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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 over 370 platforms, including major surface combatants, submarines, ocean-going amphibious ships, mine warfare ships, aircraft carriers, and fleet auxiliaries. Notably, this figure does not include approximately 60 HOUBEI-class patrol combatants that carry anti-ship cruise missiles (ASCM). The… overall battle force [of China's navy] is expected to grow to 395 ships by 2025 and 435 ships by 2030." The U.S. Navy, by comparison, included 296 battle force ships as of August 12, 2024, and the Navy's FY2025 budget submission projects that the Navy will include 294 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, the capacity of China's shipbuilding industry compared with the capacity of the U.S. shipbuilding industry, and 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; and developed new operational concepts for countering PRC maritime A2/AD forces. 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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Issue for Congress

This report provides background information and issues for Congress on the naval modernization effort of the People's Republic of China (PRC, or China) 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 PLA 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]

[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 2023, Annual Report to Congress*, released on October 19, 2023, 192 pp. Hereinafter *2023 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 2022-2023*, and previous editions.

[6] For a map showing the first and second island chains, see *2023 DOD CMSD*, p. 69.

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 PRC 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, "The PLAN is the largest navy in the world with a battle force of over 370 platforms, including major surface combatants, submarines, ocean-going amphibious ships, mine warfare ships, aircraft carriers, and fleet auxiliaries. Notably, this figure does not include approximately 60 HOUBEI-class patrol combatants that carry anti-ship cruise missiles (ASCM). The PLAN's overall battle force is expected to grow to 395 ships by 2025 and 435 ships by 2030. Much of this growth will be in major surface combatants."[8] The U.S. Navy, by comparison, included 296 battle force ships as of August 12, 2024, and the Navy's FY2025 budget submission projects that the Navy will include 294 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, the capacity of China's shipbuilding industry compared with the capacity of the U.S. shipbuilding industry, and trend lines regarding the relative sizes and capabilities of China's navy and the U.S. Navy.[10] China's navy is viewed as posing a major challenge to

[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] *2023 DOD CMSD*, p. 55. 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, Alexander Palmer, Henry H. Carroll, and Nicholas Velazquez, "Unpacking China's Naval Buildup," Center for Strategic and International Studies (CSIS), June 5, 2024; James Stavridis, "China Has 350 Warships. The US Has 290. That's a Problem," *Bloomberg*, May 1, 2024; Lauren C. Williams, "China Is Winning the Shipbuilding Numbers Game—and That's a Problem, INDOPACOM Nom [Nominee] Says," *Defense One*, February 2, 2024; Svetlana Shkolnikova, "China's Buildup of Warships on a 'Concerning Trajectory,' Says Nominee to (continued...)

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 PRC 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, "Today, 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]

Command US Forces in Indo-Pacific," *Stars and Stripes*, February 1, 2024; Mackenzie Eaglen, "The U.S. Navy Is Falling Behind China, And The Pentagon Knows It," *19FortyFive*, October 31, 2023; Michael Lee, "Chinese Shipbuilding Capacity Over 200 Times Greater Than US, Navy Intelligence Says," *Fox News*, September 14, 2023; Joseph Trevithick, "Alarming Navy Intel Slide Warns Of China's 200 Times Greater Shipbuilding Capacity," *The Drive*, July 11, 2023; 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 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] *2023 DOD CMSD*, p. 53.

[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.

- 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, 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 PRC 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

[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 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.

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 to train large numbers of personnel to crew its new ships,[21] non-commissioned officers (NCOs) that are not empowered by unit commanders through mission command to achieve a commander's intent,[22] and a lack of recent combat experience.[23] China is working to reduce or overcome such limitations and

[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.

[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. See also Mallory Shelbourne, "At-Sea Political Officers Could Pose Problems for Chinese Navy in War, Experts Say," *USNI News*, September 20, 2023.

[22] See, for example, Rich Abott, "INDOPACOM Official Names Chinese Military Structure Limitations And Russian Debts To China," *Defense Daily*, October 12, 2023.

[23] 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.

In November 2023, *The Economist* published a collection of articles regarding weaknesses and limitations in China's military as a whole, including its navy. The online landing page for the collection is "Unknown Soldiers, Overestimating China's Armed Forces Would Be Dangerous, Argues Jeremy Page," *Economist*, November 11, 2023. Individual articles in the collection include the following: "How Scary is China? America Must Understand China's Weaknesses as Well as Its Strengths," *Economist*, November 9, 2023; "The People's Liberation Army Is Not Yet as Formidable as the West Fears," *Economist*, November 6, 2023; "From Hypersonic Missiles to Undersea Drones, The PLA Is Making Leaps, But China's Military Tech Still Lags Behind the West's," *Economist*, November 6, 2023; "China Is Struggling to Recruit Enough Highly Skilled Troops," *Economist*, November 6, 2023; "Xi Jinping Worries That China's Troops Are Not Ready to Fight," *Economist*, November 6, 2023; "Xi Jinping Is Obsessed with Political Loyalty in the PLA, Ideology Is Undermining China's Drive to Prepare Forces for Combat," *Economist*, November 6, 2023; "Invading Taiwan Would Be a Logistical Minefield for China," *Economist*, November 6, 2023. See also Paul Dibb, "Be Alert to China's Military Weaknesses," *Strategist*, December 1, 2023.

The use of a dual command structure in the crews of larger PLA Navy 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 Mallory Shelbourne, "At-Sea Political Officers Could Pose Problems for Chinese Navy in War, Experts Say," *USNI News*, September 20, 2023; Roderick Lee, *PLA Navy Submarine Leadership - Factors Affecting Operational Performance*, China Maritime Studies Institute (CMSI), U.S. Naval War College, June 2023, 21 pp.; "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 Bloomberg News, "China's Military Probes Slew of Graft Issues Going Back to 2017," *Bloomberg*, July 26, 2023; Gordan G. Chang, "China's Military Is Nowhere Near as Strong as the CCP Wants You to Think," *Newsweek*, June 16, 2023; Frank Chen, "Ex-PLA Navy Chief in Deep Water Amid War on Graft," *Asia Times*, June 26, 2020.

Regarding corruption in China's military in general, see, for example, "Xi Jinping Is Struggling to Stamp Out Graft in the PLA, How Will It Affect China's Fighting Ability?" *Economist*, January 11, 2024; Chun Han Wong, "China's Military Shake-Up Raises Questions About Combat Readiness," *Wall Street Journal*, January 4, 2024; Peter Martin and Jennifer Jacobs, "US Intelligence Shows Flawed China Missiles Led Xi to Purge Army," *Wall Street Journal*, December 6, 2023. For an alternative perspective, see Alex Velez-Green, "Corruption in China's Military Is No Excuse for American Complacency," *Defense News*, January 22, 2024; John Grady, "Chinese Military Corruption Won't Slow PLA Expansion, Panel Says," *USNI News*, October 31, 2023.

weaknesses.[24] Although China's navy has limitations and weaknesses, it may nevertheless be sufficient for performing missions of interest to China's 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."[25] China also operates a 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.[26]

Numbers of Ships; Comparisons to U.S. Navy

Overview

DOD states

[24] 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 capabilities through the development of its surface combatants and special mission aircraft, but it continues to lack a robust deep-water anti-submarine warfare (ASW) capability.
>
> (*2023 DOD CMSD*, p. 56.)

See also Gabriel Honrada, "China Simulates 'Z-day' Total Sea War with the US," *Asia Time*s, July 5, 2023; Stephen Chen, "Chinese Military Conjures World War Z Scenario of All-Out Conflict to Test and Evaluate New Navy Weapons," *South China Morning Post*, June 28, 2023; 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.

[25] DOD states that

> The CCG's [China Coast Guard's] continued expansion and modernization makes it the largest maritime law enforcement fleet in the world. Newer CCG vessels are larger and more capable than older vessels, allowing them to operate further offshore and remain on station longer. While exact numbers are unavailable, open-source reporting and commercial imagery counts indicate the CCG has over 150 regional and oceangoing patrol vessels (more than 1,000 tons). These larger vessels include over 20 corvettes transferred from the PLAN, which were modified for CCG operations. , The newer, larger CCG vessels are equipped with helicopter facilities, high-capacity water cannons, multiple interceptor boats and guns ranging from 20 to 76 millimeters., Revised estimates indicate the CCG operates more than 50 regional patrol combatants (more than 500 tons), which can be used for limited offshore operations, and an additional 300 coastal patrol craft (100 to 499 tons).
>
> (*2023 DOD CMSD*, pp. 79-80. See also *2019 DIA CMP*, p. 78.)

[26] For additional discussion, see *2023 DOD CMSD*, pp. 79-82, and CRS Report R42784, *U.S.-China Strategic Competition in South and East China Seas: Background and Issues for Congress*, by Ronald O'Rourke.

> The PLAN is the largest navy in the world with a battle force of over 370 platforms, including major surface combatants, submarines, ocean-going amphibious ships, mine warfare ships, aircraft carriers, and fleet auxiliaries. Notably, this figure does not include approximately 60 HOUBEI-class patrol combatants that carry anti-ship cruise missiles (ASCM). The PLAN's overall battle force is expected to grow to 395 ships by 2025 and 435 ships by 2030. Much of this growth will be in major surface combatants.[27]

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."[28]

Another set of observers states:

> China's rapid military buildup has left the People's Liberation Army Navy (PLAN) poised to overtake the U.S. Navy in several measures of maritime might more quickly than sometimes assumed. If China continues to expand its fleet at the current pace and the United States does not revitalize its shipbuilding industry, China will grow increasingly likely to emerge victorious from interstate war, especially a prolonged great power war….
>
> China now possesses the world's largest maritime fighting force, operating 234 warships [excluding auxiliary and support ships] to the U.S. Navy's 219 [warships excluding auxiliary and support ships].[29]

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.[30] 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 China's 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."[31]

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

Relative U.S. and PLA naval capabilities are sometimes assessed by showing comparative numbers of U.S. and PLA ships (or comparative aggregate fleet displacements [i.e, tonnages]). Although the total number of ships in a navy (or a navy's aggregate displacement) is relatively

[27] *2023 DOD CMSD*, p. 55. See also *2019 DIA CMP*, p. 63.

[28] *2019 DIA CMP*, p. 69.

[29] Alexander Palmer, Henry H. Carroll, and Nicholas Velazquez, "Unpacking China's Naval Buildup," Center for Strategic and International Studies (CSIS), June 5, 2024.

[30] 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.

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

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 (or aggregate displacements) are highly problematic as a means of assessing relative U.S. and PLA 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* (or aggregate displacements) can shed some light on how the relative balance of U.S. and PLA naval capabilities might be changing over time.

Tables Showing Numbers of PLA Navy and U.S. Navy Ships

Table Showing Figures from Annual DOD Reports

Table 1 shows numbers of certain types of PLA Navy ships—those that might be thought of as the principal combat ships (PCSs)[32] of China's navy—from 2004 to the present, along with the number of China Coast Guard ships from 2016 to the present, as presented in DOD's annual reports on military and security developments involving China. (The DOD report for a given year presents data for PLA forces for the previous year.)[33] As can be seen in **Table 1**, most types of PLA Navy ships shown in the table have increased numerically since 2004.

As can be seen in **Table 1**, about 53% of the increase since 2004 in the total number of PLA Navy ships shown in the table (a net increase of 59 ships out of a total net increase of 112 ships) resulted from increases in missile-armed fast patrol craft starting in 2008 (a net increase of 9 ships) and corvettes starting in 2014 (50 ships). These are the smallest surface combatants shown in the table. 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."[34] As can also be seen in the table, most of the remaining increase since 2004 in the number of PLA Navy ships shown in the table is accounted for by increases in cruisers and destroyers (29 ships) and amphibious ships (17 ships).

Table 1 lumps together less capable older PLA ships with more capable modern PLA ships. In examining the numbers in the table, it can be helpful to keep in mind that for many of the types of PLA 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 U.S. Navy battle force ships (BFSs), meaning the types of ships that count toward the quoted size of the U.S. Navy, and compares it to the total number of the types of PLA ships that are shown in the table. The result is an apples-vs.-oranges comparison, because the PLA figures exclude auxiliary and support ships, while the U.S. Navy figure includes auxiliary and support ships but excludes patrol craft (although the U.S. Navy has very few patrol craft). Changes over time in this apples-vs.-oranges comparison,

[32] The *term principal combat ships* (PCSs) is a term used in this CRS report.

[33] Thus, the 2023 edition of the DOD report covers presents data for 2022, and so on for prior-year editions of the report.

[34] 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.

however, can be of value in understanding trends in the comparative sizes of the U.S. and PLA navies.

Table 1. Numbers of Certain Types of PLA Navy and U.S. Ships Since 2004

Figures for PLA ships taken from annual editions DOD reports on military and security developments involving China dated 2005 and subsequent years, showing data for 2004 and subsequent years

Data for that year (as shown in DOD report dated the following year)	Principal PLA combat ships—*excludes* auxiliary and support ships. (The figure for total U.S. battle force ships shown toward the right *includes* auxiliary and support ships, but *excludes* patrol craft, of which the Navy has very few.)															
	Submarines			Surface combatants						Amphibious ships				*China Coast Guard*	Total U.S. battle force ships	U.S. vs. China
	SSB	SSN	SS	CV	CG	DD	FF	FFL	PC	LHA	LST/ LPD	LSM	Total			
2004	1	6	51	0	0	21	43	0	51	0	20	23	**216**	*n/a*	**292**	**+76**
2005	1	5	50	0	0	25	45	0	45	0	25	25	**221**	*n/a*	**281**	**+60**
2006	1	5	53	0	0	25	47	0	41	0	25	25	**222**	*n/a*	**281**	**+59**
2007	1	5	54	0	0	29	45	0	45	0	26	28	**233**	*n/a*	**279**	**+46**
2008	2	6	54	0	0	27	48	0	70	0	27	28	**262**	*n/a*	**282**	**+20**
2009	2	6	54	0	0	25	49	0	85	0	27	28	**276**	*n/a*	**285**	**+9**
2010	2	5	49	0	0	26	53	0	86	0	27	28	**276**	*n/a*	**288**	**+12**
2011	2	5	48	0	0	26	53	0	86	0	28	23	**271**	*n/a*	**284**	**+13**
2012	3	5	49	1	0	23	52	0	85	0	29	26	**273**	*n/a*	**287**	**+14**
2013	3	5	51	1	0	24	49	8	85	0	29	28	**283**	*n/a*	**285**	**+2**
2014	4	5	53	1	0	21	52	15	86	0	29	28	**294**	*n/a*	**289**	**-5**
2015	4	5	57	1	0	23	52	23	86	0	30	22	**303**	*n/a*	**271**	**-32**
2016	4	5	54	1	0	21	56	23	88	0	34	21	**317**	*185*	**275**	**-42**
2017	4	5	57	1	0	28	51	28	86	0	33	23	**306**	*240*	**279**	**-27**
2018	4	6	50	1	0	33	54	42	86	0	37	22	**335**	*248*	**286**	**-49**
2019	4	6	46	2	1	32	49	49	86	0	37	21	**333**	*255*	**290**	**-43**
2020	6	9	56	2	1	32	48	51	86		57		**348**	*223*	**296**	**-52**
2021	6	9	56	2	6	36	45	50	84		57		**351**	*224*	**294**	**-57**
2022	6	6	47	2	8	42	47	50	60	3		57	**328**	*142*	**289**	**-39**
Change from 2004 to 2022																
	+5	0	-4	+2	+8	+21	+4	+50	+9		+17		**+112**	*n/a*	**-3**	**-115**

Sources: Table prepared by CRS based on 2005-2023 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. The DOD report shows data for China for the year prior to the report's cover date. For example, the 2005 edition of the DOD report shows data for 2004.

