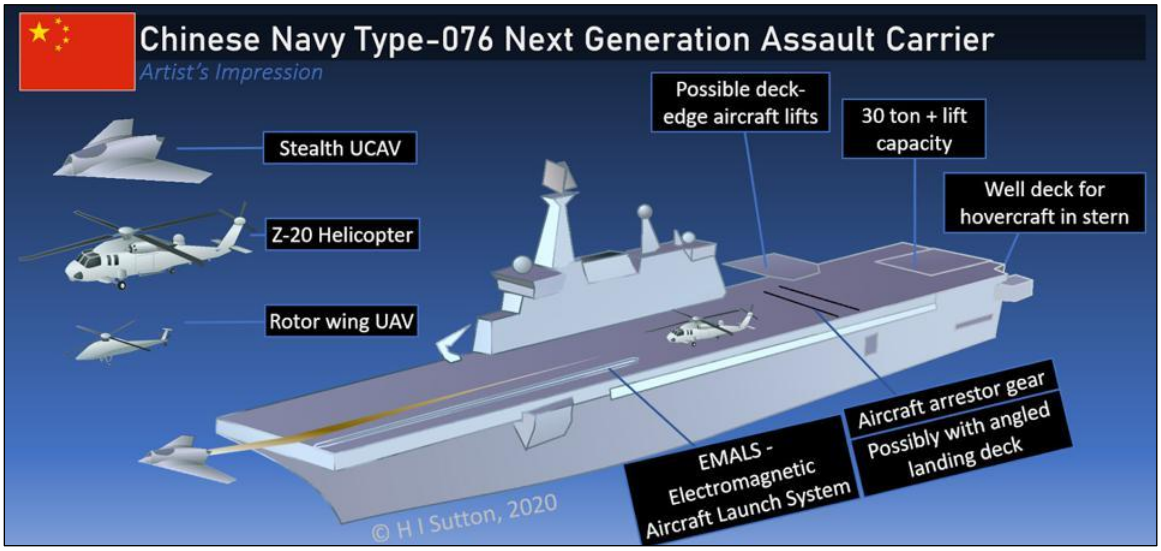
[98] H. I. Sutton, "Stealth UAVs Could Give China's Type-076 Assault Carrier More Firepower," *Forbes*, July 23, 2020; Kathrin Hille, "China Plans Hybrid Assault Vessel to Strengthen Overseas Power," *Financial Times*, July 24, 2020; Minnie Chan, "Chinese Shipbuilder Planning Advanced Amphibious Assault Ship," *South China Morning Post*, July 27 (updated July 28), 2020; Rick Joe, "Whispers of 076, China's Drone Carrying Assault Carrier," *Diplomat*, August 21, 2020.

[99] See, for example, Grant Newsham, "China's Amphibious Force Emerges," *Asia Times*, November 5, 2019.

Figure 25. Type 075 Amphibious Assault Ship

Source: Photograph accompanying Liu Zhen, "Chinese Military's First Type 075 Amphibious Assault Ship Begins Sea Trial," *South China Morning Post*, August 7, 2020. The article credits the photograph to Weibo. Possible Type 076 Catapult-Equipped Amphibious Assault Ship.

Figure 26. Notional Rendering of Possible Type 076 Amphibious Assault Ship



Source: Illustration accompanying H. I. Sutton, "Stealth UAVs Could Give China's Type-076 Assault Carrier More Firepower," *Forbes*, July 23, 2020.

Figure 27. Notional Rendering of Possible Type 076 Amphibious Assault Ship

Source: Illustration accompanying Minnie Chan, "Chinese Shipbuilder Planning Advanced Amphibious Assault Ship," *South China Morning Post*, July 27 (updated July 28), 2020.

Potential Use of Commercial Ships

In assessing China's capacity for conducting an amphibious invasion of Taiwan, some observers have focused on China's potential for using civilian ferries and other commercial ships to augment the transport and landing capacity of China's amphibious ships. Reported Chinese exercises indicate that China is exploring and testing this concept.[100]

[100] See, for example, John Konrad, "Is COSCO China's Secret Invasion Fleet?" *gCaptain*, April 1, 2023; Conor Kennedy, "RO-RO Ferries and the Expansion of the PLA'S Landing Ship Fleet," Center for International Maritime Security (CIMSEC), March 27, 2023; J. Michael Dahm, *More Chinese Ferry Tales: China's Use of Civilian Shipping in Military Activities, 2021-2022 Use of Civilian Shipping in Military Activities, 2021-2022*, China Maritime Studies Institute (CMSI), U.S. Naval War College, China Maritime Report No. 25, January 2023, 71 pp.; Parth Satam, "Civilian Ship Armed With Tanks—Scary Images Reveal China's 'Notorious Plan' To Invade & Annex Taiwan," *Eurasian Times*, November 8, 2022; Thomas Shugart, "Mind the Gap, Part 2: The Cross-Strait Potential of China's Civilian Shipping Has Grown," *War on the Rocks*, October 12, 2022; H I Sutton and Sam LaGrone, "Chinese Launch Assault Craft from Civilian Car Ferries in Mass Amphibious Invasion Drill, Satellite Photos Show," *USNI News*, September 28, 2022; Bethany Dawson, "China Is Using a Stealth Fleet of Fishing Boats and Ferries to Boost Its Naval Power, Say Military Experts," *Business Insider*, September 24, 2022; David Rising, "China Using Civilian Ships to Enhance Navy Capability, Reach," *Associated Press*, September 24, 2022; Thomas Shugart, "Mind The Gap: How China's Civilian Shipping Could Enable a Taiwan Invasion," *War on the Rocks*, August 16, 2022; J. Michael Dahm, *Chinese Ferry Tales, The PLA's Use of Civilian Shipping in Support of Over-the-Shore Logistics*, China Maritime Studies Institute (CMSI), U.S. Naval War College, China Maritime Report No. 16, November 2021, 56 pp.; Brian Waidelich, Patrick deGategno, Timothy Ditter, and Thomas Bickford, *Chinese Views of Civilian Ship Mobilization*, DSI-2021-U-030614-Final, CNA, November 10, 2021, 2 pp. (with a note indicating that it is a summary based on the full-length CNA report, *Chinese Views of Civilian Ships' Support to PLA Maritime Operati*ons, DRM2021-C-029795-Final); Kris Osborn, "Could China's Civilian Ferries Play a Role in a Taiwan Invasion?" *National Interest*, October 21, 2021; Keoni Everington, "Video Shows Ship Packed with Chinese Tanks for 'Future Battlefield' in Taiwan," *Taiwan News*, October 18, 2021; Michael Dahm and Conor M. Kennedy, "Civilian Shipping: Ferrying the People's Liberation Army Ashore," Center for International Maritime Security (CIMSEC), September 9, 2021; Chris Horton, "China Mobilizes Civilian Ferries for Taiwan Invasion Drills," *Nikkei Asia*, August 25, 2021; Andrew Tate, "Chinese Military Using Commercial Ro-Ro Shipping to Enhance Its Amphibious Capabilities," *Jane's*, August 23, 2021; Thomas Shugart, "Mind the Gap: How China's Civilian Shipping Could Enable a Taiwan Invasion," *War on the Rocks*, August 16, 2021; Mike Yeo, "China Reportedly Converted Civilian Ferries for Amphibious Assault Operations," *Defense News*, August 4, 2021; David Hambling, "China Converts Car Ferries For Amphibious Assault," *Forbes*, July 27, 2021; Courtney Mabeus, "Chinese Navy Using Commercial Car Ferries to Launch Amphibious Landing Craft," *USNI News*, July 26, 2021; Conor Kennedy, "Ramping the Strait: Quick and Dirty Solutions to Boost Amphibious Lift," *China*

Operations Away from Home Waters

Ship Operations

Although China's navy operates primarily in China's home waters, Chinese navy ships are conducting increasing numbers of operations away from China's home waters, including the broader waters of the Western Pacific, the Indian Ocean, and the waters surrounding Europe, including the Mediterranean Sea and the Baltic Sea. A November 23, 2019, DOD news report quoted Admiral Philip Davidson, the commander of the U.S. Indo-Pacific Command, as stating that China's navy had conducted more global naval deployments in the past 30 months than it had in the previous 30 years.[101]

DOD states that "the PLAN's ability to perform missions beyond the First Island Chain is modest but growing as it gains more experience operating in distant waters and acquires larger and more advanced platforms. China's experience in extended range operations primarily comes from extended task group deployments and its ongoing counterpiracy mission in the Gulf of Aden."[102] China has been conducting antipiracy operations in the Gulf of Aden since December 2008 via a succession of more than 40 rotationally deployed naval escort task forces.[103] China's long-distance naval deployments have also been for making diplomatic port calls and conducting training exercises.

Current or Potential Bases Outside China[104]

China's distant naval operations are supported in part by **China's military base in Djibouti**, where the Gulf of Aden meets the Red Sea. China officially opened the base in August 2017 as its first overseas military base.[105]

Observers are now following developments at **Cambodia's Ream naval base**, which fronts onto the Gulf of Thailand. DOD states that

> The PRC's military facility at Ream Naval Base in Cambodia will be the first PRC overseas base in the Indo-Pacific.... As of early 2021, dredgers were spotted off Cambodia's Ream

Brief, July 16, 2021.

[101] David Vergun, "Freedom of Navigation in South China Sea Critical to Prosperity, Says Indo-Pacific Commander," *DOD News*, November 23, 2019.

[102] *2022 DOD CMSD*, p. 51.

[103] See, for example, "43rd Chinese Naval Escort Taskforce Officially Starts Escort Mission," *China Military Online*, February 7, 2023.

[104] For an overview discussion, Cristina L. Garafola, Stephen Watts, and Kristin J. Leuschner, China's Global Basing Ambitions, Defense Implications for the United States, RAND, report RRA1496-1, 2022, 31 pp.

[105] For discussions of Djibouti and other potential Chinese military bases outside China, see *2022 DOD CMSD*, pp. xii, 143-145; Kathrin Hille, Demetri Sevastopulo, and John Paul Rathbone, "China Denies Building Naval Bases But Fear of Its Military Reach Grows," *Financial Times*, June 19, 2022. Regarding China's military base in Djibouti, see H. I. Sutton, "Satellite Images Show That Chinese Navy Is Expanding Overseas Base," *Forbes*, May 10, 2020; Peter Suciu, "China's Naval Base in Africa Is Getting Bigger. Is a Network of Bases Next?" *National Interest*, May 11, 2020; staff writer, "Chinese Navy Expanding Base in Africa, Satellite Images Confirm," *War Is Boring*, May 11, 2020; Jean-Pierre Cabestan, "China's Djibouti Naval Base Increasing Its Power," *East Asia Forum*, May 16, 2020; Dave Makichuk, "China Builds a Mega-Fortress on the Horn of Africa," *Asia Times*, May 18, 2020; Michael Evans, "Beijing's African Port Ready for Aircraft Carriers," *Times (UK)*, May 19, 2020.

> Naval Base, where the PRC is funding construction work and deeper port facilities that would be necessary for the docking of larger military ships.[106]

A June 6, 2022, press report stated

> China is secretly building a naval facility in Cambodia for the exclusive use of its military, with both countries denying that is the case and taking extraordinary measures to conceal the operation, Western officials said. The military presence will be on the northern portion of Cambodia's Ream Naval Base on the Gulf of Thailand....
>
> The Wall Street Journal reported in 2019[107] that China had signed a secret agreement to allow its military to use the base, citing U.S. and allied officials familiar with the matter....
>
> Over the weekend ... a Chinese official in Beijing confirmed to The Washington Post that "a portion of the base" will be used by "the Chinese military....
>
> The two governments have taken pains to mask the presence of the Chinese military at Ream, the official said....
>
> The secrecy around the base appears to be driven primarily by Cambodian sensitivities and concern about a domestic backlash, the second official said.[108]

A June 8, 2022, press report stated, "Cambodian and Chinese officials broke ground on a Beijing-funded expansion of Ream Naval Base on Wednesday [June 8], using the occasion to again reject reports the site will be used by China's military."[109]

A March 21, 2023, press report stated:

> Construction efforts are rapidly moving forward on a Cambodian naval base that U.S. officials say will secretly host Chinese forces, according to a British news site.
>
> At least 25 buildings and two piers have been completed since 2019 at Ream Naval Base on the Gulf of Thailand, according to a March 14 report from London-based Naval Technology that cited recent satellite imagery from geospatial intelligence company BlackSky....
>
> BlackSky's satellite imagery showed that one of the piers measures more than 2,200 feet and has nearly 1,000 feet of usable docking area, according to the Naval Technology report.
>
> The pier extends into waters "deep enough to service aircraft carriers, with columns deployed to a length sufficient to moor these vessels," according to a Feb. 28 Naval Technology report.[110]

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[106] *2022 DOD CMSD*, p. 145.