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 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 (although the U.S. Navy has very few 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.

On the basis of the figures in **Table 1**, it might be said that in 2014, the total number of principal combat ships in China's navy (a figure that *excludes* PLAN auxiliary and support ships) surpassed the total number of U.S. Navy battle force ships (a figure that *includes* U.S. Navy 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.[35]

Table Showing ONI Figures from February 2020

Table 2 shows comparative total numbers of PLA Navy and U.S. Navy battle force ships (BFSs), as well as specific 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. (As noted earlier, battle force ships are the types of ships that count toward the quoted size of the U.S. Navy. The ONI information paper applied the same counting rules to the PLA Navy.) For China, the total number of battle force ships shown excludes the missile-armed patrol craft (PCs) 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 patrol craft can be a significant factor for operations within the first island chain.[36]

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.[37]

[35] For further discussion on this point, see Alexander Palmer, Henry H. Carroll, and Nicholas Velazquez, "Unpacking China's Naval Buildup," Center for Strategic and International Studies (CSIS), June 5, 2024.

[36] See, for example, Richard Sterk, "Chinese Missile Boats Operate on an Attack Swarm Principle," *Defense and Security Monitor*, March 19, 2024.

[37] For further discussion on this point, see Alexander Palmer, Henry H. Carroll, and Nicholas Velazquez, "Unpacking China's Naval Buildup," Center for Strategic and International Studies (CSIS), June 5, 2024.

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

Figures for PLA Navy 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***	***287***	***294***
U.S. total above compared to China total above	***+108***	***+62***	***+68***	***+16***	***-64***	***-113***	***-131***

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.

Table Showing U.S. Navy Figures from October 2020

Table 3 shows numbers of certain types of PLA 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 PLA Navy and U.S. Navy totals, because the PLA total excludes auxiliary and support ships, while the U.S. Navy total includes auxiliary and support ships, but excludes patrol craft (although the U.S. Navy has very few patrol craft).

As shown in **Table 3**, the U.S. Navy projects that between 2020 and 2040, the total number of PLA 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). The total number of U.S. Navy battle force ships projected for 2040 assumes that the Navy's FY2025 30-year shipbuilding plan is fully implemented. As shown by Congressional Budget Office (CBO) analysis, the realized number of U.S. Navy battle force ships in a given year has often been less than the number that was projected for that year in prior-year editions of the Navy's 30-year shipbuilding plan.[38]

[38] Congressional Budget Office, *Perspectives on the Navy's 2023 Shipbuilding Plan, Presentation by Eric J. Labs, an analyst in CBO's National Security Division, at the Surface Navy Association's 35th National Symposium*, January 12, 2023, available at https://www.cbo.gov/publication/58864, slide 8 of 24, entitled "The Navy's Projections of Its Fleet Under the Past 11 Shipbuilding Plans, Compared With Actual Inventories."

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

Figures for PLA 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	***296***	***287***	***294***	***378***	***+82***
U.S. total above compared to China total above	***+57***	***+9***	***-16***	***+45***	***-12***

Source: For PLA Navy ships: U.S. Navy data provided to CRS by Navy Office of Legislative Affairs, reflecting data as of October 26, 2020. For U.S. Navy ships: U.S. Navy data—actual for 2020, and projections for subsequent years shown in Navy's FY2025 30-year shipbuilding plan.

Graphs Showing Numbers of PLA Navy and U.S. Navy Ships

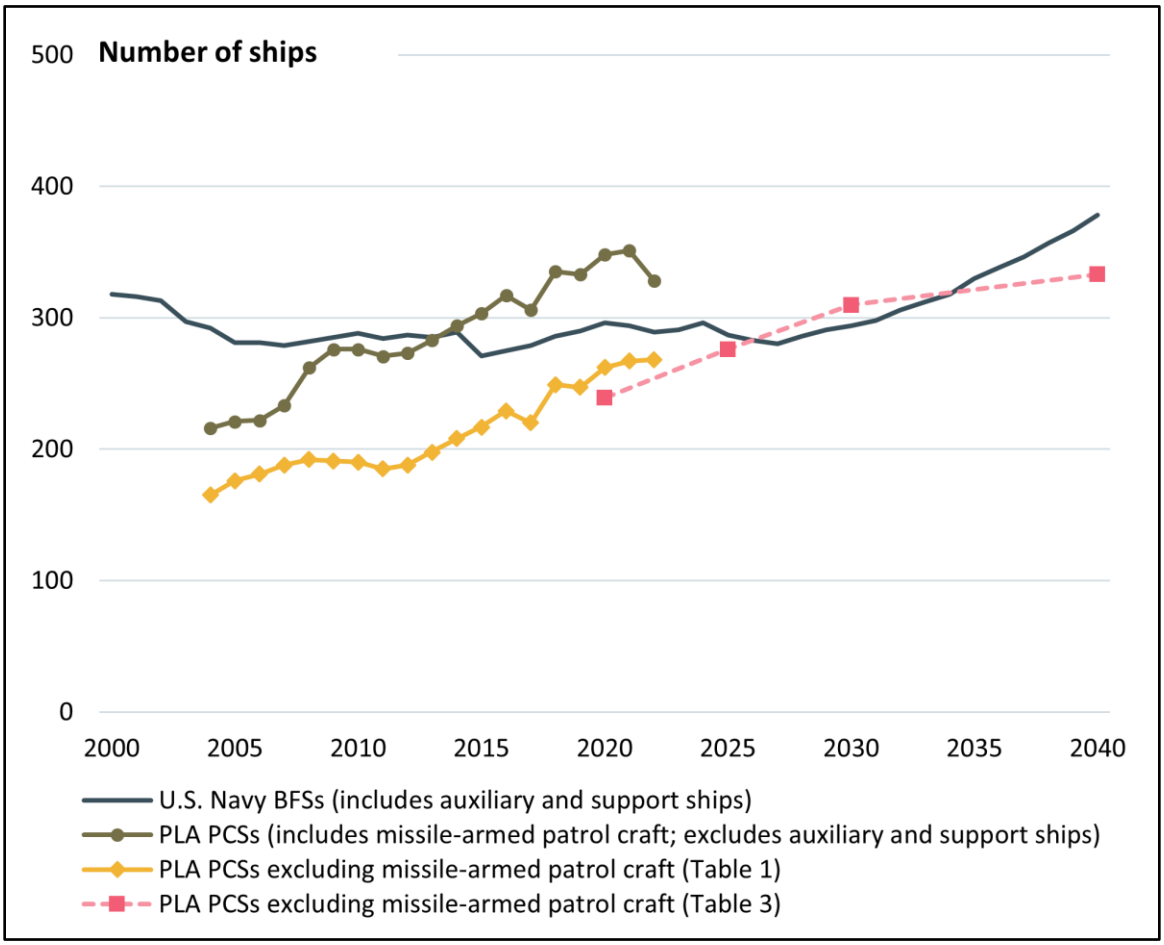
Graph Showing PLA Navy Principal Combat Ships and U.S. Navy Battle Force Ships

Figure 1, which uses numbers from **Table 1** and **Table 3**, shows the total number of PLA Navy principal combat ships (PCSs)—a figure that excludes auxiliary and support ships—and the total number of U.S. Navy battle force ships—a figure that *includes* auxiliary and support ships. In other words, **Figure 1** depicts the apples-vs.-oranges comparison discussed earlier in connection with **Table 1** and **Table 3**. The total number of U.S. Navy battle force ships projected for 2025 through 2040 assumes that the Navy's FY2025 30-year shipbuilding plan is fully implemented. As shown by CBO analysis, the realized number of U.S. Navy battle force ships in a given year has often been less than the number that was projected for that year in prior-year editions of the Navy's 30-year shipbuilding plan.[39]

[39] Congressional Budget Office, *Perspectives on the Navy's 2023 Shipbuilding Plan, Presentation by Eric J. Labs, an analyst in CBO's National Security Division, at the Surface Navy Association's 35th National Symposium*, January 12, 2023, available at https://www.cbo.gov/publication/58864, slide 8 of 24, entitled "The Navy's Projections of Its Fleet Under the Past 11 Shipbuilding Plans, Compared With Actual Inventories."

Figure 1. PLA Navy Principal Combat Ships and U.S. Navy Battle Force Ships

PLAN principal combat ships (PCSs) *excludes* auxiliary and support ships; U.S. Navy battle force ships (BFSs) *includes* auxiliary and support ships



Sources: Data from **Table 1** and **Table 3** of this CRS report and (for U.S. Navy figures) U.S. Navy data, including projected figures for 2025 and beyond shown in Navy's FY2025 30-year shipbuilding plan. PCSs are principal combat ships (which exclude auxiliary and support ships); BFSs are battle force ships (which include auxiliary and support ships).

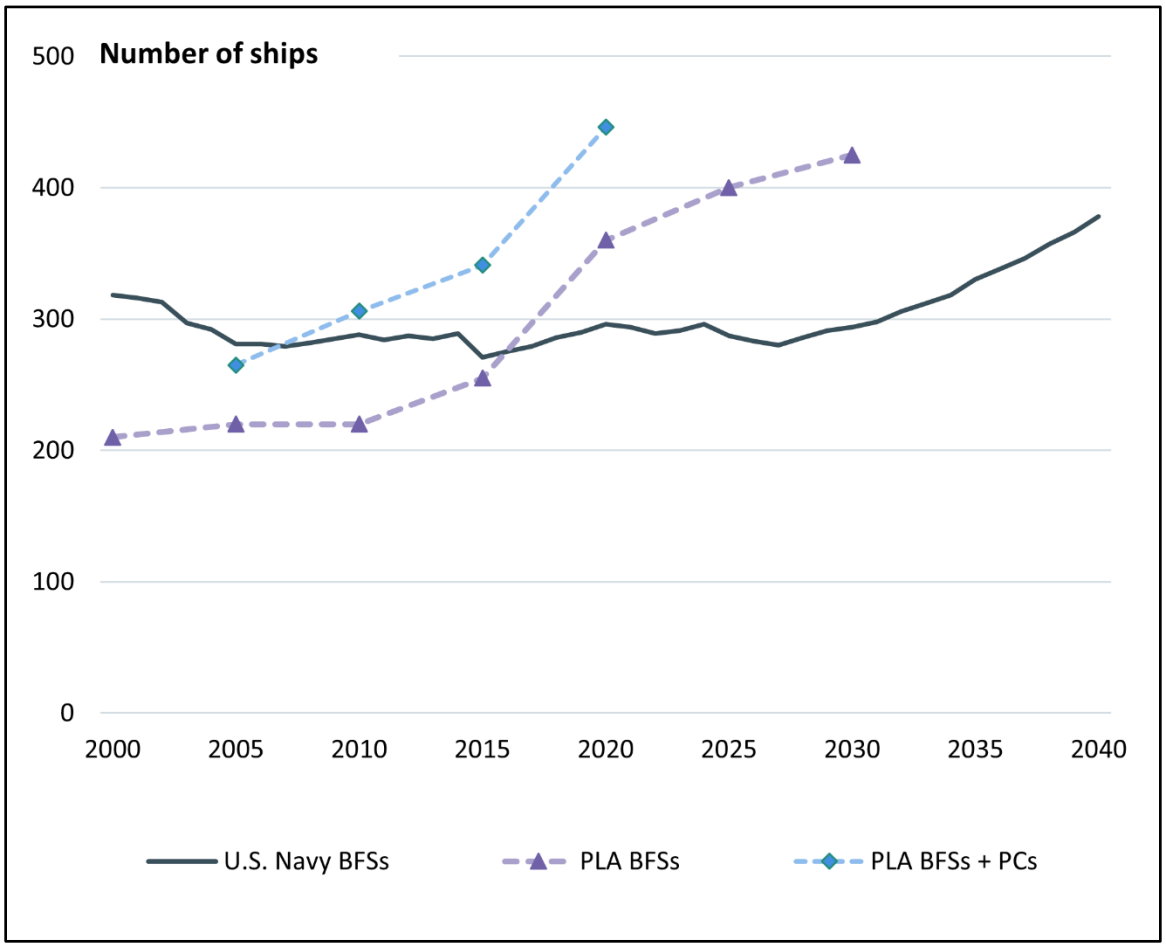
Graph Showing PLA Navy Battle Force Ships and U.S. Navy Battle Force Ships

Figure 2, which uses figures from **Table 1** and **Table 3**, shows the total number of PLA Navy battle force ships (BFSs), the total number of PLA Navy battle force ships plus missile-armed patrol craft (PCs), and the total number of U.S. Navy battle force ships. (As mentioned earlier, the U.S. Navy has very few patrol craft.) As discussed in connection with **Table 2**, comparing total numbers of battle force ships comes 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 patrol craft can be a significant factor for operations within the first island chain. As discussed in connection with **Figure 1**, the total number of U.S. Navy battle force ships projected for 2025 through 2040 assumes that the Navy's FY2025 30-year shipbuilding plan is fully implemented. As shown by CBO analysis, the realized number of U.S. Navy battle force ships in a given year has often been

less than the number that was projected for that year in prior-year editions of the Navy's 30-year shipbuilding plan.[40]

Figure 2. PLA Navy Battle Force Ships and U.S. Navy Battle Force Ships

Figures for both PLAN and U.S. Navy are total number of battle force ships (BFSs), which include auxiliary and support ships.