[107] Jeremy Page, Gordon Lubold, and Rob Taylor, "Deal for Naval Outpost in Cambodia Furthers China's Quest for Military Network," *Wall Street Journal*, July 22, 2019.

[108] Ellen Nakashima and Cate Cadell, "China Secretly Building Naval Facility in Cambodia, Western Officials Say," *Washington Post*, June 6, 2022. See also James R. Holmes, "A Naval Base in Cambodia Supports China's Calibrated Aggression," *The Hill*, June 10, 2022; Niharika Mandhana, Sun Narin, and Chun Han Wong, "China to Upgrade Ream Naval Base in Cambodia, Fueling U.S. Concerns," *Wall Street Journal*, June 8, 2022; Charlie Campbell, "A Chinese Naval Base in Cambodia Signals a New Era of Competition in the Asia-Pacific Region," *Time*, June 7, 2022; "Dredgers Spotted at Cambodia's Ream Naval Base," Asia Maritime Transparency Initiative (AMTI) (Center for Strategic and International Studies [CSIS]), January 21, 2022; RFA Khmer Service, "US calls on Cambodia to explain its plans for Ream Naval Base," *Radio Free Asia*, January 24, 2022.

[109] Shaun Turton and Bopha Phorn, "Cambodia Breaks Ground on China-Funded Ream Naval Base Expansion," *Nikkei Asia*, June 8, 2022.

[110] Alex Wilson, "Images Show Chinese-Funded Construction at Cambodian Naval Base Is Progressing Rapidly," Stars and Stripes, March 21, 2023. The March 14, 2023, news report from *Naval Technology* that is mentioned in the quoted passage is Andrew Salerno-Garthwaite, "China's Secret Naval Base in Cambodia, Through Satellite Imagery," *Naval*

A security agreement between China and the **Solomon Islands** that was announced by the Solomon Islands in April 2022 has led some observers to express concern that the agreement could eventually lead to, among other things, the establishment of a Chinese naval base in that country.[111] The Prime Minister of the Solomon Islands ruled out that possibility, stating that it would "put our country and our people as targets for potential military strikes."[112]

In December 2021, it was reported that China may be seeking to establish a military (including naval) base at a port in **Equatorial Guinea**, a country located on the Atlantic coast of Africa—a location that could enhance China's ability to conduct naval operations in the Atlantic.[113]

A January 3, 2023, press report states: "China is once again pressuring Argentina to build a naval base in **Ushuaia, Tierra del Fuego province**, which would mean opening the door to Antarctica for Beijing."[114]

U.S. Navy Response

Overview

The U.S. Navy has taken a number of actions to counter China's naval modernization effort. Among other things, the U.S. Navy has

- shifted a greater percentage of its fleet to the Pacific;[115]

Technology, March 14, 2023. See also Andrew Salerno-Garthwaite, "BlackSky Details Building of China's Secret Naval Base in Cambodia," *Naval Technology*, February 28, 2023; RFA Staff, "Satellite Photos Show Expansion of Chinese-Funded Naval Base in Cambodia," *Radio Free Asia*, February 22, 2023; Jack Detsch, "U.S. Looks to Check Chinese Advances at Cambodian Naval Base," *Foreign Policy*, December 5, 2022.

[111] See, for example, Camilla Pohle-Anderson, "China's Search for a Permanent Military Presence in the Pacific Islands," United States Institute of Peace, July 21, 2022; Damien Cave, "Why a Chinese Security Deal in the Pacific Could Ripple Through the World, In Potentially Opening the Door to a Chinese Military Base, the Solomon Islands Threatens the Balance of Power in a Vital Shipping Region," *New York Times*, April 20, 2022; Ralph Jennings, "Analysts: Chinese Navy to Grow Through 2050, With Emphasis on Hardware," *Voice of America*, April 5, 2022.

[112] See, for example, "Solomons Leader: Chinese Base Would Make His People Targets," *Associated Press*, July 14, 2022; John Feng, "China Military Base in Solomon Islands Ruled Out in Blow to Naval Ambitions," *Newsweek*, July 14, 2022; Lice Movono and Kate Lyons, "Solomon Islands PM Rules Out China Military Base and Says Australia is 'Security Partner of Choice,'" *Guardian*, July 13, 2022.

[113] See, for example, Michael M. Phillips, "China Seeks First Military Base on Africa's Atlantic Coast, U.S. Intelligence Finds, Alarmed Officials at the White House and Pentagon Urge Equatorial Guinea to Rebuff Beijing's Overtures," *Wall Street Journal*, December 5, 2021; Bonny Lin, Jude Blanchette, Joseph S. Bermudez Jr., and Mvemba Phezo Dizolele, "Is China Building a New String of Pearls in the Atlantic Ocean?" Center for Strategic and International Studies (CSIS), December 20, 2021; Michael M. Phillips, "U.S. Aims to Thwart China's Plan for Atlantic Base in Africa," *Wall Street Journal*, February 11, 2022; Cobus van Staden, "Fears of a Chinese Naval Base in West Africa Are Overblown," *Foreign Policy*, March 3, 2022; Paul Nantulya, "Considerations for a Prospective New Chinese Naval Base in Africa," Africa Center for Strategic Studies, May 12, 2022.

[114] Guillermo Saavedra, "China Pressures Argentina to Build Naval Base," *Diálogo Americas*, January 3, 2023.

[115] Efforts in this regard began at least as far back as 2006: The final report on the 2006 Quadrennial Defense Review (QDR) directed the Navy "to adjust its force posture and basing to provide at least six operationally available and sustainable carriers and 60% of its submarines in the Pacific to support engagement, presence and deterrence." (U.S. Department of Defense, *Quadrennial Defense Review Report*. Washington, 2006. February 6, 2006, p. 47.) Subsequent to this directive, the Navy announced an intention to increase to 60% (from a starting point of about 55%) the percentage of the fleet as a whole that is assigned to the Pacific. An October 13, 2021, press report stated, "US Naval Chief of Operations, Admiral Michael Gilday, on Tuesday kicked off his 5-day visit to India by meeting his Indian counterpart Admiral Karambir Singh, Chief of Defence Staff General Bipin Rawat and other senior government officials.... Asked about what the US intends to do to counter China's aggressive modernisation of its Navy, Gilday said they will not try to outspend it, but partners like India in the region will be the key to ensure that the Indian Ocean

- assigned its most-capable new ships and aircraft to the Pacific;
- maintained or increased general presence operations, training and developmental exercises, and engagement and cooperation with allied and other navies in the Indo-Pacific;
- increased the planned future size of the Navy;
- initiated, increased, or accelerated numerous programs for developing new military technologies and acquiring new ships, aircraft, unmanned vehicles, and weapons;
- developed new operational concepts (i.e., new ways to employ Navy and Marine Corps forces) for countering Chinese maritime A2/AD forces; and
- signaled that the Navy in coming years will shift to a more distributed fleet architecture that will feature a substantially greater use of unmanned vehicles.

Some of the above items are discussed in more detail below.

Planned Size of Navy

As discussed in greater detail in another CRS report,[116] the Navy's existing force-level goal, which the Navy released on December 15, 2016, calls for achieving and maintaining a fleet of 355 ships—an increase of 47 ships over the previous 308-ship force-level goal of March 2015. As also discussed in the other CRS report, the Navy and the Office of the Secretary of Defense (OSD) have been working since 2019 to develop a successor for the 355-ship force-level goal but have not been able to come to closure on a successor goal. The Navy's FY2023 30-year (FY2023-FY2052) shipbuilding plan, released on April 20, 2022, presented the results of three studies on possibilities for the Navy's successor force-level goal. These studies call for a future Navy with 321 to 404 manned ships and 45 to 204 large surface and underwater unmanned vehicles (UVs).

Highly Capable Ships, Aircraft, and Weapons

Many of the Navy's programs for acquiring highly capable ships, aircraft, and weapon systems can be viewed as intended, at least in part, at improving the U.S. Navy's ability to counter Chinese maritime A2/AD capabilities. Examples include the following:

- Virginia-class nuclear-powered attack submarines (SSNs);[117]
- the Navy's envisaged next-generation SSN, called the SSN(X);[118]
- Gerald R. Ford (CVN-78) class nuclear-powered aircraft carriers (CVNs);[119]

Region (IOR) is stable. Given the importance of the region, 60 per cent of US Navy's forces are now in the Indo-Pacific, he said." (Krishn Kaushik, "60% Navy Forces in Indo-Pacific Region Now: US Navy Chief," *Indian Express*, October 13, 2021.)

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

[117] For more on the Virginia-class program, see CRS Report RL32418, *Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress*, by Ronald O'Rourke

[118] For more on the SSN(X) program, see CRS In Focus IF11826, *Navy Next-Generation Attack Submarine (SSN[X]) Program: Background and Issues for Congress*, by Ronald O'Rourke.

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

- Navy and Marine Corps versions of the F-35 Joint Strike Fighter (JSF);[120]
- Arleigh Burke (DDG-51) class guided missile destroyers (DDGs);[121]
- the Navy's envisaged next-generation DDG, called the DDG(X);[122]
- Constellation (FFG-62) class frigates;[123]
- new anti-ship weapons, such as the Long-Range Anti-Ship Missile (LRASM), also known as the Offensive Anti-Surface Warfare (OASuW) Increment 1 weapon;[124]
- hypersonic weapons, including the ship-launched Conventional Prompt Strike (CPS) weapon and the Hypersonic Air-Launched OASuW (HALO) weapon, also known as OASuW Increment 2;[125]
- shipboard high-energy lasers;[126] and
- new electronic warfare systems.

Fleet Architecture and Operational Concepts

Remarks from Navy and DOD officials since 2019 have indicated that the successor to the 355-ship force-level goal will introduce a change in fleet architecture, meaning basic the types of ships that make up the Navy and how these ships are used in combination with one another to perform Navy missions. This new fleet architecture is to be more distributed than the fleet architecture reflected in the 355-ship goal or previous Navy force-level goals. In particular, the new fleet architecture is expected to feature a substantially greater use of unmanned vehicles (UVs).[127] Navy and DOD leaders believe that shifting to a more distributed fleet architecture is

- **operationally necessary**, to respond effectively to the improving maritime anti-access/area-denial (A2/AD) capabilities of other countries, particularly China;[128]

[120] For more on the JSF program, see CRS Report RL30563, *F-35 Joint Strike Fighter (JSF) Program*, by John R. Hoehn.

[121] For more on the DDG-51 program, see CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke.

[122] For more on the DDG(X) program, see CRS In Focus IF11679, *Navy DDG(X) Next-Generation Destroyer Program: Background and Issues for Congress*, by Ronald O'Rourke.

[123] For more on the FFG-62 program, see CRS Report R44972, *Navy Constellation (FFG-62) Class Frigate Program: Background and Issues for Congress*, by Ronald O'Rourke.

[124] For more on the LRASM program, see CRS In Focus IF11353, *Defense Primer: U.S. Precision-Guided Munitions*, coordinated by Nathan J. Lucas.

[125] For more on the CPS program, see CRS Report R45811, *Hypersonic Weapons: Background and Issues for Congress*, by Kelley M. Sayler

[126] For more on Navy laser programs, see CRS Report R44175, *Navy Shipboard Lasers: Background and Issues for Congress*, by Ronald O'Rourke.