Sources: Data from **Table 1** and **Table 2** of this CRS report and (for U.S. Navy figures) U.S. Navy data, including projected figures for 2025 and beyond shown in Navy's FY2025 30-year shipbuilding plan. BFSs are battle force ships; PCs are missile-armed patrol craft.

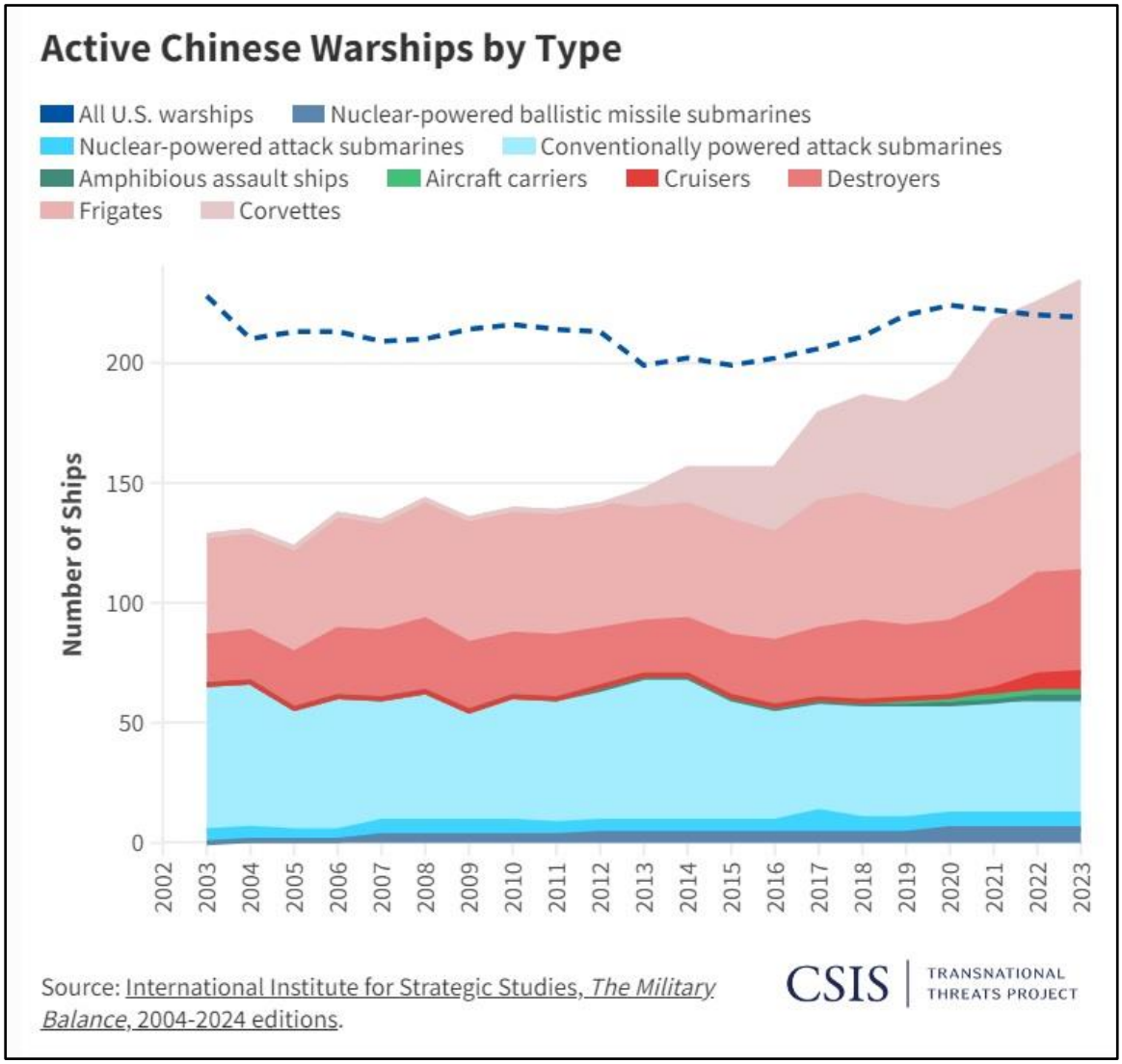
Graph Showing PLAN and U.S. Navy Principal Combat Ships Excluding Patrol Craft

Figure 3, which was prepared by Center for Strategic and International Studies (CSIS) using data from the International Institute for Strategic Studies (IISS), shows numbers of PLA Navy and U.S. Navy principal combatant ships, excluding missile-armed patrol craft (PCs). The dashed line at the top is the line for the U.S. Navy.

[40] Congressional Budget Office, *Perspectives on the Navy's 2023 Shipbuilding Plan, Presentation by Eric J. Labs, an analyst in CBO's National Security Division, at the Surface Navy Association's 35th National Symposium*, January 12, 2023, available at https://www.cbo.gov/publication/58864, slide 8 of 24, entitled "The Navy's Projections of Its Fleet Under the Past 11 Shipbuilding Plans, Compared With Actual Inventories."

Figure 3. PLA Navy and U.S. Navy Principal Combat Ships

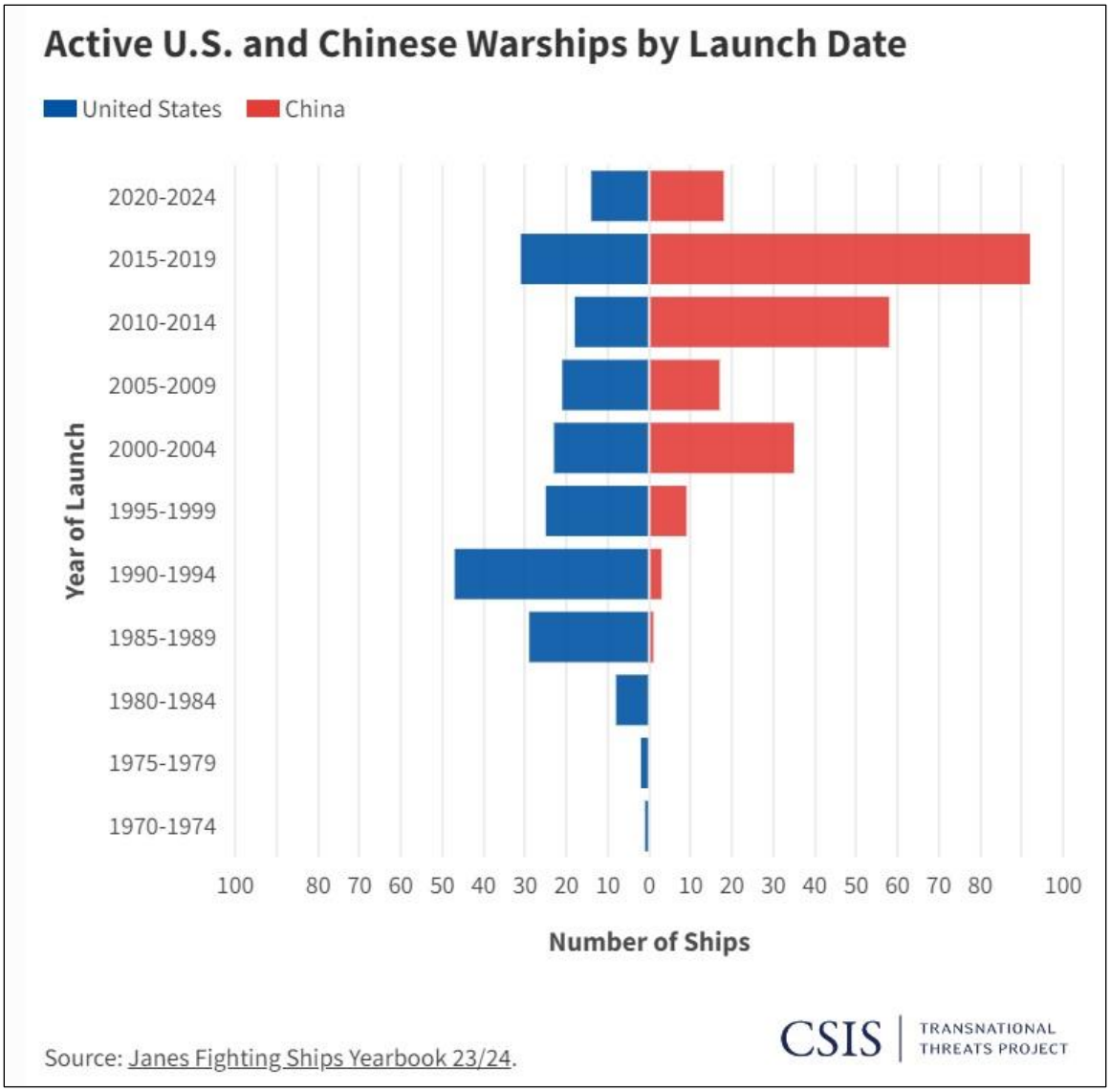
Excluding missile-armed patrol craft (PCs)



Source: Figure accompanying Alexander Palmer, Henry H. Carroll, and Nicholas Velazquez, "Unpacking China's Naval Buildup," Center for Strategic and International Studies (CSIS), June 5, 2024.

Figure 4, which was prepared by CSIS using data from IISS, shows the launch dates of PLA Navy and U.S. Navy warships. (Launched means the ship has been put into the water for the final stages of its construction.)

Figure 4. Launch Dates for PLA Navy and U.S. Navy Ships

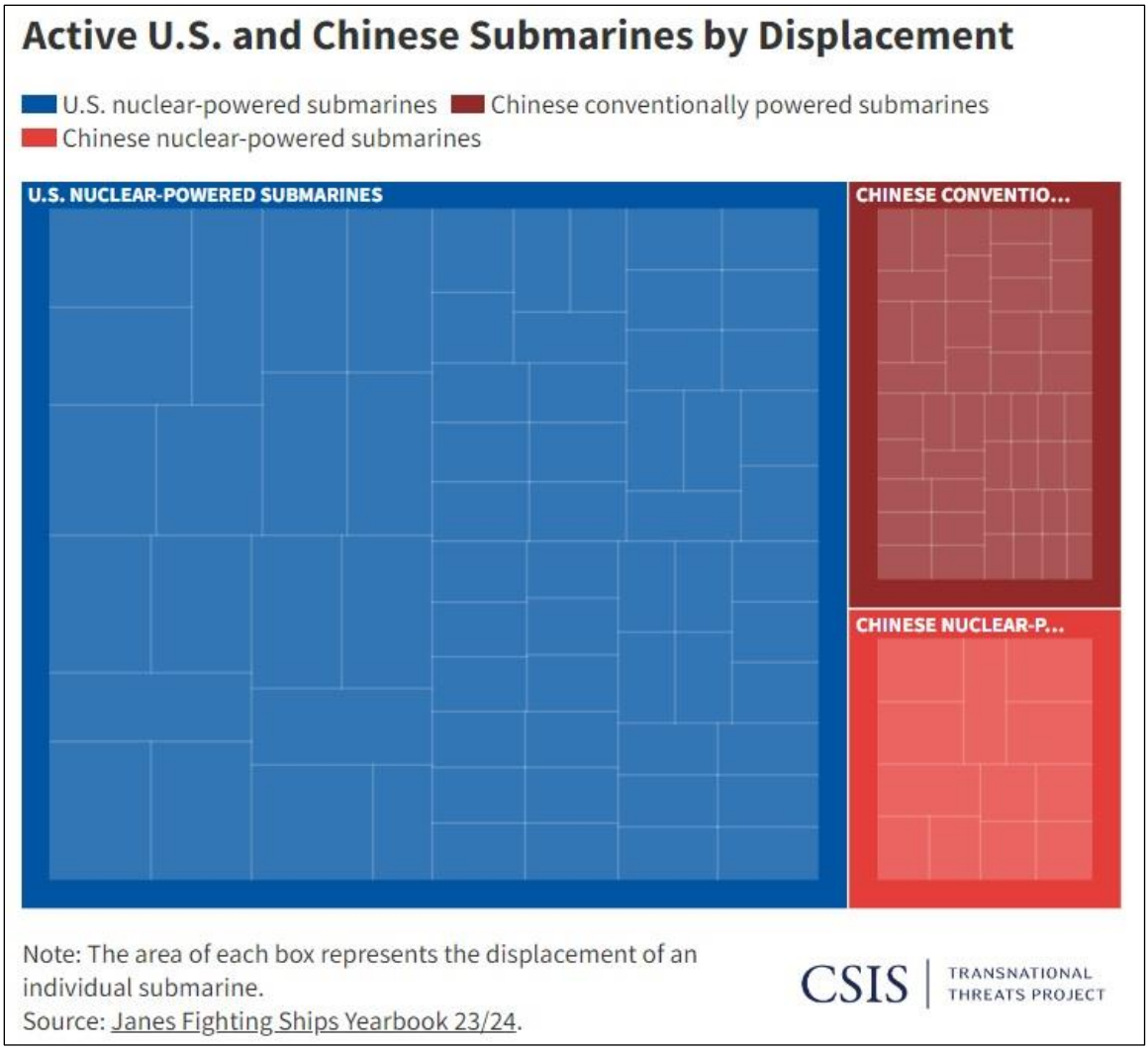


Source: Figure accompanying Alexander Palmer, Henry H. Carroll, and Nicholas Velazquez, "Unpacking China's Naval Buildup," Center for Strategic and International Studies (CSIS), June 5, 2024.

Notes: Launched means the ship has been put into the water for the final stages of its construction.

Figure 5, which was prepared by CSIS using data from IISS, shows the aggregate displacement (i.e., tonnage) of PLA Navy submarines and U.S. Navy submarines. A ship's displacement is sometimes used as a rough proxy for its capability, as a larger ship can carry more combat system equipment and more weapons. As mentioned earlier and discussed in further detail in **Appendix A**, displacement is a one-dimensional measure that leaves out other factors bearing on a ship's capability.