[127] See, for example, Patrick Tucker, "The Navy Wants Drones to Counter China's Gray-Zone Moves," *Defense One*, April 4, 2023; Parth Satam, "US Developing 'Swarms-Of-Swarms' That Can Attack From Land, Air & Sea & Overturn China's Numerical Edge," *Eurasian Times*, February 18, 2023. See also Bryan Clark, "We Don't Have the Missiles to Stop China. Time For Drone Swarms," *Defense One*, February 1, 2023.

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

- **technically feasible** as a result of advances in technologies for UVs and for networking widely distributed maritime forces that include significant numbers of UVs; and
- **affordable**—no more expensive, and possibly less expensive, than the current fleet architecture for a given level of overall fleet capability, so as to fit within expected future Navy budgets.

Shifting to a more distributed force architecture, Navy and Marine Corps officials have indicated, will support implementation of the Navy and Marine Corps' new overarching operational concept, called Distributed Maritime Operations (DMO), and a supporting Marine Corps operational concept called Expeditionary Advanced Base Operations (EABO).[129] A key aim of DMO and EABO is to improve the ability of the Navy and Marine Corps to counter China's improving maritime military capabilities.

Some elements of the Navy's new, more distributed fleet architecture are reflected in Navy budget submission, including the following:

- development of a smaller amphibious warship called the Medium Landing Ship (LSM) (previously referred to as the Light Amphibious Warship, or LAW);[130]
- development of a smaller resupply ship called the Light Replenishment Oiler (TAOL) (previously referred to as Next-Generation Medium Logistics Ship, or NGLS);[131]
- development of two types of larger unmanned surface vehicles (USVs)—Large USVs (LUSVs) and Medium USVs (MUSVs);[132] and
- procurement of large unmanned underwater vehicles (UUVs) called Extra Large UUVs (XLUUVs).[133]

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

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

[129] For more on DMO, see, for example, Edward Lundquist, "DMO is Navy's Operational Approach to Winning the High-End Fight at Sea," *Seapower*, February 2, 2021. For more on EABO, see CRS Report R46374, *Navy Light Amphibious Warship (LAW) Program: Background and Issues for Congress*, by Ronald O'Rourke.

[130] For more on the LSM program, see CRS Report R46374, *Navy Medium Landing Ship (LSM) (Previously Light Amphibious Warship [LAW]) Program: Background and Issues for Congress*, by Ronald O'Rourke.

[131] For more on the TAOL program, see CRS In Focus IF11674, *Navy Light Replenishment Oiler (TAOL) (Previously Next-Generation Logistics Ship [NGLS]) Program: Background and Issues for Congress*, by Ronald O'Rourke.

[132] For more on the LUSV and MUSV programs, see CRS Report R45757, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress*, by Ronald O'Rourke.

[133] For more on the XLUUV program, see CRS Report R45757, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress*, by Ronald O'Rourke.

Cooperation with Naval Forces of Allies and Other Countries

U.S. Navy efforts to increase cooperation with naval forces from allies such as Japan and Australia and other countries such India appear aimed in part at expanding existing bilateral forms of naval cooperation (e.g., U.S.-Japan, U.S.-Australia, U.S.-India) into trilateral (e.g., U.S.-Japan-Australia, U.S.-Australia-India) or quadrilateral (U.S.-Japan-Australia-India) forms that could enhance the ability of the United States and its allies in the Indo-Pacific region to balance against China's growing military capabilities and deter potential assertive actions by China.[134]

Issues for Congress

Overview

The overall issue for Congress is whether to approve, reject, or modify the Biden Administration's proposed U.S. Navy plans, budgets, and programs for responding to China's naval modernization effort. Within this overall issue, specific issues include the following:

- the current and potential future U.S.-China balance of naval power in general, and in specific geographic areas, particularly the Taiwan Strait and the South China Sea;
- whether the planned size of the Navy will be appropriate for countering China's naval modernization effort in coming years while also permitting the Navy to perform other missions, including countering Russian military forces in the Atlantic and the Mediterranean, and defending U.S. interests in the Middle East;
- whether Navy shipbuilding plans, Navy plans for keeping existing Navy ships in service, and resulting Navy projections of future Navy force levels are consistent with the goal of increasing the size of the Navy toward a total of 355 ships or a successor force-level goal;
- whether the Navy is doing enough to
  - improve its ability to counter China's ASBMs, hypersonic weapons, or other maritime A2/AD weapons, such as wake-homing torpedoes;
  - develop and procure new ASCMs with ranges that match or exceed those of China's longer-ranged ASCMs;
  - increase the operating range of Navy carrier air wings, so as to improve the ability of carriers and their air wings to achieve effects while operating at longer distances from Chinese ASBMs and other A2/AD weapons; and
- whether Congress should modify acquisition policies or the metrics for judging the success of acquisition programs so as to facilitate faster development of new technologies and weapons for the Navy—and if so, how those policies or metrics should be modified.

U.S.-China Balance of Naval Power

Regarding the U.S.-China balance of naval power in general, U.S. and other observers generally assess that while the United States today has more naval capability overall, China's naval

[134] For additional discussion, see CRS In Focus IF11678, *The "Quad": Security Cooperation Among the United States, Japan, India, and Australia*, coordinated by Emma Chanlett-Avery.

modernization effort since the 1990s has substantially reduced the U.S. advantage, and that if current U.S. and Chinese naval capability trends (such as those shown in **Table 1** and **Table 2**) do not change, China might eventually draw even with or surpass the United States in overall naval capability. In remarks to a conference on November 3, 2022, for example, Admiral Charles A. Richard, commander of U.S. Strategic Command, stated

> As I assess our level of deterrence against China, the ship is slowly sinking. It is sinking slowly, but it is sinking, as fundamentally they are putting capability in the field faster than we are. As those curves keep going, it isn't going to matter how good our [operating plan] is or how good our commanders are, or how good our forces are—we're not going to have enough of them. And that is a very near-term problem....
>
> Undersea capabilities is still the one ... maybe the only true asymmetric advantage we still have against our opponents. But unless we pick up the pace, in terms of getting our maintenance problems fixed, getting new construction going ... if we can't figure that out ... we are not going to put ourselves in a good position to maintain strategic deterrence and national defense.[135]

Regarding the U.S.-China naval balance of power specifically in the South China Sea, some observers are concerned that China has already drawn even with or even surpassed the United States. U.S. Navy Admiral Philip Davidson, in responses to advance policy questions from the Senate Armed Services Committee for an April 17, 2018, hearing before the committee to consider nominations, including Davidson's nomination to become Commander, U.S. Pacific Command (PACOM),[136] stated that "China is now capable of controlling the South China Sea in all scenarios short of war with the United States."[137]

Skeptics of assessments like those above might argue that they do not give adequate weight to relative U.S. strengths (and corresponding Chinese relative weaknesses and limitations) in areas such as undersea warfare; personnel quality, training, and initiative; operational experience (particularly in combat situations); joint operations with other U.S. military services; and potential support from allies and partners, particularly Japan and Australia. A December 7, 2022, blog post, for example, states:

> One of the data points used to bolster the China threat argument is the relative size of the two naval fleets, but not all fleets are created equal. In terms of the number of ships, the People's Liberation Army Navy (PLAN) is significantly larger than the U.S. Navy.... The discrepancy between the Chinese fleet and the U.S. fleet is already striking, but it will likely only grow in the coming years, and that simple fact will undoubtedly continue to be exploited by defense hawks....
>
> While the raw data may seem alarming, they hardly tell a complete story. What the U.S. fleet lacks in total numbers it more than makes up in tonnage. The relative weight of a fleet is significant because it indicates the sailing range and purpose of the fleet. Larger ships are needed for longer voyages, since they can carry more fuel and munitions. For instance, the U.S. Navy's global mission necessitates larger ships capable of spanning oceans and operating away from friendly shores and land-based defenses.

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[135] C. Todd Lopez, "Stratcom Commander Says U.S. Should Look to 1950s to Regain Competitive Edge," *DOD News*, November 3, 2022. (Material in brackets and ellipses as in original.) Admiral Richard's remarks are quoted similarly in Oliver Parken and Tyler Rogoway, "Extremely Ominous Warning About China From US Strategic Command Chief, Admiral Richard Says 'The Big One' with China Is Coming and the "Ship Is Slowly Sinking" in Terms of U.S. Deterrence," *The Drive*, November 6, 2022; and Max Hauptman, "US Strategic Command Chief: Ukraine 'Just the Warmup' for 'the Big One' with China," *Task & Purpose*, November 8, 2022.

[136] The name of the command has since been changed to the U.S. Indo-Pacific Command (INDOPACOM).

[137] Advance Policy Questions for Admiral Philip Davidson, USN Expected Nominee for Commander, U.S. Pacific Command, p. 18. See also pp. 8, 16, 17, 19, and 43.

> The Chinese fleet combined displaces approximately 1,854,000 tons, less than half of the total tonnage of the U.S. Navy. The difference is easy to see when comparing similar vessel types....
>
> The larger American ships give the fleet a significant advantage in a number of areas, including the capacity to launch cruise missiles. U.S. surface ships have more than 9,000 vertical missile launch cells, compared to the 1,000 in the Chinese fleet.17
>
> When it comes to submarines, the Chinese force is about the same size as the U.S. Navy's, but the two differ significantly in capability....
>
> China's Navy would have a difficult time operating outside the waters adjacent to the mainland because it lacks the structure necessary to do so. Much has been made about Chinese aircraft carriers in recent years, but the carrier fleet remains in its infancy....
>
> The Chinese military overall lacks experience conducting major modern combat operations. The Chinese last fought a war in 1979, when the People's Liberation Army briefly invaded northern Vietnam in support of China's allies in Cambodia and to disrupt the alliance between the Vietnamese and the Soviet Union.... Chinese military leaders are now two generations removed from actual combat experience, which calls into question their potential prowess.[138]

Davidson Window/Decade of Concern

Some Members of Congress and other U.S. observers are concerned about the possibility that China might attack Taiwan sometime between 2021 and 2027 (a timeframe sometimes referred to as the Davidson window)[139] or between 2020 and 2030 (a timeframe sometimes referred to as the decade of concern),[140] and about the readiness the U.S. military, including the U.S. Navy, for a conflict in that timeframe.

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[138] Dan Grazier, "China Threat Inflation and America's Nonsensical Plans," Project on Government Oversight (POGO), December 7, 2022. See also Brad Lendon, "China Has Built the World's Largest Navy. Now What's Beijing Going to Do with It?" *CNN*, March 5, 2021.

[139] At a March 9, 2021, hearing before the Senate Armed Services Committee, Admiral Philip S. Davidson, Commander, U.S. Indo-Pacific Command (USINDOPACOM), when asked about a timeline for a potential conflict in the Taiwan Strait, replied

> I think our concerns are manifest here during this decade not only on the development, the number of ships, aircraft, rockets, etc. that they have—that they have put in the field but the way they are advancing those capabilities as well in combination with everything that you just cited Hong Kong and Tibet and line of actual control in the South China Sea, in the East China Sea.
>
> I worry that they are accelerating their ambitions to be—to supplant the United States and our leadership role in a rules-based international order which they have long said that they want to do that by 2050. I'm worried about the moving that target closer. Taiwan is clearly one of their ambitions before that, and I think the threat is manifest during this decade, in fact, in the next six years.
>
> (CQ transcript of hearing. See also, for example, William Cole, "China Could Soon Outgun US in Western Pacific, Indo-Pacific Chief Says," *Honolulu Star-Advertiser*, March 6, 2021; Mallory Shelbourne, "Davidson: China Could Try to Take Control of Taiwan In 'Next Six Years,'" *USNI News*, March 9, 2021; Adela Suliman, "China Could Invade Taiwan in the Next 6 Years, Assume Global Leadership Role, U.S. Admiral Warns," *NBC News*, March 10, 2021.)