Figure 5. PLA Navy and U.S. Navy Submarine Displacements



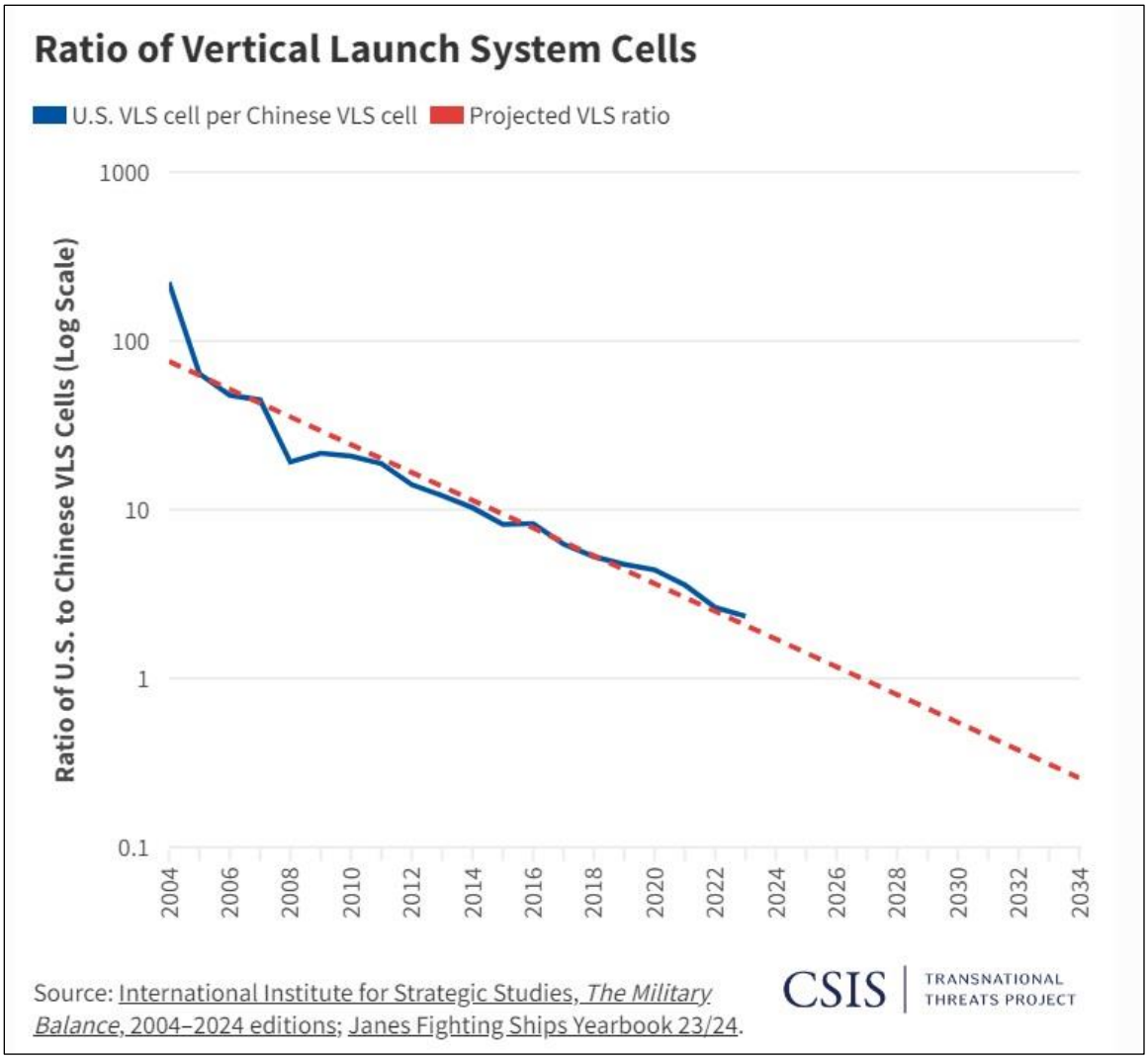
Source: Figure accompanying Alexander Palmer, Henry H. Carroll, and Nicholas Velazquez, "Unpacking China's Naval Buildup," Center for Strategic and International Studies (CSIS), June 5, 2024.

Notes: "Chinese conventio…" is Chinese conventionally powered submarines. "Chinese nuclear-p…" is Chinese nuclear-powered submarines.

Figure 6, which was prepared by CSIS using data from IISS, shows the ratio between the aggregate number of vertical launch system (VLS) cells on U.S. navy ships and the aggregate number of VLS cells on PLA Navy ships. VLS cells are cells on a ship for storing and firing missiles. A ship's number of VLS cells is one measure of the ship's weapon capacity, though not a complete one, as ships can be armed with additional missiles that are fired from deck-mounted box launchers rather than VLS cells, and ships can be armed with weapons other than missiles, including guns. Even so, aggregate numbers of VLS cells are sometimes used as a shorthand for measuring a navy's total missile capacity.[41]

[41] See, for example, U.S. Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2025*, March 2024, p. 11 (Figure 1), and Congressional Budget Office, An Analysis of the Navy's Fiscal Year 2024 Shipbuilding Plan, October 2023, p. 22 (Figure 8).

Figure 6. Aggregate Numbers of VLS Cells: Ratio of PLA Navy to U.S. Navy



Source: Figure accompanying Alexander Palmer, Henry H. Carroll, and Nicholas Velazquez, "Unpacking China's Naval Buildup," Center for Strategic and International Studies (CSIS), June 5, 2024.

Notes: VLS is vertical launch system.

Selected Elements of China's Naval Modernization Effort

Below are brief overviews of selected elements of China's naval modernization effort.

Anti-Ship Missiles

Anti-Ship Ballistic Missiles (ASBMs)

China has fielded two types of land-based ballistic missiles with a capability of hitting ships at sea at extended ranges—the DF-21D (**Figure 7**), a road-mobile anti-ship ballistic missile (ASBM) with a range of more than 1,500 kilometers (i.e., more than 810 nautical miles), and the DF-26 (**Figure 8**), a road-mobile, multi-role intermediate range ballistic missile (IRBM) with a

maximum range of 3,000 kilometers to 4,000 kilometers[42] (i.e., about 1,620 nautical miles to 2,160 nautical miles) that DOD says "is designed to rapidly swap conventional and nuclear warheads and is capable of conducting precision land-attack and anti-ship strikes in the Western Pacific, the Indian Ocean, and the SCS [South China Sea] from mainland China."[43]

Figure 7. 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 8. 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.

[42] *2023 DOD CMSD*, p. 66. A map on page 69 of the report shows the DF-26 with a range of 4,000 kilometers.

[43] *2023 DOD CMSD*, p. 67. The report similarly states on page 89: "The DF-26 intermediate range ballistic missile is a capable of ranging Guam and is capable of conducting nuclear, precision conventional, and maritime attacks."

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.[44] 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.

China reportedly is developing hypersonic glide vehicles that, if incorporated into PLA ASBMs, could make PLA 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.[45]

An August 9, 2024, press report states:

> Through a series of images and videos that went viral via Open Source Intelligence (OSINT) sources, the latest test launches of the new YJ-21 hypersonic anti-ship missile from a Type 055 destroyer of the People's Liberation Army Navy (PLAN) have come to light….
>
> The YJ-21 is one of the most advanced hypersonic anti-ship missiles in service at the People's Liberation Army Navy, with an operational range of approximately 1,500 kilometers [about 810 nm] and cruising speeds of Mach 6, reaching terminal speeds of Mach 10.
>
> Although many details about the missile remain classified, various sources speculate that the missile is an adapted version for launch from surface ships, based on the CM-401 missile, but with substantial improvements in speed and range. Furthermore, as various

[44] See, for example, Chris Panella, "China Has a Lot More Missiles — with US Warships and Bases in Its Sights," *Business Insider*, May 4, 2024.

[45] 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.

reports suggest, there are versions designed to be launched from H-6N bombers in service with the People's Liberation Army Air Force.[46]

Anti-Ship Cruise Missiles (ASCMs)

China's extensive inventory of anti-ship cruise missiles (ASCMs) (see **Figure 9**, **Figure 10**, and **Figure 11** for examples of reported images) includes both Russian- and PRC-made designs, including some advanced and highly capable ones, such as the PRC-made YJ-18.[47]

Figure 9. 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, observers are nevertheless concerned about them. As discussed later in this report, the relatively long ranges of certain PLA 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.

[46] "A Type 055 Destroyer of the Chinese Navy Successfully Conducted the Launch of the New YJ-21 Hypersonic Anti-Ship Missile," *Zona Militar*, August 9, 2024. See also Mark Nicol, "China Has Made 'Dramatic Advances' in Its Hypersonic Missiles that Can Reach up to 6,500mph and Are Almost Impossible to Stop, Intelligence Officials Warn," *Daily Mail (UK)*, February 7, 2024.

[47] *2023 DOD CMSD*, pp. 56-57. 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.

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 purpose of surreptitiously deploying YJ-18s on merchant ships (**Figure 12**),[48] a capability that, if implemented, could violate the law of naval warfare.[49]

Figure 10. 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."

[48] 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.

[49] 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 11. 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 12. 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 PRC and Russian designs.[50] Qualitatively, China's newest submarines might not be as capable as Russia's newest submarines,[51] but compared to China's earlier submarines, which were built to antiquated designs, its newer submarines are much more capable.[52] An August 2023 Naval War College Report on China's submarines states

> After nearly 50 years since the first Type 091 SSN was commissioned, China is finally on the verge of producing world-class nuclear-powered submarines. This report argues that the propulsion, quieting, sensors, and weapons capabilities of the Type 095 SSGN could approach Russia's Improved Akula I class SSN. The Type 095 will likely be equipped with a pump jet propulsor, a freefloating horizontal raft, a hybrid propulsion system, and 12-18 vertical launch system tubes able to accommodate anti-ship and land-attack cruise missiles. China's newest SSBN, the Type 096, will likewise see significant improvements over its predecessor, with the potential to compare favorably to Russia's Dolgorukiy class SSBN in the areas of propulsion, sensors, and weapons, but more like the Improved Akula I in terms of quieting. If this analysis is correct, the introduction of the Type 095 and Type 096 would have profound implications for U.S. undersea security.[53]

A September 2023 Naval War College report on China's submarine industrial base states

> In recent years, China's naval industries have made tremendous progress supporting the modernization of the People's Liberation Army Navy (PLAN) submarine force, both through robust commitment to research and development (R&D) and the upgrading of production infrastructure at the country's three submarine shipyards…. Nevertheless, China's submarine industrial base continues to suffer from surprising weaknesses in propulsion (from marine diesels to fuel cells) and submarine quieting. Closer ties with Russia could provide opportunities for China to overcome these enduring technological limitations by exploiting political and economic levers to gain access to Russia's remaining undersea technology secrets.[54]

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[50] 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 Gabriel Honrada, "China-Russia in a Nuclear Sub Counter to AUKUS," *Asia Times*, October 23, 2023; Joseph Trevithick, "Top Russian Submarine Design Bureau Hit By Cyber Attack With Chinese Characteristics," *The Drive*, May 10, 2021.

[51] 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.

[52] 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 undersea warfare capabilities that was held by the China Maritime Studies Institute on April 11-13, 2023. See also Alastair Gale, "The Era of Total U.S. Submarine Dominance Over China Is Ending, New Chinese Submarines and Sensors to Catch U.S. Subs Will Alter the Balance of Power," *Wall Street Journal*, November 20, 2023.

[53] Christopher P. Carlson and Howard Wang, *A Brief Technical History of PLAN Nuclear Submarines Nuclear Submarines*, China Maritime Studies Institute (CMSI), U.S. Naval War College, August 2023, p. 1.

[54] Sarah Kirchberger, *China's Submarine Industrial Base: State-Led Innovation with Chinese Characteristics State-Led* (continued...)

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 for some time 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 currently operates six nuclear-powered ballistic missile submarines (SSBN), six nuclear-powered attack submarines (SSN), and 48 diesel-powered/air-independent powered attack submarines (SS). The PLAN's submarine force is expected to grow to 65 units by 2025 and 80 units by 2035 despite the ongoing retirement of older hulls due to an expansion of submarine construction capacity."[55]

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.[56] 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 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."[57]

China's newest series-built SS design is the Yuan-class (Type 039) SS (**Figure 13**), its newest SSN class is the Shang-class (Type 093) SSN (**Figure 14**), and its newest SSBN class is the Jin (Type 094) class SSBN (**Figure 15**).

DOD states

> 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 units (Type 039) and 21 YUAN-class diesel-electric air-independent propulsion attack submarine (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 (both non-ASCM capable) purchased from Russia in the 1990s.[58]

Innovation with Chinese Characteristics, China Maritime Studies Institute (CMSI), U.S. Naval War College, September 2023, p. 1.

[55] *2023 DOD CMSD*, p. 55.

[56] 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.

[57] 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.

[58] *2023 DOD CMSD*, p. 55.

Figure 13. *Yuan* (Type 039) Attack Submarine (SS)

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

Figure 14. *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 15. *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 12 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) (3,900NM) or the CSS-N-20 (JL-3) SLBM (5,400NM), the PLAN's six operational JIN-class SSBNs represent the PRC's first credible sea-based nuclear deterrent. Each JIN-class SSBN can carry up to 12 missiles. In 2019, Beijing displayed these missiles at the PRC's 70th founding anniversary parade. The PRC's next-generation TYPE 096 SSBN will reportedly be armed with follow-on longer range SLBM. The TYPE 096 will likely begin construction in the near future. Based on the projected 30-plus-year service life of the platforms, the PRC will operate its JIN and TYPE 096 SSBN fleets concurrently in the 2030s. This would align with Xi's 2018 directive for the SSBN force to achieve "stronger growth."
>
> The PRC launched two SHANG III (TYPE 093B)-class guided-missile nuclear attack submarines (SSGN) between May 2022 and January 2023 and could have three hulls of this class operational hulls by 2025. 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). The PLAN is also improving its anti-submarine warfare capabilities through the development of its surface combatants and special mission aircraft, but it continues to lack a robust deep-water anti-submarine warfare (ASW) capability.[59]

A June 21, 2024, press report states:

[59] *2023 DOD CMSD*, pp. 55-56. See also Ryan Chan, "Satellite Photos Show China Building New Submarine," *Newsweek*, July 29, 2024; Thomas Newdick, "China's Latest Submarine Features X-Shaped Stern," *The War Zone*, July 29, 2024.