The period between 2021 and 2027 subsequently came to be referred to by some observers as the Davidson window. Possibly the earliest user of the term was Jerry Hendrix; see for example, Jerry Hendrix, "Closing the Davidson Window," *Real Clear Defense*, July 3, 2021. See also Miya Tanaka, "Ex-U.S. Indo-Pacific Commander Sticks to 2027 Window on Taiwan Aattack," *Kyodo News*, January 23, 2023.

[140] Possibly the earliest user of the term *decade of concern* was James (Jim) Fanell. See, for example, China's National Sovereignty and the Tightening Noose Around the Senkaku Islands, James E. Fanell, Captain U.S. Navy (Retired),

In addition to the Davidson window and the decade of concern, some observers have offered alternative near-term time windows.[141] Still other observers, including some DOD officials, believe a Chinese attack on Taiwan does not appear to be imminent or is not particularly likely to occur in the near term,[142] or have questioned the notion of identifying a particular time window.[143]

For observers who are concerned about the Davidson window or decade of concern, given the time needed to build major U.S. Navy warships (typically several years), decisions made now on procuring new ships for the Navy will have only a small impact on the number of ships the Navy will have in service during the Davidson window or the decade of concern. (Decisions made now on procuring new ships for the Navy will primarily impact the number of ships the Navy will have in service in years after the Davidson window or the decade of concern, a time period which is also of potential concern to policymakers.) Options for bolstering Navy capabilities during the Davidson window or the decade of concern focus mostly on matters other than procuring new ships, including but not limited to the following, which are not presented in any particular order:

- keeping existing ships and aircraft in service during the Davidson window or decade of concern rather than retiring them during the Davidson window or decade of concern (while preserving the option of retiring them after the end of the Davidson window or decade of concern);

Testimony before Hearing on the Hotspots Along China's Periphery, Panel II: How China Prepares to Fight in Hotspots: East China Sea / Senkaku Islands Contingency Operation, U.S.-China Economic and Security Review Commission, April 13, 2017, p. 3, 25-27, 32; Jim Fanell, "Now Hear This—The Clock is Ticking in China: The Decade of Concern Has Begun," *U.S. Naval Institute Proceedings*, October 2017; China's Global Naval Strategy and Expanding Force Structure: Pathway to Hegemony, Testimony by Captain James Fanell (USN, Ret.) [prepared statement for hearing on China's worldwide military expansion before the House Permanent Select Committee on Intelligence, May 17, 2018], pp. 55-59; Bonnie Girard, "Time to Counter China and Rebuild the US Navy? A Former U.S. Pacific Fleet Naval Intelligence Chief Testifies to Congress on China's Maritime Ambitions," *Diplomat*, May 23, 2018; James E. Fanell, "Asia Rising: China's Global Naval Strategy and Expanding Force Structure," *Naval War College Review*, Winter 2019.

[141] See, for example, Keoni Everington, "China Could Invade Taiwan in 'A Year or Two': Former US National Security Adviser," Taiwan News, May 5, 2023; Takashi Imai (Yomiuri Shimbun), "China May Invade Taiwan Within 2 Years, Former U.S. National Security Adviser Says," *Japan News*, May 4, 2023; Bill Gertz, "China Held Taiwan War Council in October, General's Memo Reveals, Memo Predicting Conflict by 2025 Clashes with Biden Detente Push," *Washington Times*, February 2, 2023; Mallory Shelbourne, "China's Accelerated Timeline to Take Taiwan Pushing Navy in the Pacific, Says CNO Gilday," *USNI News*, October 19, 2022. See also Robert Delaney, "US Navy Should Prepare for an Invasion of Taiwan as Soon as This Year, Fleet Chief Says," *South China Morning Post*, October 20, 2022; Demetri Sevastopulo, "US Navy chief warns China could invade Taiwan before 2024," *Financial Times*, October 20, 2022; Agence France-Presse, " China Could Invade Taiwan This Year, US Admiral Warns," *News.com.au*, October 21, 2022.

[142] See, for example, J. Tedford Tyler, "China Isn't Ready to Invade Taiwan," *National Interest*, December 11, 2022; Meghann Myers and Joe Gould, "Pentagon Sees No Imminent Threat to Taiwan from Chinese Buildup," *Military Times*, November 29, 2022; Jerusalem Post Staff, "US General Mark Milley Says Invading Taiwan Would Be 'Very Difficult' for China," *Jerusalem Post*, November 18, 2022; Derek Grossman, "Xi Jinping Is Not Looking to Go to War over Taiwan Anytime Soon, Little Sign Chinese Leader Is Accelerating Invasion Preparations," *Nikkei Asia*, November 16, 2022; Nick Wadhams, "China Won't Be Able to Attack Taiwan in Near Future, US General Milley Says," *Bloomberg*, November 16, 2022; John Grady, "China Will Increase Pressure on Taiwan in Next Two Years Rather Than Invade, Says Pentagon Official," *USNI News*, November 7, 2022; Briana Reilly, "DOD Policy Chief Doesn't Anticipate Taiwan Invasion in 'Near Term,'" *Inside Defense*, November 4, 2022; Iain Marlow, "'Sloppy' US Talk on China's Threat Worries Some Skeptical Experts," *Bloomberg*, November 3 (updated November 4), 2022; Timothy R. Heath, "Is China Planning to Attack Taiwan? A Careful Consideration of Available Evidence Says No," *War on the Rocks*, October 14, 2022.

[143] See, for example, Demetri Sevastopulo, "US Commander Pushes Back against Colleagues 'Guessing' Taiwan Invasion Date," *Financial Times*, April 18, 2023.

- increasing the material readiness of existing ships and aircraft, so as to maximize the percentage of them that are available for operations, by working down ship and aircraft maintenance backlogs;
- shifting additional ships, aircraft, weapons, and supplies from the Atlantic theater to the Pacific theater (although the risks of doing that in connection with deterring and responding to Russian actions in the Atlantic and Mediterranean would be a factor to consider);
- upgrading existing ships, aircraft, and weapons, particularly through the installation of improved or additional systems or components that can be quickly switched out or bolted on;
- procuring new aircraft and weapons, if those aircraft and weapons can enter service before the end of the Davidson window or the decade of concern;[144]
- procuring spare parts and supplies and positioning them in the Pacific;
- acting to alleviate bottlenecks or otherwise increase the capacity of the industrial base to produce aircraft, weapons, and supplies and/or repair ships, aircraft, weapons, and supplies;
- hardening air bases and other land-based facilities in the Pacific that support U.S. Navy operations so as to improve their ability to withstand attack by Chinese missiles or other weapons;
- increasing intelligence, surveillance and reconnaissance (ISR) activities for understanding and monitoring China's naval forces;
- increasing activities for measuring and understanding the physical operating environment in the Pacific;
- increasing the operational proficiency of Navy personnel through training and exercises; and
- increasing operations for demonstrating U.S. Navy capabilities to China and/or perhaps creating uncertainty or confusion in China about U.S. Navy capabilities, concepts of operations, or tactics.

Divest to Invest

Related to discussion of the Davidson window or decade of concern is discussion of what DOD refers to as its divest-to-invest budget strategy, which refers to DOD's budget proposals for eliminating certain existing U.S. military platforms (e.g., ships and aircraft) and capabilities that it views as not well aligned with current and projected mission needs so as to release funding for application to what DOD views as higher priorities, including expanding other current military capabilities that DOD views as better aligned with current mission needs, and developing future military capabilities that DOD views as better aligned with projected future mission needs.[145] As part of DOD's divest-to-invest strategy, the military services have included proposed divestments as part of their proposed budgets for FY2024 and prior years.[146] The Department of the Navy

[144] Regarding the adequacy of Navy weapon inventories for a potential conflict in the Pacific, see Nick Wilson, "Del Toro: Navy Needs Larger Missile Stockpiles in the Pacific," *Inside Defense*, May 2, 2023.

[145] In connection with DOD's proposed FY2023 budget, for example, see Jim Garamone, "Austin Lays Out Reasoning Behind DOD Budget Request," *DOD News*, April 7, 2022.

[146] See, for example, Sean Carberry, "Budget 2024: Air Force Budget Continues Divest to Invest Strategy," *National*

states in its FY2024 budget submission that it "continues to scrutinize the portfolio and divest where appropriate to field the strongest balance of capabilities."[147] Proposed divestments in Navy budget submissions for FY2024 and prior years include proposals to retire certain ships (particularly Littoral Combat Ships, or LCSs) before the end of their expected service lives.[148]

The Navy, DOD, and other supporters of the divest-to-invest strategy argue that it is not cost effective to continue expending funds on platforms and capabilities that are not well aligned with current and projected mission needs, particularly if doing so reduces funding available for current or future capabilities that would be better aligned with current or projected future mission needs. Skeptics of the divest-to-invest strategy argue that it can reduce near-term capabilities that could be useful during the Davidson window or decade of concern, and do so in return for, in some cases, the promise of future capabilities whose realization is uncertain and would happen after the Davidson window or decade of concern. Rather than divesting certain existing platforms, they argue, military officials should focus more on identifying how those platforms might be modified to better align with current and projected future mission needs.[149]

Other Specific Issues

As noted earlier, the planned size of the Navy and the shift to a more-distributed fleet architecture are discussed in detail in another CRS report.[150]

The issue of the Navy's ability to counter China's ASBMs and hypersonic weapons is discussed in detail in this report in **Appendix B**.

The issue of the Navy's ability to counter wake-homing torpedoes may have been made more pressing by the reportedly poor performance of an anti-torpedo torpedo that the Navy was developing as a means for Navy surface ships to counter hard-to-decoy wake-homing torpedoes and other torpedoes. The Navy reportedly removed the anti-torpedo torpedo system from the ships that were equipped with it.[151]

Defense, March 14, 2023.

[147] Department of the Navy, *Highlights of the Department of the Navy FY 2024 Budget*, March 2023, p. 12-3. See also the discussion of proposed Navy FY2023 divestments in Department of the Navy, *Highlights of the Department of the Navy FY 2023 Budget*, 2022, pp. 12-2 through 12-7.

[148] See, for example, Mallory Shelbourne, "SECNAV, CNO Pushing Plans to Decommission 11 Warships in Fiscal Year 2024," *USNI News*, March 20, 2023, and the discussion of proposed Navy FY2023 divestments in Department of the Navy, *Highlights of the Department of the Navy FY 2023 Budget*, 2022, pp. 12-2 through 12-7.

[149] See, for example, Mackenzie Eaglen, "Shrinking U.S. Military Capacity Now For Capabilities Later Is A Mistake," *19FortyFive*, May 1, 2023; Mackenzie Eaglen, "The Bias for Capability over Capacity Has Created a Brittle Force," *War on the Rocks*, November 17, 2022; John Michael Loh, "US Air Force's 'Divest to Invest' Plan Is Too Risky," *Defense News*, November 16, 2022; Hallie Coyne, "Bad Idea: Divest to Invest," Center for Strategic and International Studies (CSIS), December 10, 2021.

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

[151] For additional discussion, see Alex Lockie, "US Navy Admits Failure on $760 Million Weapon to Prtect Its Aircraft Carriers from An Age-Old Threat," *Business Insider*, February 5, 2019; Joseph Trevithick, "The Navy Is Ripping Out Underperforming Anti-Torpedo Torpedoes From Its Supercarriers," *The Drive*, February 5, 2019. For an article advocating certain measures to improve the Navy's ability to counter China's submarines in general, see Walker Mills, Collin Fox, Dylan Phillips-Levine, and Trevor Phillips-Levine, "China's Sub Force Is Growing More Powerful. This Is What the US Navy Needs to Do to Stay Ahead," *Military.com*, November 8, 2021.