> China's increased focus on nuclear-powered submarines is aimed at boosting long-distance naval combat and deterrence power amid growing risks of high-seas confrontation with the US, according to military analysts.
>
> The People's Liberation Army has for the first time publicly acknowledged a strategic shift away from conventional submarines, as Beijing pushes to build a modernised military by 2027.
>
> "The current development of China's submarine fleet is dual-capable, both nuclear-powered and conventional, with a focus on nuclear capabilities," Wen Xuexing, a member of a PLA Navy submarine unit, told state broadcaster CCTV.[60]

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 ships to decoy. DOD states that each Jin-class SSBN is equipped to carry up to 12 JL-2 or JL-3 nuclear-armed submarine-launched ballistic missiles (SLBMs).[61] 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.[62]

Aircraft Carriers

Overview

China's first aircraft carrier, *Liaoning* (Type 001), entered service in 2012. China's second aircraft carrier (and its first fully indigenously built carrier), *Shandong* (Type 002), entered service in 2019. China's third carrier, *Fujian* (Type 003), reportedly conducted sea trials in early May 2024. China's fourth carrier reportedly has begun construction.

Liaoning and *Shandong* are conventionally powered and launch fixed-wing aircraft using a "ski ramp" at the ship's bow. Compared with *Liaoning* and *Shandong*, U.S. Navy aircraft carriers are

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[60] Zhao Ziwen and Coy Li, "Chinese Military Focusing on Nuclear-Powered Subs with Eye on US Navy: Analysts," *South China Morning Post*, June 21, 2024.

[61] *2023 DOD CMSD*, pp. 55, 108. DOD estimates the range of the JL-2 at 3,900 nautical miles (*2023 DOD CMSD*, p. 55). 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

> With a range of approximately 3,900NM, a JIN equipped with the JL-2 would have to operate in the mid-Pacific Ocean in order to threaten targets in the western half of the Continental United States (as well as Hawaii and Alaska) or east of Hawaii in order to threaten targets on the East Coast of the United States. PRC sources claim the JL-3 has a range of over 5,400NM which would allow a JIN armed with this missile to target portions of CONUS [continental United States] from Chinese littoral waters.
>
> (*2023 DOD CMSD*, p. 59. See also pp. viii, 104, 108.)

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.

[62] 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 [PLA] 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.

larger, nuclear powered (giving them greater cruising endurance than a conventionally powered ship), able to embark and operate a larger number of aircraft, 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. *Fujian* is conventionally powered, closer in size and flight deck configuration to U.S. Navy aircraft carriers,[63] and equipped with catapults rather than a ski ramp for launching aircraft.

Observers have speculated that China may eventually field a force of four to six (or possibly more than six) aircraft carriers. Observers expect that it will be some time before China masters carrier-based aircraft operations on a substantial scale.[64]

Although aircraft carriers might have some value for China in Taiwan-related conflict scenarios, they are not considered critical for PLA operations in such scenarios, because Taiwan is within range of land-based PLA 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. PLA 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.[65] In a combat situation involving opposing U.S. naval and air forces, PLA aircraft carriers would be highly vulnerable to attack by U.S. ships and aircraft, but conducting such attacks could divert U.S. ships and aircraft from performing other missions. PLA 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).

Liaoning (Type 001)

Liaoning (**Figure 16**) is a refurbished ex-Ukrainian aircraft carrier that China purchased from Ukraine in 1998 as an unfinished ship.[66] It has an estimated full load displacement of about 60,000 tons, and reportedly can accommodate an air wing of 30 or more fixed-wing airplanes and helicopters, including 24 fighters. Some observers have referred to the *Liaoning* as China's "starter" carrier. China has used *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),[67] although that term might not mean the same as it does when used by DOD in connection with U.S. weapon systems.

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[63] For a graphic providing an overhead comparison of the Type 003 design to the U.S. Navy's Gerald R. Ford (CVN-78) class aircraft carrier design, see Kathrin Hille, "China's Newest Aircraft Carrier Prepares to Take to the Seas," *Financial Times*, September 12, 2023.

[64] For additional discussion, see Bradley Perrett, "Chinese Carrier Aircraft Fleet Is Poised For Rapid Growth," *Aviation Week*, June 20, 2023; 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.

[65] 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. See also Ben Ho Wan Beng, "(Re)assessing the Near-Term Chinese Carrier Threat in a Taiwan Scenario," *Breaking Defense*, July 21, 2023.

[66] 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.

[67] 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; (continued...)

Shandong (Type 002)

Shandong (**Figure 17**) 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 wing of 40 aircraft that includes 36 fighters.[68] Its displacement is estimated at about 66,000 tons.

Fujian (Type 003)

Fujian (and **Figure 18**, **Figure 19**, and **Figure 20**) was launched (i.e., put into the water for the final stages of its construction) on June 17, 2022,[69] and reportedly conducted sea trials in early May 2024.[70] ONI expects the ship to enter service by 2024,[71] though some observers believe it could be years before the ship begins making regular deployments.[72] The ship has an estimated full load displacement of about 80,000 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.[73]

China's Fourth Carrier

A March 7, 2024, press report states that construction of China's fourth aircraft carrier reportedly has begun.[74] The ship's design, including its estimated displacement and whether it will be nuclear-powered or conventionally powered, had not been announced as of March 2024.[75]

Global Times, "Chinese Aircraft Carrier Forming All-Weather Combat Capability with Successful Night Takeoff and Landing," *People's Daily Online*, May 29, 2018.

[68] 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.

[69] 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.

[70] See, for example, Zhao Lei, "Chinese Aircraft Carrier Fujian Completes Maiden Sea Trials," *China Daily*, May 8, 2024; Jesse Johnson, "China's Newest Aircraft Carrier Begins First Sea Trials," *Japan Times*, May 1, 2024; Brad Lendon, "China's Newest Aircraft Carrier Heads to Sea for First Time," *CNN*, May 1, 2024; Dzirhan Mahadzir, "Chinese Aircraft Carrier Fujian Leaves for First Set of Sea Trials," *USNI News*, May 1, 2024; Jun Mai, Yuanyue Dang, and Hayley Wong, "China's Third Aircraft Carrier Fujian Tests Power, Navigation in Maiden Sea Trial," *South China Morning Post*, May 1, 2024; Yuichi Shiga and Tamayo Muto, "China Flexes Muscle at Sea as New Aircraft Carrier Starts Trials," *Nikkei Asia*, May 1, 2024; Albee Zhang, Ryan Woo and Kevin Krolicki, "China Launches Sea Trials for Next-Generation Aircraft Carrier," *Reuters*, May 1, 2024.

[71] 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.

[72] See, for example, Alex Wilson, "China's Newest Carrier Likely Several Years Away from Regular Deployments, Experts Say," *Stars and Stripes*, May 2, 2024.

[73] China Power Team. "How Advanced Is China's Third Aircraft Carrier?" Center for Strategic and International Studies (CSIS), May 17, 2023 (updated May 3, 2024); Naval News, "3rd China Navy's Aircraft Carrier Fujian Holds Propulsion Tests," *Navy Recognition*, May 4, 2023.

[74] Fabrice Wolf, "The Construction of the 4th Chinese Aircraft Carrier Has Reportedly Started," *Meta-Defense.FR*, March 7, 2024.

[75] See, for example, Liu Xuanzun, "China to Unveil Fourth Aircraft Carrier Soon: PLA Navy Political Commissar," *Global Times*, march 6, 2024.

Figure 16. *Liaoning* (Type 001) Aircraft Carrier

Source: Cropped version of photograph accompanying Chris Osieck, "Analysis of Chinese Aircraft Carriers Their History, Modifications, Spotted Places, and What the Future Has in Store for Us," *Medium*, June 14, 2022.

Reported New Dedicated Drone Carrier

China reportedly is building a new dedicated drone carrier (i.e., a carrier whose embarked air wing would consist entirely of unmanned aerial vehicles [UAVs]) (**Figure 21**).[76]

Type 076 Amphibious Assault Ship

See also the discussion of the Type 076 amphibious assault ship that might be equipped with an electromagnetic aircraft catapult, 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.[77]

[76] H. I. Sutton, "China Builds World's First Dedicated Drone Carrier," *Naval News*, May 15, 2024.

[77] David Axe, "Surprise! The Chinese Navy Just Transformed This Cargo Ship Into An Instant Helicopter Carrier," (continued...)

Figure 17. *Shandong* (Type 002) Aircraft Carrier

Source: Cropped version of photograph accompanying "China's Shandong Aircraft Carrier Strike Group Operated under Strict Surveillance by Japanese Naval Air Assets," Zona Militar, July 17, 2024.

Figure 18. *Fujian* (Type 003) Aircraft Carrier

Source: Cropped version of photograph accompanying Orange Wang, "China Says Its Fujian Carrier Is World's Largest Conventionally Powered Warship," *South China Morning Post*, June 23, 2024. The caption to the photograph credits the photograph to Xinhua.

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.

Figure 19. *Fujian* (Type 003) Aircraft Carrier

Source: Cropped version of photograph accompanying Zhao Lei, "Chinese Aircraft Carrier Fujian Completes Maiden Sea Trials," *China Daily*, May 8, 2024. The caption to the photograph credits the photograph to Xinhua.

Figure 20. *Fujian* (Type 003) Aircraft Carrier

Source: Photograph accompanying Zhao Lei, "Chinese Aircraft Carrier Fujian Completes Maiden Sea Trials," *China Daily*, May 8, 2024. The caption to the photograph credits the photograph to Xinhua.

Figure 21. Reported New Dedicated Drone Carrier

Source: Cropped version of photograph accompanying H. I. Sutton, "China Builds World's First Dedicated Drone Carrier," Naval News, May 15, 2024. The uncropped version carries a mark showing that it is from Airbus DS. The line extending away from the left end of the ship is an annotation that was added to the uncropped version to indicate that this is the dedicated drone carrier.

Carrier-Based Aircraft[78]

China's primary carrier-based fighter aircraft is the J-15 or Flying Shark (**Figure 22** and **Figure 23**), 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.[79] December 2021 press reports stated that China had developed an upgraded, catapult-capable version of the J-15 that could have improved range/payload when operated from a catapult-equipped carrier.[80]

China may be developing a carrier-capable variant of its FC-31/J-31 fifth-generation stealth fighter to complement or succeed the J-15 on catapult-equipped PLA carriers.[81] China reportedly

[78] 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.

[79] 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.

[80] 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.

[81] See *2023 DOD CMSD*, p. 62; Yukio Tajima, "China Develops New Stealth Aircraft Likely to Be Deployed on Carriers," *Nikkei Asia*, July 8, 2024; Amber Wang, "China's Latest Stealth Fighter Jet 'J-31B' Ready for Military Service, CCTV Video Post Suggests," *South China Morning Post*, July 6, 2024; 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," *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'?" (continued...)

is also developing a carrier-based airborne early warning (NAEW) aircraft, called the KJ-600, that is similar to the U.S. Navy's carrier-based E-2 Hawkeye AEW aircraft,[82] and stealth drone aircraft.[83]

Figure 22. 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.

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.

[82] *2023 DOD CMSD*, p. 58. 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.

[83] 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 23. 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 China's Defense Ministry.

Surface Combatants

Overview

China since the early 1990s has put into service numerous new classes of indigenously built surface combatants, including a new cruiser (also referred to as a 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. As of late 2022, the PLAN was building an aircraft carrier, a new batch of guided-missile cruisers, guided-missile destroyers, and a new batch of guided missile frigates, including a new 054 variant designated JIANGKAI III. 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."[84] 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

[84] *2023 DOD CMSD*, p. 56.

cases exceeding, that of other modern navies."[85] China is also upgrading its older surface combatants with new weapons and other equipment.[86]

Type 055 Cruiser/Large Destroyer

China is building a new class of cruiser (also referred to as a large destroyer), called the Renhai-class or Type 055 (**Figure 24** and **Figure 25**) that reportedly displaces between 12,000 and 13,000 tons.[87] A March 7, 2021, press report by a PRC media outlet states that the ship displaces more than 12,000 tons.[88] 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. ONI states that Type 055 ships are being built by two shipyards.[89] The first Type 055 ship was reportedly commissioned into service in January 2020,[90] and the 10th was reportedly launched (i.e., put into the water for the final stages of its construction) in May 2024.[91]

Figure 24. *Renhai* (Type 055) Cruiser (or Large Destroyer)

Source: Cropped version of photograph accompanying "Type-055 Destroyer Sails at Sea," *People's Daily Online*, December 18, 2023. The photograph is credited to eng.chinamil.com.cn/Photo by Wang Zezhou.

[85] *2019 DIA CMP*, p. 70.

[86] 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.

[87] 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.

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

[89] 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.

[90] 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 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.

[91] Alex Luck, "China Launches 10th Type 055 Vessel, Increases Production At Dagushan," *Naval News*, May 28, 2024.

Figure 25. *Renhai* (Type 055) Cruiser (or Large Destroyer)

Source: Photograph accompanying Seong Hyeon Choi, "China Could Match US in Military Conflict Thanks to Shipbuilding Strength, Analysts Say," *South China Morning Post*, June 17, 2024. A caption to the photograph credits the photograph to Weibo.

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 26**), 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 had begun to put into service an upgraded version of the Type 052D, informally called the Type 052DL, that incorporates an extended-length helicopter flight deck and a new radar.[92]

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 stages of their construction), and that three additional Type 052D ships were under construction at the same shipyard.[93]

[92] "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.

[93] 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 (continued...)

Figure 26. *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 27**), which displaces about 4,000 tons. ONI stated in February 2020 that 30 Type 054As entered service between 2008 and 2019.[94] Construction of Type 054 frigates reportedly has shifted to improved versions called the Type 054AG and 054B.[95]

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)."

[94] 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.

[95] Alex Luck, "China Launches Improved Type 054AG Frigate, More Hulls Coming," Naval News, August 14, 2024; Liu Zhen, "China's Navy Starts Open Water Trials for New Type 054B Frigate," *South China Morning Post*, January 19, 2024; Minnie Chan, "China Has Launched Bigger, Faster Version of 054A Guided Missile Frigate, Online Photos Suggest," *South China Morning Post*, August 28, 2023; 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.

Figure 27. *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 has also built a new class of corvettes (i.e., a light frigates, or FFLs) called Jiangdao class or Type 056 ships (**Figure 28**) that reportedly displace 1,300 tons to 1,500 tons.[96] 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 in February 2021, completing the production run. The PLAN subsequently transferred the early flight TYPE 056 variants, likely 22 ships total, to the China Coast Guard in 2021, probably due to the early models' lack of towed-array sonar. The remaining JIANGDAOs (056A) are equipped with a towed-array sonar and are, thus, capable of contributing to ASW operations."[97] 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.

[96] 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.

[97] *2023 DOD CMSD*, p. 56.