The Navy has initiated efforts to develop and procure longer-ranged ASCMs and other new weapons, but some observers have expressed frustration that these efforts are not moving quickly enough.[152] In support of its efforts, the Navy testified in March 2023 as follows:

> **Tomahawk [cruise missile]**
>
> The Navy is continuing investment into Tomahawk Block V new production, Maritime Strike [i.e., anti-ship] Tomahawk, and recertification/modernization of Tomahawk Block IV. The FY 2024 budget request adds $23.4 million to reduce Tomahawk production lead time. These funds are being invested to increase industrial capacity, specifically by relieving chokepoints within the Tomahawk production line.
>
> In the FY 2024 budget request, the Department sustains the Tomahawk as the nation's premier all-weather, long-range, survivable deep strike offensive weapon to include new production of and recertification of current inventory into modernized BLK V Tomahawk missiles. BLK V(a) Maritime Strike Tomahawk (MST) provides a long-range moving maritime strike capability [i.e., a capability to hit moving ships at sea] to meet current and future threats, supporting the Surface Warfare Mission area through the inclusion of a seeker suite in the Tomahawk BLK V missile. The FY 2024 budget request for MST provides continuation of Test and Evaluation (T&E) plans that include missile functional ground testing and missile test flights from a ground launcher apparatus to assess seeker performance, mature and refine seeker algorithms, and provide verification and validation data for Modeling and Simulation. MST IOC [initial operational capability] is planned for FY 2025. The FY 2024 budget request continues engineering, manufacturing, and development of the Joint Multiple-Effects Warhead System (JMEWS), which will deliver a hardened target penetration capability with the Tomahawk BLK V(b) missile in FY 2027. The FY 2024 budget request continues engineering, manufacturing, and development of the Military Code Global Positioning System (GPS) receiver, which will deliver significant increased resiliency in spoofing and jamming threat environments to the Tomahawk BLK V missile in FY 2026.
>
> **Offensive Anti-Surface Warfare (OASuW) Increment 1/ Long Range Anti-Ship Missile (LRASM), LRASM C-1/C-3, and OASuW Increment 2 / HALO**
>
> The FY 2024 President's Budget requests $639.6 million to initiate LRASM MYP [multiyear procurement][153] with the USAF. The FY 2024 procurement funding covers the EOQ [economic order quantity materials [i.e., up-front batch orders of components] along with the buy of 91 DON LRASM weapon systems in the initial year of the five-year MYP. The FY 2024 President's Budget request also includes RDT&E funding for the completion of the LRASM 1.1 capability improvements.
>
> The LRASM C-1 and C-3 variants add near-term, cost-effective capacity to the DON's long range strike capability while enhancing the OASuW mission. The FY 2024 budget requests funding for Navy strike mission integration and employment by upgrading the existing AGM-158 product [i.e., LRASM] to respond to rapidly changing threats. Navy AGM-158 development efforts also involve development and integration of a Beyond Line-of-Sight radio subsystem to enable dual mission capability and enhanced operational flexibility, optimizing carrier magazine capacity to complement OASuW warfighting capability. The FY 2024 President's Budget requests $141.9 million to continue developing

[152] See, for example, James Turnwall, "The Navy Is Losing the Missile Arms Race," *U.S. Naval Institute Proceedings*, November 2019. For similar discussions regarding U.S. and Chinese air-to-air missiles, see Douglas Barrie, "Will America's Next Long-Range Air-to-Air Missile Match Up to China's?" *Defense One*, October 22, 2019; Joseph Trevithick, "Meet The AIM-260, The Air Force And Navy's Future Long-Range Air-To-Air Missile," *The Drive*, June 21, 2019; Thomas Newdick, "Testing Of The Secretive New AIM-260 Long-Range Air-To-Air Missile Is Well Underway," *The Drive*, November 22, 2021.

[153] For more on MYP contracting, see CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke.

AGM-158 derived capability and radio integration on F/A-18; develop software for strike mission planning, Universal Armament Interface and missile Operational Flight Plan. The FY 2024 President's Budget request also includes $83.7 million for procurement of the initial 10 LRASM in the C-3 configuration.

The FY 2024 President's Budget includes $95.8 million in support of OASuW Increment 2, which is now referred as Hypersonic Air Launched OASuW (HALO). HALO supports the national imperative to mature hypersonic capabilities and will provide the Navy a necessary air-launched, carrier-based weapon to address evolving long range, high speed threats from near peer competitors. In order to deliver this capability to the warfighter when needed, the DON will collaborate heavily with the Air Force.[154]

Advanced Anti-Radiation Guided Missile (AARGM) & AARGM Extended-Range (AARGM-ER)

AARGM domestic procurement completed in FY 2021 with the award of the last DON Full Rate Production (FRP) contract. There have been 1450 AARGMs (All Up Rounds, Training Missiles, and Spares) delivered to the Fleet as of March 2023. Program of record delivery is 1803 missiles. Deliveries continue through FY 2024 in support of the transition to AARGM-ER. AARGM-ER provides the DON with a 5th generation compatible extended-range asset to project power and provide Suppression of Enemy Air Defenses, both at-sea and on land. The first AARGM-ER delivery is scheduled for 4QFY23. The budget requests $195.7 million in Weapons Procurement, Navy (WPN) to procure 77 AARGM-ER all-up-rounds and six Captive Air Training Missiles. The FY 2024 President's Budget requests $51.8 million in RDT&E to support operational and Integration testing of production representative hardware.

Hypersonic Program

The DON is developing a hypersonic weapon system that will enable precise and timely strike capability against deep inland targets in contested environments. In collaboration with the Army, the Department is leveraging a common All Up Rounds missile design and test opportunities to field a conventional hypersonic weapon system [i.e., the Conventional Prompt Strike weapon (CPS)]. Zumwalt Class DDGs will be the first Navy platform to field this hypersonic capability in the mid-2020s, followed by Block V Virginia Class SSNs starting in the early 2030s. In March 2020, the Services executed a successful flight test of the Common Hypersonic Glide Body [to be used on CPS], and in June 2022, the Services followed up that testing with several static-fire tests and a flight test of the newly developed two-stage Solid Rocket Motor. The DON has validated the design of the Navy's cold-gas launch approach and continued sounding rocket testing in support of future capability, manufacturability, and affordability improvements. This rapid development and demonstration of hypersonic strike weapon systems supports the U.S. ability to deter, and if necessary, defeat potential adversaries.

The Department's FY 2024 budget request funds continued build of the first three All Up Rounds [of CPS] to be delivered to the first Zumwalt Class DDG and All Up Rounds for future flight testing, supports construction of the Underwater Launch Test Facility, and executes two flight tests, including the first launch of the CPS All Up Round using the cold-gas launch approach for sea-based fielding. The request totals $901 million in CPS R&D funding. Additionally, the request includes $341 million in funding to procure additional rounds in support of Zumwalt Class fielding.

[154] See also Nick Wilson, "Navy Looks to Streamline HALO Fielding with MTA Rapid Prototyping Approach," *Inside Defense*, May 4, 2023; Justin Katz, "Hypersonic Ship-Killer: Navy Taps Lockheed, Raytheon to Start Developing HALO Missile," *Breaking Defense*, March 29, 2023; "Navy Moves Forward with Hypersonic, Carrier-Based Weapon," Naval Air Systems Command (NAVAIR), March 28, 2023.

> The Marine Corps is working towards the capability to employ smaller, highly mobile hypersonic weapons through science and technology initiatives. The Marine Corps is pursuing an acquisition strategy that leverages the developmental work of other Services and agencies, investing when the capability has reached a higher technology readiness level that allows for expedited prototype experimentation at reduced costs.
>
> **Torpedoes**
>
> The Department continues to invest heavily in increasing the capacity and capability of both the Heavyweight and Lightweight Torpedo inventories to maintain our advantage in the undersea domain against our strategic competitors. The MK 48 Heavyweight Torpedo is the Navy's primary submarine-launched ASW and ASuW weapon. While the Navy has continued to upgrade its existing inventory to incorporate the latest technology and capability, the Navy restarted production of the MK 48 to meet munitions requirements and during the summer of 2022 accepted the first new production heavyweight torpedoes in over twenty years. In addition, the Department is progressing development of new capabilities with the MK 48 MOD 8 and MK 48 MOD 9 to maintain our advantage over the threat today and in the future. The MK 54 Lightweight Torpedo, which is employed by both surface ships and air platforms, continues to be produced and upgraded to keep pace with the ASW threat. At current production demand, the torpedo industrial base remains healthy, producing the MK 54 MOD 0 for the Nation's allied partners in addition to the upgraded MK 54 MOD 1 for the U.S. Navy.
>
> The Department has also partnered with industry and University Affiliated Research Centers to rapidly develop and field new and advanced capabilities to further our advantage in the undersea domain. This includes the MK 54 MOD 2, which will improve performance against the high-end threat, as well as a Very Light Weight Torpedo that will deliver multi-mission capability as both a hard-kill torpedo countermeasure and a short range ASW weapon. The Navy is also expanding the methods in which the MK 54 is employed to provide greater flexibility, effectiveness, and lethality. From high altitude via the P-8A and the High Altitude ASW Weapon Capability (HAAWC) wing kit, to the Hammerhead encapsulated effector and future stand-off ASW capabilities, MK 54 payloads will continue to be essential to the US Navy's and its Allies' ASW mission.[155]

An April 19, 2021, press report stated, "Exposing a new layer of long-range striking power for the U.S. Navy carrier battle group, a photo obtained by Aerospace Daily shows what appears to be a Raytheon RIM-174 SM-6 [Standard Missile 6] missile integrated on a left wing pylon of a Boeing F/A-18F Super Hornet in flight."[156]

The issue of the operating range of Navy carrier air wings is a key component of an ongoing debate over the future survivability, utility, and cost-effectiveness of aircraft carriers and their air wings, with critics arguing that the current operating range of Navy carrier air wings will force Navy aircraft carriers to operate well within the ranges of Chinese ASBMs or other A2/AD systems, which could put the carriers' survivability at substantial risk, or alternatively require

[155] Statement of Frederick J. Stefany, Assistant Secretary of the Navy (Research, Development and Acquisition), Acting and Vice Admiral Scott Conn, Deputy Chief of Naval Operations, Warfighting Requirements and Capabilities (OPNAV N9) and Lieutenant General Karsten S. Heckl, Deputy Commandant, Combat Development and Integration, Commanding General, Marine Corps Combat Development Command, before the Subcommittee on Seapower of the Senate Armed Services Committee on Department of the Navy Fiscal Year 2024 Budget Request for Seapower, March 28, 2023, pp. 33-36. See also Aaron-Matthew Lariosa, "US Navy Looks To Drastically Increase Missile Production," *Naval News*, April 5, 2023; Brian Everstine, "New U.S. Navy Weapons Plan Favors Speed Over Range," *Aviation Week*, September 19, 2022.

[156] "The Weekly Debrief: Air-Launched, SM-6-Like Missile Exposed In New Test Photo," *Aviation Week*, April 19, 2021.

carriers to operate beyond the range of those Chinese A2/AD systems, in locations that are safer but so far away that the carriers and their air wings will contribute little combat capability.

A key U.S. Navy program for increasing the operating range of Navy carrier air wings is the MQ-25 Stingray program, which is a program to acquire a carrier-based unmanned aerial vehicle (UAV) for use as a tanker for in-flight refueling of manned carrier-based aircraft (with a secondary mission of intelligence, surveillance, and reconnaissance). Some observers, while not necessarily objecting to the MQ-25 program, argue that the Navy should do more to increase the operating range of Navy carrier air wings, such as developing a stealthy, carrier-based UAV capable of penetrating enemy air defenses and striking land targets at very long ranges.

The issue of acquisition policies and the metrics for judging their success is discussed in more detail in another CRS report.[157]

Legislative Activity for FY2023

Coverage in Related CRS Reports

A variety of CRS reports cover U.S. Navy programs that in varying degrees can be viewed as responses to, at least in part, China's naval modernization effort. These reports, which include legislative activity on the programs they cover, include but are not limited to the following:

- CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report RL32418, *Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress*, by Ronald O'Rourke
- CRS In Focus IF11826, *Navy Next-Generation Attack Submarine (SSN[X]) Program: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report RS20643, *Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report RL30563, *F-35 Joint Strike Fighter (JSF) Program*, by Jeremiah Gertler (the JSF program is a joint DOD program with Navy participation)
- CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke
- CRS In Focus IF11679, *Navy DDG(X) Next-Generation Destroyer Program: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report RL33745, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report R44972, *Navy Constellation (FFG-62) Class Frigate Program: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report R46374, *Navy Medium Landing Ship (LSM) (Previously Light Amphibious Warship [LAW]) Program: Background and Issues for Congress*, by Ronald O'Rourke

[157] See CRS Report R43838, *Renewed Great Power Competition: Implications for Defense—Issues for Congress*, by Ronald O'Rourke.

- CRS In Focus IF11674, *Navy Light Replenishment Oiler (TAOL) (Previously Next-Generation Logistics Ship [NGLS]) Program: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report R45757, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report R44175, *Navy Shipboard Lasers: Background and Issues for Congress*, by Ronald O'Rourke

FY2023 National Defense Authorization Act (H.R. 7900/S. 4543/H.R. 7776/P.L. 117-263)

House

Section 1065 of H.R. 7900 as reported by the House Armed Services Committee (H.Rept. 117-397 of July 1, 2022) states

> SEC. 1065. REPORTS ON EFFECTS OF STRATEGIC COMPETITOR NAVAL FACILITIES IN AFRICA.
>
> (a) INITIAL REPORT.—
>
> (1) IN GENERAL.—Not later than May 15, 2023, the Secretary of Defense shall submit to the appropriate congressional committees a report on the effects on the national security of the United States of current or planned covered naval facilities in Africa.
>
> (2) ELEMENTS.—The report required under paragraph (1) shall include the following:
>
> (A) An identification of—
>
> (i) any location in Africa where a covered naval facility has been established; and
>
> (ii) any location in Africa where a covered naval facility is planned for construction.
>
> (B) A detailed description of—
>
> (i) any agreement entered into between China or Russia and a country or government in Africa providing for or enabling the establishment or operation of a covered naval facility in Africa; and
>
> (ii) any efforts by the Department of Defense to change force posture, deployments, or other activities in Africa as a result of current or planned covered naval facilities in Africa.
>
> (C) An assessment of—
>
> (i) the effect that each current covered naval facility has had on United States interests, allies, and partners in and around Africa;
>
> (ii) the effect that each planned covered naval facility is expected to have on United States interests, allies, and partners in and around Africa;
>
> (iii) the policy objectives of China and Russia in establishing current and future covered naval facilities at the locations identified under subparagraph (A); and
>
> (iv) the specific military capabilities supported by each current or planned covered naval facility.
>
> (b) UPDATE TO REPORT.—

(1) IN GENERAL.—Not later than March 1, 2024, the Secretary of Defense shall submit to the appropriate congressional committees a report containing an update to the report required under subsection (a).

(2) ELEMENTS.—The report required under paragraph (1) shall include the following:

(A) An identification of—

(i) any location in Africa where a covered naval facility has been established since the date of the submittal of the report under subsection (a); and

(ii) any location in Africa where a covered naval facility has been planned for construction since such date.

(B) A detailed description of—

(i) any agreement entered into between China or Russia and country or government in Africa since such date providing for or enabling the establishment of a covered naval facility in Africa; and

(ii) any efforts by the Department of Defense since such date to change force posture, deployments, or other activities in Africa as a result of current or planned covered naval facilities in Africa.

(C) An updated assessment of—

(i) the effect that each current covered naval facility has had on United States interests, allies, and partners in and around Africa since such date;

(ii) the effect that each planned covered naval facility has had on United States interests, allies, and partners in and around Africa since such date;

(iii) the policy objectives of China and Russia, including new objectives and changes to objectives, in establishing current and future covered naval facilities at the locations identified in the report required under subsection (a) or in subparagraph (A); and

(iv) the specific military capabilities supported by each current or planned covered naval facility at such locations, including new capabilities and changes to capabilities.

(D) A detailed description of—

(i) the policy of the Department of Defense surrounding strategic competitor efforts to establish and maintain covered naval facilities in Africa; and

(ii) any actual or planned actions taken by the Department in response to such efforts and in coordination with global Department priorities, as identified in the national defense strategy under section 113(g) of title 10, United States Code.

(c) FORM.—A report required under subsection (a) or (b) shall be submitted in unclassified form without any designation relating to dissemination control, but may include a classified annex.

(d) DEFINITIONS.—In this section:

(1) The term ‘‘Africa’’ means all countries in the area of operations of United States Africa Command and Egypt.

(2) The term ‘‘appropriate congressional committees’’ means—

(A) the Committee on Armed Services, the Committee on Foreign Affairs, and the Permanent Select Committee on Intelligence of the House of Representatives; and

(B) the Committee on Armed Services, the Committee on Foreign Relations, and the Select Committee on Intelligence of the Senate.

(3) The term ‘‘covered naval facility’’ means a naval facility owned, operated, or otherwise controlled by the People’s Republic of China or the Russian Federation.

(4) The term ‘‘naval facility’’ means a naval base, civilian sea port with dual military uses, or other facility intended for the use of warships or other naval vessels for refueling, refitting, resupply, force projection, or other military purposes.

H.Rept. 117-397 states

Report on Air Force counter-maritime strategy

The committee notes the important work the Department of the Air Force is doing to advance its ability to strike maritime targets, to include pursuit of the Joint Air-to-Surface Standoff Missile, and test and integration activities to expand the compatibility of the Long-Range Anti-Ship Missile. However, the committee is concerned that these efforts are moving too slowly, and that wide gaps remain in the Department’s operational concepts, plans, programs, capabilities and capacity for detecting and defeating adversary maritime surface and subsurface forces from air and space at a scale that would be expected in an Indo-Pacific conflict. Therefore, the committee directs the Secretary of the Air Force, in coordination with the Secretary of the Navy and the Secretary of the Army, to prepare a report to the congressional defense committees by March 1, 2023 as to the strategy and implementation plan for conducting counter-maritime operations.

The report shall include:

(1) operational concepts, plans, programs and key enabling technologies for detecting, tracking and defeating a range of adversary maritime vessels, including while underway;

(2) how the Air Force command and control enterprise will support long-range standoff fires for maritime engagements, to include proficient use of data link and joint range extension networks required for dynamic weapons employment;

(3) how the air battle management system will incorporate sensing data for maritime targets;

(4) how the bomber fleet, and specifically the B–21 program of record, accounts for the capacity required for a counter-maritime role in addition to other mission sets, and if not, provide an updated fleet size;

(5) what steps the Air Force will take and what resources are required to establish an inventory in such quantities of appropriate munitions that achieve desired effects in counter-maritime operations;

(6) what capability is needed to engage targets beyond the range of a Joint Direct Attack Munition and inside the range of a Joint Air to Surface Stand-off Missile in a cost effective way and an estimate of the funds necessary to accrue the capability in required quantities;

(7) considerations and modifications required for various platforms to carry munitions for maritime engagement;

(8) what steps the Air Force is taking to ensure its training methods and simulators prepare warfighters for the counter-maritime mission set alongside the Joint force;

(9) an explanation of how the Air Force intends to integrate and leverage Department of the Navy capabilities and technologies in its detection, targeting and engagement methods; and

(10) an overall assessment of funding to include projected shortfalls and alternative near-term funding opportunities in order to rapidly develop, test and field counter-maritime capabilities from now and over the next five years. (Pages 35-36)

Section 1253 of H.R. 7776 (Engrossed House Amendment of December 8, 2022) states:

SEC. 1253. MODIFICATION OF PROHIBITION ON PARTICIPATION OF THE PEOPLE'S REPUBLIC OF CHINA IN RIM OF THE PACIFIC (RIMPAC) NAVAL EXERCISES TO INCLUDE CESSATION OF GENOCIDE BY CHINA.

Section 1259(a)(1) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (10 U.S.C. 321 note) is amended--

(1) in subparagraph (B), by striking ``and'' at the end;

(2) in subparagraph (C), by striking the period at the end and inserting ``; and''; and

(3) by adding at the end the following:

``(D) ceased committing genocide in China, as articulated in the Department of State's Country Report on Human Rights Practices released on April 12, 2022, and engaged in a credible justice and accountability process for all victims of such genocide.''.

Enacted

Section 1076 of the FY2023 National Defense Authorization Act (H.R. 7776/P.L. 117-263 of December 23, 2022) states:

SEC. 1076. REPORT ON EFFECTS OF STRATEGIC COMPETITOR NAVAL FACILITIES IN AFRICA.

(a) In General.--Not later than May 15, 2023, the Secretary of Defense shall submit to the congressional defense committees a report on the effects of current or planned covered naval facilities in Africa on the interests of the Department of Defense.

(b) Elements.--The report required under subsection (a) shall include the following:

(1) An identification of--

(A) any location in Africa where a covered naval facility has been established; and

(B) any location in Africa where a covered naval facility is planned for construction.

(2) A detailed description of--

(A) any agreement entered into between China or Russia and a country or government in Africa providing for or enabling the establishment or operation of a covered naval facility in Africa; and

(B) any efforts by the Department of Defense to change force posture, deployments, or other activities in Africa as a result of current or planned covered naval facilities in Africa.

(3) An assessment of--

(A) the effect that each current covered naval facility has had on Department of Defense interests in and around Africa, including Department of Defense operational plans in the areas of responsibility of geographic combatant commands other than United States Africa Command;

(B) the effect that each planned covered naval facility is expected to have on Department of Defense interests in and around Africa, including Department of Defense operational plans in the areas of responsibility of geographic combatant commands other than United States Africa Command;

(C) the policy objectives of China and Russia in establishing current and future covered naval facilities at the locations identified under paragraph (1); and

(D) the specific military capabilities supported by each current or planned covered naval facility.

(c) Form of Report.--The report required under subsection (a) shall be submitted in unclassified form without any designation relating to dissemination control, but may include a classified annex.

(d) Definitions.--In this section:

(1) The term ``Africa'' means all countries in the area of operations of United States Africa Command and Egypt.

(2) The term ``covered naval facility'' means a naval facility owned, operated, or otherwise controlled by the People's Republic of China or the Russian Federation.

(3) The term ``naval facility'' means a naval base, civilian sea port with dual military uses, or other facility intended for the use of warships or other naval vessels for refueling, refitting, resupply, force projection, or other military purposes.

Section 1253 of H.R. 7776/P.L. 117-263 states:

SEC. 1253. MODIFICATION OF PROHIBITION ON PARTICIPATION OF THE PEOPLE'S REPUBLIC OF CHINA IN RIM OF THE PACIFIC (RIMPAC) NAVAL EXERCISES TO INCLUDE CESSATION OF GENOCIDE BY CHINA.

Section 1259(a)(1) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (10 U.S.C. 321 note) is amended--

(1) in subparagraph (B), by striking ``and'' at the end;

(2) in subparagraph (C), by striking the period at the end and inserting ``; and''; and

(3) by adding at the end the following:

``(D) ceased committing genocide in China, as articulated in the Department of State's Country Report on Human Rights Practices released on April 12, 2022, and engaged in a credible justice and accountability process for all victims of such genocide.''.

Appendix A. Comparing U.S. and Chinese Numbers of Ships and Naval Capabilities

This appendix presents some additional discussion of factors involved in comparing U.S. and Chinese numbers of ships and naval capabilities.