Figure 28. *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.

Reported New Corvette Design

China reportedly has built at least one example of a new corvette (i.e., light frigate or FFL) design that observers estimate to be somewhat larger than the Type 056 design. It is not clear whether this ship is a test platform or the lead ship of a new class of corvettes.[98]

Figure 29. Reported New Corvette Design

Source: Cropped version of photograph accompanying Joseph Trevithick and Oliver Parken, "China's Mysterious Stealthy Warship Has Headed Out To Sea (Updated)," *The War Zone*, May 14, 2024.

[98] Joseph Trevithick and Oliver Parken, "China's Mysterious Stealthy Warship Has Headed Out To Sea (Updated)," *The War Zone*, May 14, 2024.

Amphibious Ships

Type 071 Amphibious Ship

China's new *Yuzhao* or Type 071 amphibious ships (**Figure 30**) have an estimated displacement of more than 19,855 tons,[99] 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."[100]

Figure 30. *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,[101] called the *Yushen* or Type 075 (**Figure 31** and **Figure 32**), that has an estimated displacement of about 36,000 tons, compared to 41,000 to 45,000 tons for U.S. Navy LHA/LHD-type amphibious assault ships.[102] In March 2022, it was reported that the first Type 075 ship had

[99] 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.

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

[101] 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.

[102] See, for example, Matthew P. Funaiole, Brian Hart, Aidan Powers-Riggs, and Joseph S. Bermudez Jr., "China's Massive Next-Generation Amphibious Assault Ship Takes Shape," Center for Strategic and International Studies (CSIS), August 1, 2024; 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.

achieved initial operational capability (IOC),[103] 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.[104] The third was reportedly commissioned on or perhaps a few days prior to October 1, 2022.[105] The fourth was reportedly launched (i.e., put into the water for the final stages of its construction) in December 2023.[106]

Figure 31. *Yushen* (Type 075) Amphibious Assault Ship

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

[103] 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.

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

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

[106] Xavier Vavasseur, "China Launches 4th Type 075 LHD For The PLAN," *Naval News*, December 14, 2023. See also "Construction of China Navy Fourth Type 075 LHD Progressing Well," *Navy Recognition*, November 10, 2023.

Figure 32. *Yushen* (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.

Type 076 Amphibious Assault Ship

China reportedly is building a new type of amphibious assault ship called the *Yulan* or Type 076 that has an estimated displacement of 50,000 tons and might be equipped with an electromagnetic aircraft catapult (**Figure 33**). An August 1, 2024, blog entry states:

> New satellite imagery of China's sprawling Changxing Island Shipbuilding Base shows rapid progress on the construction of the first Yulan-class landing helicopter assault (LHA) ship. Dubbed the Type 076, the vessel represents a substantial step forward in the ability of the People's Liberation Army (PLA) to project power farther from China's shores.
>
> Once completed, the Type 076 will be the world's largest amphibious assault ship. Satellite imagery from July 4, 2024, shows that its flight deck spans approximately 260 meters by 52 meters, which is over 13,500 square meters (m2)—nearly the area of three U.S. football

fields. That is considerably larger than the U.S. America-class LHA and Japanese Izumo-class helicopter carriers (CVHM/DDH). The Type 076 will also be much larger than its Chinese predecessor, the Type 075….

… The vessel will feature significant technological upgrades that place it in a class above its peers. Most notably, it will boast a catapult for launching fixed-wing aircraft, making it unique among all other amphibious assault ships. Historically, only "flat top" aircraft carriers have been outfitted with catapults, while amphibious assault ships have only been able to launch helicopters and vertical/short takeoff and landing (V/STOL) aircraft such as the F-35B. China has not yet fielded manned aircraft with V/STOL capabilities.

The Type 076's catapult will likely be similar to the electromagnetic aircraft launch system (EMALS) pioneered by the U.S. Ford-class aircraft carriers….

The exact timeline of the Type 076's construction is unknown, but even for China's prolific shipyards, the pace of the ship's progress has been extraordinary. Extrapolating from the construction timeline of China's Fujian carrier and its Type 075s, the Type 076 could be launched into the water in the first half of 2025. It will then take another several months or even years before the ship is commissioned into China's navy.[107]

Figure 33. *Yulan* (Type 076) Amphibious Assault Ship

Source: Photograph accompanying Matthew P. Funaiole, Brian Hart, Aidan Powers-Riggs, and Joseph S. Bermudez Jr., "China's Massive Next-Generation Amphibious Assault Ship Takes Shape," Center for Strategic and International Studies (CSIS), August 1, 2024.

Amphibious Ship Roles and Missions

Although larger amphibious ships such as the Type 071, Type 075, and Type 076 would be of value for conducting amphibious landings in Taiwan-related conflict scenarios, some observers

[107] Matthew P. Funaiole, Brian Hart, Aidan Powers-Riggs, and Joseph S. Bermudez Jr., "China's Massive Next-Generation Amphibious Assault Ship Takes Shape," Center for Strategic and International Studies (CSIS), August 1, 2024. See also Maritime Executive, "China is Building the World's Largest Amphib and Adding a Catapult," *Maritime Executive*, August 1, 2024; Chen Chuanren, "China Equipping Amphibious Assault Ship With UCAS Launch System," *Aviation Week*, June 10, 2024.

believe that China is building such ships in part 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.[108]

Potential Use of Commercial Ships

Whether and when China will become capable of conducting a large-scale amphibious invasion of Taiwan is an ongoing matter of debate and discussion.[109] In assessing China's capacity for conducting a large-scale 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 PLA exercises indicate that China is exploring and testing this concept.[110]

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

[109] See, for example, Jeff Seldin, "Doubts Cast China Will Be Ready to Invade Taiwan by 2027," *VOA*, April 17, 2024; Jesse Johnson, "China on Track to Be Ready to Invade Taiwan by 2027, U.S. Commander Says," *Japan Times*, March 21, 2027; Laura Zhou, "PLA May Not Be Ready for Major Amphibious Attack on Taiwan Before 2030: Ex-US Navy Intelligence Officer," South China Morning Post, February 11, 2024.

[110] See, for example, Gregor Stuart Hunter, "China Preparing Armada of Ferries to Invade Taiwan," *Telegraph (UK)*, May 26, 2024; Conor M. Kennedy, *Deck Cargo Ships: Another Option for a Cross-Strait Invasion*, China Maritime Studies Institute (CMSI), U.S. Naval War College, CMSI Note No. 4, February 8, 2024, 6 pp.; J. Michael Dahm, *Beyond Chinese Ferry Tales, The Rise of Deck Cargo Ships in China's Military Activities, 2023*, China Maritime Studies Institute (CMSI), U.S. Naval War College, China Maritime Report No. 35, February 2024, 68 pp.; Matthew P. Funaiole, Brian Hart, Jaehyun Han, and Jennifer Jun, "China Accelerates Construction of 'Ro-Ro' Vessels, with Potential Military Implications," China Power (Center for Strategic and International Studies [CSIS]), October 11, 2023; Jack Lau, "China's Navy Includes Civilian Ferry in Military Transport Drill," *South China Morning Post*, July 26, 2023; 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*
(continued...)

Operations Away from Home Waters

Ship Operations

Although China's navy operates primarily in China's home waters, PLA 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.[111]

DOD states that "the PLAN's ability to perform missions beyond the FIC [first island chain] is modest but growing as it gains more experience operating in distant waters and acquires larger and more advanced platforms. The PRC's experience in extended range operations primarily comes from extended task group deployments and its ongoing counterpiracy mission in the Gulf of Aden."[112] China has been conducting antipiracy operations in the Gulf of Aden since December 2008 via a succession of more than 45 rotationally deployed naval escort task forces.[113] China's long-distance naval deployments have also been for making diplomatic port calls and conducting training exercises.

Current or Potential Bases Outside China

China's distant naval operations are supported in part by **China's military base in Djibouti**, which is located where the Gulf of Aden meets the Red Sea. China officially opened the base in August 2017 as its first overseas military base.[114]

Some observers expect that China in coming years will seek to establish a global network of locations in various parts of the world for refueling and resupplying PLA Navy ships conducting distant naval operations.[115]

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 Brief*, July 16, 2021.

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

[112] *2023 DOD CMSD*, p. 54. See also p. 91.

[113] See Dennis J. Blasko, *Recent Changes in the PLA Navy's Gulf of Aden Deployment Pattern*, China Maritime Studies Institute (CMSI), Naval War College, CMSI Note No. 8, August 13, 2024, 8 pp. See also, for example, "45th, 46th Chinese naval escort taskforces rotate in Gulf of Aden," *China Military Online*, March 6, 2024; Aadil Brar, "China Sends Warships to the Middle East," *Newsweek*, February 22, 2024.

[114] For discussions of Djibouti and other potential PLA military bases outside China, see *2023 DOD CMSD*, pp. xi, 154-156; 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.

[115] See, for example, Maxwell Simon and Jayaram Ravi, *Navigating China's Opportunistic Approach to Overseas Naval Base Acquisition*, Belfer Center (Harvard Kennedy School), November 2023, 69 pp.; Cristina L. Garafola, (continued...)

Observers are now following developments at **Cambodia's Ream naval base**, which fronts onto the Gulf of Thailand.[116] DOD states, "In June 2022, a PRC official confirmed that the PLA would have access to parts of Cambodia's Ream Naval Base."[117] The first PLA Navy ships reportedly docked at the base in December 2023.[118]

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 PRC naval base in that

Stephen Watts, and Kristin J. Leuschner, *China's Global Basing Ambitions, Defense Implications for the United States*, RAND, report RRA1496-1, 2022, 31 pp.; Brad Lendon and Simone McCarthy, "Blue-Water Ambitions: Is China Looking Beyond Its Neighborhood Now It Has the World's Largest Navy?" *CNN*, September 2, 2023; John Grady, "Beijing Investing in Network of Global Chinese Naval Bases, Researchers Find," *USNI News*, August 16, 2023; Rathindra Kuruwita, "AidData Report Warns of a Chinese Naval Base in Sri Lanka's Hambantota Port," *Diplomat*, August 15, 2023; Guy Taylor, "Port Call: China's Navy Scouting Range of Sites for Future Overseas Bases," *Washington Times*, August 15, 2023; Philip Heijmans, "China's Top Option for Next Naval Base Is Sri Lanka, Report Says," *Bloomberg*, July 28, 2023; Alexander Wooley and Sheng Zhang, "Beijing Is Going Places—and Building Naval Bases," *Foreign Policy*, July 27, 2023; Alex Wooley, Sheng Zhang, Rory Fedorochko, and Sarina Patterson, *Harboring Global Ambitions: China's Ports Footprint and Implications for Future Overseas Naval Bases*, AidData (William & Mary), July 2023 (posted online July 25, 2023), 44 pp.

[116] RFA Staff, "Cambodian Naval Base Could Accommodate Chinese Submarines: Analyst," *Radio Free Asia (RFA)*, July 26, 2024; Agnes Chang and Hannah Beech, "The Chinese Base That Isn't There," *New York Times*, July 14, 2024; Christopher Woody, "China's Newest Military Base Abroad Is Up and Running, and There Are More on the Horizon," *Breaking Defense*, July 12, 2024; Austin Ramzy, "Cambodia Denies Hosting Chinese Naval Base, but Two Ships Raise Suspicions," *Wall Street Journal*, July 1, 2024; RFA Staff, "Record Number of Chinese Warships Operating in Cambodia," *Radio Free Asia (RFA)*, May 21, 2024; Sopheng Cheang and David Rising, "Chinese Warships Have Been Docked in Cambodia for 5 Months, But Government Says It's Not Permanent," *Associated Press*, May 8, 2024; Seong Hyeon Choi, "Chinese War Ships Have 'Exclusive' Access at Cambodia Port: US Report," *South China Morning Post*, April 19, 2024; Shaun Turton and Bopha Phorn," *Nikkei Asia*, April 18, 2024; "First Among Piers: Chinese Ships Settle in at Cambodia's Ream," Asia Maritime Transparency Initiative (AMTI), Center for Strategic and International Studies (CSIS), April 18, 2024; Yuji Nitta, "Chinese Warships Spotted Again at Cambodia Naval Base," *Nikkei Asia*, April 1, 2024; Aadil Brar, "US Worried About China-Funded Naval Base," *Newsweek*, March 8, 2024; Seong Hyeon Choi, "US Has 'Serious Concerns' about Chinese-Funded Upgrade to Cambodian Naval Base, Senior Diplomat Daniel Kritenbrink Says," *South China Morning Post*, March 7, 2024; Aadil Brar, "Satellite Photos Show China's Dramatic Progress at Foreign Naval Base," *Newsweek*, February 23, 2024.

[117] *2023 DOD CMSD*, p. 154.

[118] David Brunnstrom, "US Monitoring Reports of Chinese Warships at Cambodian Base," *Reuters*, December 6, 2023; Nectar Gan, "The First Chinese Warships Have Docked at a Newly Expanded Cambodian Naval Base. Should the US Be Worried?" *CNN*, December 6, 2023; Philip Heijmans, "US Raises Concern Over China Warships' Rare Stop in Cambodia," *Bloomberg*, December 6 (updated December 7), 2023; Jack Lau, "Chinese Warships Visit Controversial Cambodian Naval Base for Joint Exercise," *South China Morning Post*, December 6, 2023; RFA Staff, "Chinese Warships Dock at Cambodia's Ream Naval Base for 'Training,'" *Radio Free Asia (RFA)*, December 6, 2023. See also H.I. Sutton, "Chinese Navy's Suspected New Overseas Base In Cambodia Now Even Larger," *Naval News*, November 13, 2023.

For press reports in July 2022 about construction of the base nearing completion, see James Brooke, "China Completing Major Naval Base in Cambodia, Capable of Docking Its New Generation of Carriers," *New York Sun*, July 28, 2023; Ashish Dangwal, "China's 1st Naval Facility In Indo-Pacific Almost Ready; Capable Of Hosting Aircraft Carrier–Reports," *Eurasian Times*, July 26, 2023; Sun Narin and Han Noy, "Cambodian Ream Naval Base Modernized by China Nears Completion: Defense Ministry," *VOA*, July 26, 2023; Demetri Sevastopulo, "Chinese Base in Cambodia Nears Completion in Challenge to US Naval Power," *Financial Times*, July 24, 2023; Blacksky, "Blacksky Releases Imagery of Near-Complete Chinese Military Naval Station in Cambodia," press release dated July 24, 2023.

country.[119] The Prime Minister of the Solomon Islands reportedly ruled out that possibility, stating that it would "put our country and our people as targets for potential military strikes."[120]

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.[121]

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."[122]

A November 7, 2023, press report states, "President Joe Biden has been briefed on what his advisers see as a PRC plan to build a military facility in **Oman**, people familiar with the matter said, amid a broader effort by Beijing to deepen defense and diplomatic ties with the Middle East."[123]

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;[124]

[119] See, for example, Camilla Pohle-Anderson, "China's Search for a Permanent Military Presence in the Pacific Islands," U.S. 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.