U.S. and Chinese naval capabilities are sometimes compared by showing comparative numbers of U.S. and Chinese ships. Although the total number of ships in a navy (or a navy's aggregate tonnage) is relatively easy to calculate, it is a one-dimensional measure that leaves out numerous other factors that bear on a navy's capabilities and how those capabilities compare to its assigned missions. One-dimensional comparisons of the total numbers of ships in China's navy and the U.S. Navy are highly problematic as a means of assessing relative U.S. and Chinese naval capabilities and how those capabilities compare to the missions assigned to those navies, for the following reasons:

- **A fleet's total number of ships (or its aggregate tonnage) is only a partial metric of its capability.** Many factors other than ship numbers (or aggregate tonnage) contribute to naval capability, including types of ships, types and numbers of aircraft, the sophistication of sensors, weapons, C4ISR systems, and networking capabilities, supporting maintenance and logistics capabilities, doctrine and tactics, the quality, education, and training of personnel, and the realism and complexity of exercises.[158] In light of this, navies with similar numbers of ships or similar aggregate tonnages can have significantly different capabilities, and navy-to-navy comparisons of numbers of ships or aggregate tonnages can provide a highly inaccurate sense of their relative capabilities. The warfighting capabilities of navies have derived increasingly from the sophistication of their internal electronics and software. This factor can vary greatly from one navy to the next, and often cannot be easily assessed by outside observation. As the importance of internal electronics and software has grown, the idea of comparing the warfighting capabilities of navies principally on the basis of easily observed factors such as ship numbers and tonnages has become increasingly less reliable, and today is highly problematic.
- **Total numbers of ships of a given type (such as submarines or surface combatants) can obscure potentially significant differences in the capabilities of those ships, both between navies and within one country's navy.** Differences in capabilities of ships of a given type can arise from a number of other factors, including sensors, weapons, C4ISR systems, networking capabilities, stealth features, damage-control features, cruising range, maximum speed, and reliability and maintainability (which can affect the amount of time the ship is available for operation).
- **A focus on total ship numbers reinforces the notion that changes in total numbers necessarily translate into corresponding or proportional changes in aggregate capability.** For a Navy like China's, which is modernizing by replacing older, obsolescent ships with more modern and more capable ships, this is not necessarily the case. For example, while China's attack submarine force has only a modestly larger number of boats now than it had in 2000 or 2005 (see

[158] For further discussion, see, for example, Robert McKeown, "Assessing Military Capability: More than Just Counting Guns," *U.S. Naval Institute Proceedings,* December 2022.

Table 1 and **Table 2**), it has considerably more aggregate capability than it did in 2000 or 2005, because the force today includes a much larger percentage of relatively modern designs.

- **Comparisons of total numbers of ships (or aggregate tonnages) do not take into account the differing global responsibilities and homeporting locations of each fleet.** The U.S. Navy has substantial worldwide responsibilities, and a substantial fraction of the U.S. fleet is homeported in the Atlantic. As a consequence, only a certain portion of the U.S. Navy might be available for a crisis or conflict scenario in China's near-seas region, or could reach that area within a certain amount of time. In contrast, China's navy has more-limited responsibilities outside China's near-seas region, and its ships are all homeported along China's coast at locations that face directly onto China's near-seas region. In a U.S.-China conflict inside the first island chain, U.S. naval and other forces would be operating at the end of generally long supply lines, while Chinese naval and other forces would be operating at the end of generally short supply lines.
- **Comparisons of numbers of ships (or aggregate tonnages) do not take into account maritime-relevant military capabilities that countries might have outside their navies,** such as land-based anti-ship ballistic missiles (ASBMs), land-based anti-ship cruise missiles (ASCMs), and land-based Air Force aircraft armed with ASCMs or other weapons. Given the significant maritime-relevant non-navy forces present in both the U.S. and Chinese militaries, this is a particularly important consideration in comparing U.S. and Chinese military capabilities for influencing events in the Western Pacific. Although a U.S.-China incident at sea might involve only navy units on both sides, a broader U.S.-China military conflict would more likely be a force-on-force engagement involving multiple branches of each country's military.
- **The missions to be performed by one country's navy can differ greatly from the missions to be performed by another country's navy.** Consequently, navies are better measured against their respective missions than against one another. Although Navy A might have less capability than Navy B, Navy A might nevertheless be better able to perform Navy A's intended missions than Navy B is to perform Navy B's intended missions. This is another significant consideration in assessing U.S. and Chinese naval capabilities, because the missions of the two navies are quite different.

As mentioned earlier, while comparisons of the total numbers of ships in China's Navy and the U.S. Navy are highly problematic as a means of assessing relative U.S. and Chinese naval capabilities and how those capabilities compare to the missions assigned to those navies, an examination of *the trends over time in the relative numbers of ships* can shed some light on how the relative balance of U.S. and Chinese naval capabilities might be changing over time.

Appendix B. U.S. Navy's Ability to Counter Chinese ASBMs and Hypersonic Weapons

This appendix provides additional discussion of the issue of the U.S. Navy's ability to counter China's ASBMs and hypersonic weapons.

Ability to Counter ASBMs

Although China's ASBMs, as a new type of weapon, might be considered "game changers," that does not mean they cannot be countered. There are several potential approaches for countering an ASBM that can be imagined, and these approaches could be used in combination. ASBMs are not the first "game changer" that the Navy has confronted; the Navy in the past has developed counters for other new types of weapons, such as ASCMs, and is likely exploring various approaches for countering ASBMs.

Countering China's projected ASBMs could involve employing a combination of active (i.e., "hard-kill") measures, such as shooting down ASBMs with interceptor missiles, and passive (i.e., "soft-kill") measures, such as those for masking the exact location of Navy ships or confusing ASBM reentry vehicles. Employing a combination of active and passive measures would attack various points in the ASBM "kill chain"—the sequence of events that needs to be completed to carry out a successful ASBM attack. This sequence includes detection, identification, and localization of the target ship, transmission of that data to the ASBM launcher, firing the ASBM, and having the ASBM reentry vehicle find the target ship.

Attacking various points in an opponent's kill chain is an established method for countering an opponent's military capability. A September 30, 2011, press report, for example, quotes Lieutenant General Herbert Carlisle, the Air Force's deputy chief of staff for operations, plans, and requirements, as stating in regard to Air Force planning that "We've taken [China's] kill chains apart to the 'nth' degree."[159]

To attack the ASBM kill chain, Navy surface ships, for example, could operate in ways (such as controlling electromagnetic emissions or using deception emitters) that make it more difficult for China to detect, identify, and track those ships.[160] The Navy could acquire weapons and systems for disabling or jamming China's long-range maritime surveillance and targeting systems, for attacking ASBM launchers, for destroying ASBMs in various stages of flight, and for decoying

[159] David A. Fulghum, "USAF: Slash And Burn Defense Cuts Will Cost Missions, Capabilities," *Aerospace Daily & Defense Report,* September 30, 2011: 6.

[160] For a journal article discussing actions by the Navy during the period 1956-1972 to conceal the exact locations of Navy ships, see Robert G. Angevine, "Hiding in Plain Sight, The U.S. Navy and Dispersed Operations Under EMCON, 1956-1972," *Naval War College Review*, Spring 2011: 79-95. See also Jonathan F. Sullivan, Defending the Fleet From China's Anti-Ship Ballistic Missile: Naval Deception's Roles in Sea-Based Missile Defense, A Thesis submitted to the Faculty of the Graduate School of Arts and Sciences of Georgetown University in partial fulfillment of the requirements for the degree of Master of Arts in Security Studies, April 15, 2011, accessed August 10, 2011, at http://gradworks.umi.com/1491548.pdf; Jon Solomon, "Deception and the Backfire Bomber: Reexamining the Late Cold War Struggle Between Soviet Maritime Reconnaissance and U.S. Navy Countertargeting," *Information Dissemination* (*www.informationdissemination.net*), October 27, 2014; John Solomon, "Deception and the Backfire Bomber, Part II," *Information Dissemination* (*www.informationdissemination.net*), October 28, 2014; John Solomon, "Deception and the Backfire Bomber, Part III," *Information Dissemination* (*www.informationdissemination.net*), October 29, 2014; John Solomon, "Deception and the Backfire Bomber, Part IV," *Information Dissemination* (*www.informationdissemination.net*), October 30, 2014.

and confusing ASBMs as they approach their intended targets. Options for destroying ASBMs in flight include the SM-3 midcourse BMD interceptor missile (including the new Block IIA version) and the SM-6 terminal-defense BMD interceptor missile.[161] Options for decoying and confusing ASBMs as they approach their intended targets include equipping ships with systems, such as electronic warfare systems or systems for generating radar-opaque smoke clouds or radar-opaque carbon-fiber clouds, that could confuse an ASBM's terminal-guidance radar.[162]

An October 4, 2016, press report states the following:

> Several times in the past, [Chief of Naval Operations John] Richardson has stressed that long range weapons developments from adversarial nations like Russia and China aren't the end-all, be-all of naval conflicts.
>
> Just because China's "carrier-killer" missile has a greater range than the planes aboard a US aircraft carrier doesn't mean the US would shy away from deploying a carrier within that range, Richardson has stated on different occasions.
>
> Again, Richardson challenged the notion that a so-called A2/AD zone was "an impenetrable keep out zone that forces can only enter at extreme peril to their existence, let alone their mission."
>
> Richardson took particular issue with the "denial" aspect of A2/AD, repeating his assertion that this denial is an "aspiration" not a "fait accompli." The maps so common in representing these threats often mark off the limits of different system's ranges with "red arcs that extend off coastlines," with the implication that military forces crossing these lines face "certain destruction."
>
> But this is all speculation according to Richardson: "The reality is far more complex, it's actually really hard to achieve a hit. It requires the completion of a really complex chain of events.... these arcs represent danger for sure... but the threats they are based on are not insurmountable, and can be managed, will be managed."
>
> "We can fight from within these defended areas, and we will... this is nothing new and has been done before," said Richardson.
>
> So while Russia and China can develop missiles and radars and declare their ranges on paper, things get a lot trickier in the real world, where the US has the most and best experience in operating.
>
> "Potential adversaries actually have different geographic features like choke points, islands, ocean currents, mountains," said Richardson, who urged against oversimplifying complicated, and always unique circumstances in so-called A2/AD zones.
>
> "Have no doubt, the US navy is prepared to go wherever it needs to go, at any time, and stay there for as long as necessary in response to our leadership's call to project our strategic influence," Richardson concluded.

Similarly, an August 29, 2016, press report states the following:

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[161] For more on the SM-3, including the Block IIA version, and the SM-6, see CRS Report RL33745, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, by Ronald O'Rourke.

[162] Regarding electronic warfare, see, for example, Brett Tingley, "The Navy's Secretive And Revolutionary Program To Project False Fleets From Drone Swarms," *The Drive*, November 7, 2019. Regarding the option of systems for generating radar-opaque smoke clouds, Thomas J. Culora, "The Strategic Implications of Obscurants," *Naval War College Review*, Summer 2010: 73-84; Scott Tait, "Make Smoke!" U.S. Naval Institute Proceedings, June 2011: 58-63. Regarding radar-opaque carbon-fiber clouds, see "7th Fleet Tests Innovative Missile Defense System," Navy News Services, June 26, 2014; Kevin McCaney, "Navy's Carbon-Fiber Clouds Could Make Incoming Missiles Miss Their Targets," *Defense Systems* (http://defensesystems.com), June 27, 2014. See also Sydney J. Freedberg Jr., "Cyber, EW Are Secret Missile Defense Weapons Too Secret To Use," *Breaking Defense*, December 4, 2015.

> The United States Navy is absolutely confident in the ability of its aircraft carriers and carrier air wings to fly and fight within zones defended by so-called anti-access/area denial (A2/AD) weapons....
>
> In the view of the U.S. Navy leadership, A2/AD—as it is now called—has existed since the dawn of warfare when primitive man was fighting with rocks and spears. Overtime, A2/AD techniques have evolved as technology has improved with ever-greater range and lethality. Rocks and spears eventually gave way to bows and arrows, muskets and cannons. Thus, the advent of long-range anti-ship cruise and ballistic missiles is simply another technological evolution of A2/AD.
>
> "This is the next play in that," Adm. John Richardson, chief of naval operations, told The National Interest on Aug. 25 during an interview in his office in the Pentagon. "This A2/AD, well, it's certainly a goal for some of our competitors, but achieving that goal is much different and much more complicated."
>
> Indeed, as many U.S. Navy commanders including Richardson and Rear Adm. (Upper Half) DeWolfe Miller, the service's director of air warfare, have pointed out, anti-access bubbles defended by Chinese DF-21D or DF-26 anti-ship ballistic missile systems or Russian Bastion-P supersonic anti-ship missile systems are not impenetrable 'Iron Domes.' Nor do formidable Russian and Chinese air defense systems such as the S-400 or HQ-9 necessarily render the airspace they protect into no-go zones for the carrier air wing.
>
> Asked directly if he was confident in the ability of the aircraft carrier and its air wing to fight inside an A2/AD zone protected by anti-ship cruise and ballistic missiles as well as advanced air defenses, Richardson was unequivocal in his answer. "Yes," Richardson said—but he would not say how exactly how due to the need for operational security. "It's really a suite of capabilities, but I actually think we're talking too much in the open about some of the things we're doing, so I want to be thoughtful about how we talk about things so we don't give any of our competitors an advantage."...
>
> Miller said that there have been threats to the carrier since the dawn of naval aviation. In many ways, the threat to the carrier was arguably much greater during the Cold War when the Soviet Union massed entire regiments of Tupolev Tu-22M3 Backfires and deployed massive cruise missile-armed Oscar-class SSGN submarines to hunt down and destroy the Navy's flattops. The service developed ways to defeat the Soviet threat—and the carrier will adapt to fight in the current environment.
>
> "We could have had this interview twenty-years-ago and there would have been a threat," Miller said. "The nature of war and A2/AD is not new—that's my point. I don't want to downplay it, but our improvements in information warfare, electronic warfare, payloads, the weapons systems that we've previously talked about—plus our ability to train to those capabilities that we have—we will create sanctuaries, we'll fight in those sanctuaries and we're a maneuver force."[163]

An October 18, 2017, blog post states the following:

> Assuming the DF-21D is ready for battle, can America defend against China's mighty missile?

[163] Dave Majumdar, "Chief of Naval Operations Richardson: US Aircraft Carriers Can Fight Inside A2/AD Zones," *National Interest*, August 29, 2016. See also Ryan Pickrell, "Navy Admirals Brush Aside Biggest Worry Of Modern Naval Combat," *Daily Caller*, August 31, 2016; Dave Majumdar, "Here Is Why the US Military Is Not In Panic Mode Over China's Carrier-Killer Missiles," *National Interest*, June 20, 2016.

> While opinions are clearly mixed—in speaking to many sources over the last several years on this topic—it seems clear there is great nervousness in U.S. defense circles. However, as time has passed, initial fears have turned towards a more optimistic assessment....
>
> In the end, the weapon might not be the great "game-changer" that many point it out to be, but a great complicator.[164]

A January 28, 2021, press report states

> The U.S. Navy's top intelligence officer has said the service is watching closely as China expands its anti-ship missile capabilities, particularly in and around the disputed South China Sea, to include the ongoing development of long-range anti-ship ballistic missiles. At the same time, he said he "hopes" that China's People's Liberation Army will continue to invest significant resources into these efforts, hinting that the U.S. Navy already has extensive measures to counter these threats already in use now or in development.
>
> Navy Vice Admiral Jeffrey Trussler, the Deputy Chief of Naval Operations for Information Warfare, made his remarks about China's anti-ship missile arsenal during an online event put on by the non-profit Intelligence and National Security Alliance on Jan. 27, 2021….
>
> … not only did Vice Admiral Trussler seem less concerned about PLA anti-ship missile capabilities than one would expect, he made clear he was happy with them continuing to pour time and resources into those efforts.
>
> "I hope they just keep pouring money into that type of thing," he said. "That may not be how we win the next war."
>
> The clear indication here is that Trussler is aware of countermeasures, whether they be certain systems or tactics, techniques, and procedures, that are either available now or in development. The Vice Admiral did not offer any specific details about what the Navy is doing to go along with these remarks….
>
> We also know that, by 2019, warships assigned to the Navy's 7th Fleet, which is based in Japan, were fitted with the AN/SLQ-59 Transportable Electronic Warfare Modules (TEWM). TEWM is described as a "counter-terminal threat defensive system," indicating that it is designed to help defeat incoming anti-ship missiles, or other threats, such as swarms of small drones, in the final phase of their attack on a ship. Based on the information available, The War Zone previously assessed that the AN/SLQ-59 was most likely acquired in response to growing cruise missile threats, and Chinese developments, in particular, given its fielding first on ships forward-deployed in Japan.
>
> The Navy has also been hard at work developing an entire networked electronic warfare "ecosystem," as part of its shadowy Netted Emulation of Multi-Element Signature against Integrated Sensors program, or NEMESIS. The goal here has been to craft a 'system of systems' comprising of various manned and unmanned ships, as well as submarines and aircraft, equipped with electronic warfare systems that can work together cooperatively. One of the key uses of these capabilities would be to generate signals that mimic real fleets of ships and aircraft to distract and confuse opponents, making it difficult for them to effectively spot and target real Navy assets. These networked electronic warfare platforms could also employ other kinds of electronic warfare tactics across a broad area to protect against various kinds of threats. You can read more about NEMSIS in detail in this past War Zone feature.[165]

[164] Harry J. Kazianis, "Could China's Aircraft Carrier Killer Missiles 'Sink' the U.S. Navy?" *National Interest*, October 18, 2017. See also Dick Mosier, "Breaking the Anti-Ship Missile Kill Chain," Center for International Maritime Security, February 26, 2018; Richard A. Bitzinger, "The Myth of the 'Game-Changer' Weapon," Asia Times, April 26, 2018.

[165] The article linked at this point is Brett Tingley, "The Navy's Secretive And Revolutionary Program To Project False Fleets From Drone Swarms," *The Drive*, November 7, 2019.

> A highly adaptive and deeply networked electronic warfare ecosystem could be particularly useful against long-range anti-ship missile strikes, especially using ballistic missiles, which would require targeting information from offboard platforms and the ability to send updated information to the weapon during the mid-course stage of flight….
>
> The Navy does have Arleigh Burke class destroyers outfitted specifically for ballistic missile defense, including the ability to launch the SM-3 Block IIA interceptor, which is designed to knock down ballistic missiles during the mid-course portion of their flight. Those ships are also slated to get interceptors designed to bring down hypersonic weapons in the future as part of the Regional Glide Phase Weapon System (RGPWS) program….
>
> The Navy, which has been looking to stop deploying Arleigh Burkes on dedicated missile defense missions, could seek to make more widespread use of the SM-3 Block IIA in the future. Those destroyers and other ships could gain additional missile defense capabilities as the improved Block IB variant of the SM-6 missile begins to enter service. Existing Block I and IA versions of the SM-6 already have the ability to intercept ballistic missiles during the terminal phase of their flight, as well as engage various other aerial and surface threats. The SM-6, in particular, potentially provides a potent defense against anti-ship ballistic missiles, especially those that break through mid-course traditional ballistic missile defenses, if mid-course ballistic missile defense assets are available at all.
>
> There's the possibility that Vice Admiral Trussler is aware of other developments in the classified realm that could further mitigate some or all of these threats, as well. Beyond that, there's no discounting that his public comments, which are certain to be scrutinized by the PLA itself, are a form of misinformation designed to prompt concerns within the Chinese military that its priorities may be, in some way, seriously off base.
>
> Whatever the case, the threat posed by China's anti-ship missile arsenal, which continues to grow in capability, including with the development of new anti-ship ballistic missiles, is real. At the same time, while the Navy obviously knows this, the service seems to be strongly hinting that it feels it making very good progress on getting around these challenges, or at least wants to make the Chinese think so.[166]

Regarding the above-reported remarks by Vice Admiral Trussler, a January 29, 2021, press report stated

> That confident [U.S. Navy] posture caught the attention of the Chinese military establishment. "What Trussler is saying is that the U.S. has sufficient power to handle the anti-ship missile threat from China," former People's Liberation Army instructor Song Zhongping told the South China Morning Post on Friday [January 29]. "The U.S. is emphasizing that threat and it will further boost its defenses against Chinese missiles."[167]

Ability to Counter Hypersonic Weapons

Another CRS report provides a brief survey of DOD (including Navy) efforts for developing defenses against hypersonic weapons.[168]

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[166] Joseph Trevithick, "Top Navy Intel Officer Hopes China Will Keep Dumping Money Into Anti-Ship Ballistic Missiles, The Navy Is Strongly Hinting that It Feels It Is Well on Its Way to Mitigating the Very Real Threats Posed by Anti-Ship Ballistic and Cruise Missiles," *The Drive*, January 28, 2021. See also Mallory Shelbourne, "U.S. Admiral: China Can 'Keep Pouring Money' Into Anti-Ship Ballistic Missiles," *USNI News*, January 27, 2021.

[167] Joel Gehrke, "China's 'Carrier Killer' and Military Won't 'Win the Next War,' US Admiral Says," *Washington Examiner*, January 29, 2021. The *South China Morning Post* article being cited is Teddy Ng and Minnie Chan, "US Admiral Calls China's Anti-Ship Ballistic Missiles a 'Destabilising Effort' that May Not Win a War," *South China Morning Post*, January 29, 2021. See also Kris Osborn, "Could the US Navy Destroy Attacking Chinese 'Carrier-Killer' DF-26 Anti-Ship Missiles?" *Warrior Maven*, October 11, 2022.

[168] CRS In Focus IF11623, *Hypersonic Missile Defense: Issues for Congress*, by Kelley M. Sayler.

Regarding the Navy efforts to develop capabilities for countering hypersonic weapons, at a May 9, 2023, hearing on missile defense programs before the Strategic Forces subcommittee of the Senate Armed Services Committee, the Director of the Missile Defense Agency (MDA) stated:

> MDA plans to conduct a Tracking Exercise, Flight Test Other (FTX)-23, with two [U.S. Navy] Aegis ships to perform target scene data collection of an MRBM with countermeasures. We will also demonstrate Aegis SBT [sea-based terminal defense] with a salvo engagement in Flight Test Aegis Weapon System (FTM)-32, firing two (salvo) SM-6 Dual II software upgrade guided missiles against a MRBM [medoum-range ballistic missile]. In FTX-40 we will fire a simulated SM-6 missile against a hypersonic glide vehicle....
>
> We also are developing a layered defense capability against regional hypersonic threats and have initiated a development program for a Glide Phase Interceptor [GPI], leveraging existing systems where possible, including proven engage-on-remote and launch-on-remote capabilities. We are focusing on the proven Aegis Weapon System to provide the depth-of-fire needed for a layered defense against hypersonic threats. In FY 2024, MDA will continue to develop and mature the GPI capability and leverage the Aegis Weapon System. Today, MDA already provides the Navy an initial terminal defense capability. We also are working closely with the Navy to develop, field, and upgrade SBT defenses to counter more advanced maneuvering and hypersonic threats. We anticipate delivering these Increment 3 capabilities in 2025. In FY 2024, Aegis SBT will demonstrate an engagement against an advanced target in the terminal phase (FTM-32) and a simulated engagement against a hypersonic glide vehicle (FTX-40). In FY 2025, SBT Increment 3 will demonstrate an engagement against a hypersonic glide vehicle firing an SM-6 Block IAU missile (FTM-43).[169]

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[169] [Statement of] Vice Admiral Jon A. Hill, USN, Director, Missile Defense Agency, Before the House [sic: Senate] Armed Services Committee Strategic Forces Subcommittee, May 9, 2023, pp. 8, 10-11. See also Rich Abott, "MDA Sees Counter-Hypersonic Ability In Present Missiles, Multi-Year SM-6 Order For Salvo Defense," *Defense Daily*, May 10, 2023; Rich Abott, "Northrop Grumman And Raytheon Nab More Contract Mods To Refine Hypersonic Defense Concepts," *Defense Daily*, May 1, 2023; Brent M. Eastwood, "China's DF-17 Hypersonic Missile: How To Kill An Aircraft Carrier?" *19FortyFive*, January 20, 2023; Jen Judson, "Raytheon, Northrop Advance in Competition to Develop Hypersonic Weapons Interceptor," *Defense News*, June 24, 2022. See also Jason Sherman, "MDA Selects Raytheon, Northrop to Advance in GPI Design Contest; Lockheed Sidelined," *Inside Defense*, June 24, 2022; Andrew Eversden, "Northrop, Raytheon Selected to Continue Work on Hypersonic Missile Interceptor," *Breaking Defense*, June 27, 2022; Rich Abott, "Raytheon And Northrop Grumman Win Mods To Continue Refining Hypersonic Defense Concepts," *Defense Daily*, November 16, 2022.

For more on the Aegis ballistic missile defense (BMD) program, see CRS Report RL33745, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, by Ronald O'Rourke.

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