[120] 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.

[121] See, for example, Nadia Helmy, "The Impact of the Potential Chinese Naval Bases on the Atlantic Ocean," *Modern Diplomacy*, February 15, 2024; Michael M. Phillips, "U.S.-China Tensions Have a New Front: A Naval Base in Africa," *Wall Street Journal*, February 10, 2024; Alex Vines, Henry Tugendhat, and Armida van Rij, "Is China Eyeing a Second Military Base in Africa?" U.S. Institute of Peace, January 30, 2024; Paul Nantulya, "Considerations for a Prospective New Chinese Naval Base in Africa," Africa Center for Strategic Studies, May 12, 2022; Cobus van Staden, "Fears of a Chinese Naval Base in West Africa Are Overblown," *Foreign Policy*, March 3, 2022; Michael M. Phillips, "U.S. Aims to Thwart China's Plan for Atlantic Base in Africa," *Wall Street Journal*, February 11, 2022; 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, "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.

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

[123] Michelle Jamrisko and Jennifer Jacobs, "Biden Briefed on Chinese Effort to Put Military Base in Oman," *Bloomberg*, November 7, 2023.

[124] 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 (continued...)

- 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 PLA 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,[125] the Navy's preferred force-level goal calls for achieving and maintaining a fleet of 381 battle force ships, compared to the Navy's 296 battle force ships as of August 12, 2024. Under the Navy's FY2025 30-year (FY2025-FY2054) shipbuilding plan, the U.S. Navy would grow to more than 300 ships in FY2032 and reach a total of more than 381 ships in FY2042.

Highly Capable Ships, Aircraft, Weapons, and Other Systems

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

- Virginia-class nuclear-powered attack submarines (SSNs);[126]
- the Navy's envisaged next-generation SSN, called the SSN(X);[127]
- Gerald R. Ford (CVN-78) class nuclear-powered aircraft carriers (CVNs);[128]
- Navy and Marine Corps versions of the F-35 Joint Strike Fighter (JSF);[129]

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 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.)

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

[126] For more on the Virginia-class program, see CRS Report RL32418, *Navy Virginia-Class Submarine Program and AUKUS Submarine Proposal: Background and Issues for Congress*, by Ronald O'Rourke.

[127] 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.

[128] 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.

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

- Arleigh Burke (DDG-51) class guided missile destroyers (DDGs);[130]
- the Navy's envisaged next-generation DDG, called the DDG(X);[131]
- Constellation (FFG-62) class frigates;[132]
- new anti-ship weapons, such as the Long-Range Anti-Ship Missile (LRASM);[133]
- 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;[134]
- shipboard high-energy lasers;[135]
- new electronic warfare systems;[136] and
- undersea surveillance systems for detecting and tracking adversary submarines.[137]

New Distributed Maritime Operations (DMO) Operating Concept

As discussed in other CRS reports,[138] the Department of the Navy (which includes the Navy and Marine Corps) is implementing a new operating concept called Distributed Maritime Operations (DMO) for using U.S. naval (i.e., Navy and Marine Corps) forces in combat operations against an adversary, particularly China, that has substantial capabilities for detecting and attacking U.S. Navy surface ships with anti-ship missiles and other weapons. Key features of DMO appear to include the following:

- Dispersing Navy units over a larger area within the theater of operations, so as to make it harder for an adversary to detect and target Navy units, while still permitting Navy units to support one another and concentrate their fires on adversary targets.
- Spreading the Navy's sensors and weapons across a wider array of ships and aircraft, so as to reduce the fraction of the Navy's sensors and weapons that

[130] 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.

[131] 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.

[132] 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.

[133] For more on the LRASM program, see CRS In Focus IF11353, *Defense Primer: U.S. Precision-Guided Munitions*, by Daniel M. Gettinger.

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

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

[136] See, for example, Thomas Newdick, "Destroyer Looks Radically Different After Electronic Warfare Upgrade," *The War Zone*, November 8, 2023; Brett Tingley and Tyler Rogoway, "Navy's New Shipboard Electronic Warfare System Is Being Shrunk Down For Smaller Ships," *The War Zone*, January 15, 2022.

[137] See, for example, Joe Brock, "U.S. Revives Cold War Submarine Spy Program to Counter China," *Reuters*, September 21, 2023; Anders Hagstrom, "US Pours Billions into Cold War Submarine Program as China Bolsters Navy," *Fox News*, September 21, 2023.

[138] See CRS In Focus IF12599, *Defense Primer: Navy Distributed Maritime Operations (DMO) Concept*, by Ronald O'Rourke, and CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

would be lost due to the destruction of any one Navy ship or aircraft (i.e., avoid "putting too many eggs into one basket").

- Making greater use of longer-ranged weapons, unmanned vessels, and unmanned aircraft in support of the previous two points.
- Using resilient communication links and networking technologies to knit the resulting widely dispersed force of manned and unmanned ships and aircraft into a coordinated battle force that can withstand and adapt to enemy attacks on Navy communications and networks.

Some examples of Navy acquisition programs that appear associated with DMO include the following:

- Programs for acquiring longer-ranged weapons, such as the Maritime Strike Tomahawk (a new anti-ship variant of the Tomahawk cruise missile) and the previously mentioned Long-Range Anti-Ship Missile (LRASM).
- The Large Unmanned Surface Vessel (LUSV), which is to be equipped with a Vertical Launch System (VLS) for storing and firing anti-ship missiles and other weapons. LUSVs are intended to act as adjunct missile magazines for manned Navy surface combatants.[139]
- The Medium Unmanned Surface Vessel (MUSV), which is to be equipped with radars or other sensors. MUSVs are intended to help form a distributed sensor network for supporting Navy operations.[140]
- The light replenishment oiler (TAOL) shipbuilding program for building a new class of smaller oilers. TAOLs are intended to enhance the Navy's ability to provide fuel and supplies to Navy ships that are operating in a more distributed manner across a wider sea area.[141]
- The Medium Landing Ship (LSM) program for building a class of smaller amphibious ships. The LSM program is central to implementing a Marine Corps operating concept associated with DMO that is called Expeditionary Advanced Base Operations (EABO).[142]

Cooperation with Naval Forces of Allies and Other Countries

In General

U.S. Navy efforts to increase cooperation with naval forces from allies such as Japan and Australia and other countries such India, including exercises and other forms of engagement, appear aimed not only at improving interoperability between U.S. and allied naval forces, but also 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

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

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

[141] For more on the TAOL program, see CRS In Focus IF11674, *Navy Light Replenishment Oiler (TAOL) Program: Background and Issues for Congress*, by Ronald O'Rourke.

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

the Indo-Pacific region to balance against China's growing military capabilities and deter potential assertive actions by China.[143]

AUKUS Security Agreement

The Australia-United Kingdom-United States (AUKUS) trilateral security partnership announced in September 2021 includes a major initiative (called Pillar 1) to homeport U.S. and UK nuclear-powered attack submarines (SSNs) in Australia and establish an eight-boat Australian SSN force, and another major initiative (called Pillar 2) for the three countries to cooperatively pursue advanced military capabilities, including undersea capabilities other than SSNs (such as unmanned underwater vehicles and undersea weapons); quantum technologies; artificial intelligence and autonomy; advanced cyber capabilities; hypersonic and counter-hypersonic capabilities; and electronic warfare.[144]

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 but are not limited to 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 and capabilities 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 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 PLA ASBMs and other A2/AD weapons; and
- whether constraints on U.S. shipbuilding capacity are hampering the U.S. Navy's ability to counter China's naval modernization effort, and could hamper the

[143] 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.

[144] For more on AUKUS Pillar 1 and Pillar 2, see CRS Report RL32418, *Navy Virginia-Class Submarine Program and AUKUS Submarine (Pillar 1) Project: Background and Issues for Congress*, by Ronald O'Rourke; CRS Report R47599, *AUKUS Pillar 2 (Advanced Capabilities): Background and Issues for Congress*, by Luke A. Nicastro; and CRS Report R47599, *AUKUS Pillar 2 (Advanced Capabilities): Background and Issues for Congress*, by Luke A. Nicastro.

> ability of the United States to compete with China for post-conflict naval superiority in the aftermath of a U.S.-China conflict in which large numbers of U.S. and PRC navy ships are destroyed and both countries work to reconstitute their fleets.

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 modernization effort since the 1990s has substantially reduced the U.S. advantage, and that if current U.S. and PLA naval capability trends (such as those for numbers of ships shown in **Table 1**, **Table 2**, **Table 3**, **Figure 1**, **Figure 2**, **Figure 3**, and **Figure 4**) 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.[145]

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),[146] stated that "China is now capable of controlling the South China Sea in all scenarios short of war with the United States."[147]

Skeptics of assessments like those above might argue that they do not give adequate weight to relative U.S. strengths (and corresponding PLA 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

[145] 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.

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

[147] 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.

> 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.
>
> 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.
>
> 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.[148]

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)[149] or between 2020 and 2030 (a timeframe sometimes referred to as the

[148] 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.

[149] 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

(continued...)

decade of concern),[150] and about the readiness the U.S. military, including the U.S. Navy, for a conflict in that timeframe.

In addition to the Davidson window and the decade of concern, some observers have offered alternative near-term time windows.[151] Still other observers, including some DOD officials, believe a PRC attack on Taiwan does not appear to be imminent or is not particularly likely to occur in the near term,[152] or have questioned the notion of identifying a particular time window.[153]

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

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 Noah Robertson, "How DC Became Obsessed with a Potential 2027 Chinese Invasion of Taiwan," *Defense News*, May 7, 2024; Hiroyuki Akita, "China Wants Ability to Invade Taiwan by 2027, U.S. Admiral Says," *Nikkei Asia*, April 24, 2024 (reporting remarks by Admiral John Aquilino); Miya Tanaka, "Ex-U.S. Indo-Pacific Commander Sticks to 2027 Window on Taiwan Attack," *Kyodo News*, January 23, 2023.

[150] 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), 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.

[151] 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.

[152] 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.

[153] See, for example, Bryan Clark, "Adm. Franchetti, Biden's Pick For CNO, Should Focus on the Short Game," *Defense News*, August 21, 2023; Demetri Sevastopulo, "US Commander Pushes Back against Colleagues 'Guessing' Taiwan Invasion Date," *Financial Times*, April 18, 2023.

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);
- 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, weapons, and unmanned systems, if they can enter service before the end of the Davidson window or the decade of concern;[154]
- 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 PLA 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.[155]

[154] 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.

[155] See also Mark F. Cancian, *Security in the Western Pacific, Building Future Capabilities in the Time of AUKUS, Center for Strategic and International Studies (CSIS)*, January 2024, 36 pp. The report states

Although strategists seek to expand the number of submarines, the U.S. submarine fleet will not (continued...)

Shipbuilding Capacity

As discussed at length in another CRS report,[156] industrial base capacity constraints for building U.S. Navy ships have become more prominent as an oversight matter for the congressional defense committees since about 2022. Industrial base capacity constraints for building U.S. Navy ships are present at both shipyards and supplier firms, and arise from limits on production facilities (i.e., numbers and ages of production spaces and equipment) and workforce challenges, including limits on available numbers of naval architects and marine engineers to design new classes of ships, and challenges in recruiting and retaining desired numbers of production workers at shipyards and supplier firms to build new ships.

Some Members of Congress and other observers, viewing China's much-larger shipbuilding capacity, are concerned that constraints on U.S. shipbuilding capacity are hampering the U.S. Navy's ability to counter China's naval modernization effort, and could hamper the ability of the United States to compete with China for post-conflict naval superiority in the aftermath of a U.S.-China conflict in which large numbers of U.S. and PRC navy ships are destroyed and both countries work to reconstitute their fleets.

Contributing to this concern is an unclassified U.S. Navy briefing slide with a graphic showing that China has about 230 times as much shipbuilding capacity as the United States when measured in terms of gross tons of ships that can be produced per unit of time.[157] This measure appears to relate primarily to capacity for building relatively less complex commercial cargo ships (China is a world leader in the production of commercial cargo ships) as opposed to capacity for building relatively more complex warships that are equipped with complex combat system equipment. China's capacity for building complex combat system equipment for warships may be far less than 200 times the U.S. capacity for building such equipment, meaning that the effective PRC-U.S. ratio for capacity for building warships with complex combat system equipment may be far less than 230:1. Even so, the ratio may be higher, and perhaps considerably higher, than 1:1. Some observers have characterized limits on U.S. shipbuilding capacity, particularly in relation to China's shipbuilding capacity, as a strategic liability or major cause for concern for the United States in competing militarily with China.[158]

> grow beyond its current size until the 2040s. Thus, the project studies wargames and the war in Ukraine to identify ways for the United States and its partners to manage this submarine gap. (Page 1)

See also *The Department of the Navy and Strategic Competition with the People's Republic of China*, Center for Naval Analyses (CNA), September 2023, 44 pp. The report's abstract states, "The Chief of Staff to the Secretary of the Navy asked the Center for Naval Analyses (CNA) for near-term recommendations for how DON [the Department of the Navy] can better position itself for such competition in peacetime—that is, below the threshold of armed conflict." (Page i)

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

[157] For images of this briefing slide, see, for example, Matthew Hipple, "China's Navy is Using Quantity to Build Quality," *Maritime Executive*, February 18, 2024; Joseph Trevithick, "Alarming Navy Intel Slide Warns Of China's 200 Times Greater Shipbuilding Capacity," *The Drive*, July 11, 2023. See also Michael Lee, "Chinese Shipbuilding Capacity Over 200 Times Greater Than US, Navy Intelligence Says," *Fox News*, September 14, 2023.

[158] See, for example, Peter Apps, "China Looks to Its Shipyards to Beat US in Any Future War," *Reuters*, August 14, 2024; Justin Katz, "State Dept's Campbell: Gap between US, China Shipbuilding Is 'Deeply Concerning,'" *Breaking Defense*, July 30, 2024; James E. Fanell, "The Changing Nature of Naval Power in the Pacific," Geopolitical Intelligence Services (GIS), July 9, 2024; Seong Hyeon Choi, "China Could Match US in Military Conflict Thanks to Shipbuilding Strength, Analysts Say, Observers Said China's Ability to Rapidly Reconstitute Its Combat Losses May Give It an Advantage, Including against 'Hellscape' Strategy," *South China Morning Post*, June 17, 2024; David Axe, "It's Just a New, Small Chinese Stealth Ship. But Its Arrival Is Terrifying," *Telegraph (UK)*, May 26, 2024; Gil (continued...)

The most prominent U.S. naval shipbuilding industrial base capacity constraints are those for building submarines. Virginia-class attack submarines have been procured at a rate of two boats per year since FY2011, but the submarine construction industrial base since about 2019 has not been able to complete two Virginia-class boats per year, resulting in a growing backlog of Virginia-class boats that have been procured but not completed. Since 2022, the completion rate has been about 1.2 to 1.4 Virginia-class boats per year. The Navy aims to increase the completion rate two 2.0 Virginia-class boats per year by 2028. Shipbuilding capacity constraints are also affecting the construction rates for surface ships such as DDG-51 class destroyers.

As discussed in the above-cited CRS report that discusses at length the issue of industrial base capacity constraints for building Navy ships, the Navy and the U.S. shipbuilding industry are taking certain steps to increase U.S. industrial capacity for building Navy ships. The above-cited CRS report also outlines options for expanding current efforts to increase U.S. industrial capacity for building Navy ships and for making better use of available shipbuilding capacity.

Other Specific Issues

Longer-Range Weapons

The Navy has initiated efforts to develop and procure longer-ranged ASCMs and other new weapons. The Navy testified in May 2024 as follows:

> **Tomahawk [cruise missile]**
>
> The Navy is continuing investment into Tomahawk Block V new production, Maritime Strike Tomahawk, and recertification/modernization of Tomahawk Block IV. Ally and partner interest in Tomahawk capability emphasized missile production throughput challenges. The FY 2025 budget request continues to fund factory improvements to increase industrial capacity, increasing throughput to 600 missiles per year by FY27. In the FY 2025 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 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 2025 budget request for MST provides continuation of Operational and Integration Testing and ultimately fields hardware, software, and munitions for the MST capability in 2025. The FY 2025 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 2025 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 capability to the Tomahawk BLK V missile in 2026.

Barndollar and Matthew C. Mai, "The U.S. Navy Can't Build Ships," *Foreign Policy*, May 17, 2024; Steve Cohen, "Almost All Navy Shipbuilding Is Hopelessly Behind Schedule," *The Hill*, May 2, 2024; Thomas Black, "US Navy Shipbuilding Has Fallen Dangerously Behind," *Bloomberg*, April 17, 2024.

Jeffrey M. Voth, "Charting a New Course: Why the US Navy Must Confront Unrealistic Optimism," *Diplomat*, April 15, 2024, which states that "Admiral Phil Davidson's warning of potential Chinese aggression toward Taiwan by 2027—now termed the "Davidson Window"—underscores the strategic vulnerabilities these [shipbuilding] delays could exacerbate…. This is no longer an issue of delayed timelines; it has become a strategic liability."

Offensive Anti-Surface Warfare (OASuW) Increment 1/ Long Range Anti-Ship Missile (LRASM), LRASM C-1/C-3, and OASuW Increment 2 / HALO

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 2025 President's Budget requests $102.5 million in procurement funding to buy 30 DON LRASM C-1 weapon systems with associated support to provide economic order quantity [EOQ] funding in support of the MYP [multiyear procurement][159] initiated in FY24, and to provide the assets for operational test of the C-1 configuration. The FY 2025 President's Budget request also includes $163.3 million in RDT&E funding for the continuing development of the LRASM C-3 capability improvement. Navy AGM-158 development efforts involve integration of a Beyond Line-of-Sight radio subsystem to enable enhanced operational flexibility.

The FY 2025 President's Budget continues developing the AGM-158 C-3 variant through software development and test, platform integration, and entry into integrated test. The FY 2025 President's Budget request also includes $223.9 million for procurement of 60 LRASM in the C-3 configuration migrating the primary production line to the more-capable C-3 configuration as the program reaches sufficient maturity.

The FY 2025 President's Budget includes $178.6 million for development of OASuW Increment 2, which is now referred as Hypersonic Air Launched OASuW (HALO). HALO supports the national imperative to mature hypersonic capabilities and transition them into warfighting systems, increasing the lethality and deterrent effect of our Carrier Wings. The program represents a longer-term capability that encompasses increased performance and will provide the Navy with the necessary air-launched, carrier-based weapon to address evolving long-range, -threats from near peer competitors. HALO will complete Milestone B and enter formal Engineering and Manufacturing Development, to include a competitive contract award during FY 2025.

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

AARGM domestic procurement completed in FY 2021 with the award of the last Navy Full Rate Production (FRP) contract. There have been 1450 AARGMs (All Up Rounds, Training Missiles, and Spares) delivered to the Fleet as of March 2024. Program of record delivery is 1803 missiles. Deliveries continue through FY 2025 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 3QFY24 [third quarter of FY2024]. The FY 2025 President's Budget requests $22.3 million in RDT&E to support operational and integration testing of production representative hardware. The budget requests $248.6 million in [the] Weapons Procurement, Navy (WPN) [appropriation account] to procure 151 AARGM-ER all-up-rounds and six Captive Air Training Missiles and advance procurement.

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 missile design and joint test opportunities to field a conventional hypersonic weapon system. Zumwalt [DDG-1000] Class DDGs will be the first Navy platform to field this hypersonic capability in the mid-2020's, followed by Block V Virginia Class SSNs. In March 2020, the Services executed

[159] For more on multiyear procurement, including economic order quantity procurement, see CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke.

a successful flight test of the Common Hypersonic Glide Body, and in 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 is continuing subscale and component testing in support of future capability development, 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 2025 budget request will support critical milestones on the path to fielding CPS to the first Zumwalt Class DDG. The request totals $903.9 million in CPS R&D funding.

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

As the primary weapon in maintaining an advantage in the undersea domain, Heavyweight and Lightweight Torpedoes remain a critical component of the Department's munitions inventory. Continued investments in torpedo capacity and capability are vital to outpace our strategic competitors. The MK 48 Heavyweight Torpedo remains the Navy's primary submarine-launched ASW [antisubmarine warfare] and ASuW [anti-surface warfare] weapon, while the MK 54 Lightweight Torpedo provides additional undersea dominance from the surface and air domains. The Navy continues to modernize and upgrade existing inventory to incorporate the latest capability advancements, the Navy has also restarted production of the MK 48, ramping up production through FY23 after accepting delivery of the first new production heavyweight torpedoes in over twenty years during the summer of 2022. Furthermore, the MK 48 MOD 8 and MK 48 MOD 9 will bring new capabilities and technologies to ensure our advantage is maintained will into in the future. The Department also continues to deliver and upgrade MK 54 Lightweight Torpedoes to surface ships and air platforms to maintain our edge over the ASW threat. Producing the upgraded MK 54 MOD 1 for the U.S. Navy as well as MK 54 MOD 0 torpedoes for our allied partners ensures the torpedo industrial base remains healthy.

The Department continues its partnership with industry and university affiliated research centers to develop next-generation torpedoes. These include the MK 54 MOD 2 Advanced Lightweight Torpedo designed to fight the high-end threat, and the Compact Rapid Attack Weapon, a Very Light Weight Torpedo with multi-mission capability providing both a hard-kill torpedo countermeasure and a short range ASW weapon. The Navy continues to procure the High Altitude ASW Weapon Capability (HAAWC) wing kit to employ MK 54 from high altitude via the P-8A, and we've made great progress in developing the Hammerhead encapsulated effector, continuously demonstrating the flexibility and effectiveness of MK 54 payloads for the US and our Allies.[160]

A February 27, 2024, press report states:

> The US Navy is seeking industry's assistance to rapidly prototype and field a new air-launched, stand-off weapon inexpensive enough to manufacture en masse and perform on par with the service's current anti-ship cruise missile.

[160] Statement of Nickolas H. Guertin, Assistant Secretary of the Navy (Research, Development and Acquisition) and Vice Admiral James Pitts, 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 FY25 Seapower Investment Hearing, May 1, 2024, pp. 33-36.

> Dubbed the "Multi-mission Affordable Capacity Effector (MACE)," the service posted a public notice earlier this month that it should have "increased range at lower costs" and "integrated a high-maturity propulsion system with proven payloads."
>
> "The objective of this notice is to help the government determine if there are existing sources with the capability and experience to rapidly prototype, integrate, test and field a long-range, network-enabled weapon system capable of launch from a F/A-18E/F and F-35A/C," according to the notice.
>
> The exact ranges of most Pentagon weaponry are classified, but the notice states MACE should be "complimentary" to the Long Range Anti-Ship Missile, the Lockheed Martin-made missile fielded on the Navy's F/A-18 and Air Force's B-1B.[161]

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."[162] An August 14, 2024, press report states:

> The U.S. Navy's deployment of new extremely long-range air-to-air missiles in the Indo-Pacific could erase China's advantage in aerial reach, experts say, part of an intensifying focus on projecting power amid high tensions in the region.
>
> The AIM-174B, developed from the readily available Raytheon (RTX.N) SM-6 air defence missile, is the longest-range such missile the United States has ever fielded and was officially acknowledged in July.
>
> It has three key advantages: it can fly several times farther than the next-best U.S. option, the AIM-120 AMRAAM; it does not require new production lines; and it is compatible with the aircraft of at least one ally, Australia.
>
> Crucially, a weapon such as the AIM-174B, which can attack aerial targets as far away as 400 km (250 miles), outranges China's PL-15 missile, allowing U.S. jets to keep threats farther from aircraft carriers, and safely strike "high-value" Chinese targets, such as command-and-control planes….
>
> The AIM-120, the standard long-range missile for U.S. aircraft, has a maximum range of about 150 km (93 miles), which requires the launching aircraft to fly deeper into contested territory, exposing aircraft carriers to greater danger of anti-ship attacks….
>
> The advent of Chinese stealth aircraft such as the J-20, and more important, the PL-15 missile it can carry internally—with a range of 250 km (155 miles) or more—eroded the U.S. edge, said Kelly Grieco, a senior fellow at the Stimson Center….
>
> The AIM-174B was developed to quickly address that need.
>
> The secretive Lockheed Martin (LMT.N) AIM-260, a separate U.S. Air Force program to develop an extremely long-range air-to-air missile small enough for stealth aircraft to carry internally, has been in development for at least seven years….
>
> Using Raytheon's (RTX.N) SM-6, originally designed for a ship-launched air defence role, means production lines are already available. Funding has already been earmarked for more than 100 SM-6 missiles a year….

[161] Justin Katz, "Navy Seeking to Rapidly Prototype New Air-Launched, Stand-Off Missile," *Breaking Defense*, February 27, 2024. See also Abby Shepherd, "Navy Asks Industry If It Can Quickly Build New Low-Cost, Standoff Air-Launched Weapon," *Inside Defense*, February 8, 2024.

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

> The Navy said the missile was "operationally deployed" but declined to comment on whether it would be supplied to allies, whether it would be integrated onto other aircraft, and how many AIM-174Bs it wanted each year.
>
> The versatility of the SM-6, which has also been used to hit ships, land targets and missiles, opens up possibilities beyond the AIM-174B, said Peter Layton, a defence and aviation expert at the Griffith Asia Institute.
>
> For instance, if fitted with an anti-radar seeker, it could attack and disrupt surface-to-air missile batteries from extremely long range.[163]

Countering ASBMs

For background information on the Navy's ability to counter China's ASBMs and hypersonic weapons, see **Appendix B**.

Carrier Air Wing Operating Range

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 PLA ASBMs or other A2/AD systems, which could put the carriers' survivability at substantial risk, or alternatively require carriers to operate beyond the range of those PLA 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, have argued 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.

Legislative Activity for FY2025

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:

[163] Gerry Doyle with additional reporting by Yi-Mou Lee, "US Navy's Newest Air-to-Air Missile Could Tilt Balance in South China Sea," *Reuters*, August 14, 2024. See also Douglas Barrie, "Phoenix Successor Redux: the USN's Range Riposte to China's PL-17?" International Institute for Strategic Studies (IISS), July 29, 2024; Ryan Chan, "How US Navy's New Air-to-Air Missile Can Thwart China Threat," *Newsweek*, July 19, 2024; Mackenzie Eaglen and Cole Spiller, "The Navy's New Air-to-Air Capability Could Set Roadmap for Repurposing Old Systems," *Breaking Defense*, July 16, 2024; Tyler Rogoway, "AIM-174 Missile Brings Navy's Future Counter-China Air Combat Strategy Into Focus," *The War Zone*, July 8, 2024; Jake Epstein, "US Navy Super Hornets Armed with SM-6s, a Warship Missile Newly Tested in Combat, Have Been Spotted in the Pacific," *Business Insider India*, July 5, 2024.

- CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report RL32418, *Navy Virginia-Class Submarine Program and AUKUS Submarine Proposal: 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
- 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

FY2025 National Defense Authorization Act (H.R. 8070/S. 4638)

House

In H.R. 8070 as reported by the House Armed Services Committee (H.Rept. 118-529 of May 31, 2024) and passed by the House on June 14, 2024,

- **Section 1017** would direct DOD to submit a report containing the findings of a study on the feasibility of implementing one or more naval blockades of shipments of fossil fuels to China in the event of an armed conflict between the United States and China;
- **Section 1306** would delete a national security waiver for a requirement for the Secretary of Defense to certify certain things before DOD can enable or facilitate PRC participation in any Rim of the Pacific (RIMPAC) naval exercise;[164]

[164] The national security waiver for the certification requirement was established by subsection (b) of Section 1259 of (continued...)

- **Section 1308** would expand a requirement for the Secretary of Defense to certify certain things before DOD can enable or facilitate PRC participation in any RIMPAC naval exercise by adding a requirement for the Secretary to certify that the PRC has held an internationally recognized free and fair presidential election;[165]
- **Section 1315** would direct the Secretary of Defense to designate an official to be responsible, in coordination with appropriate DOD officials, for coordinating DOD efforts to monitor the PLA's network of overseas military bases and the PLA's global pursuit of military access agreements, and require DOD to submit an annual report each year from 2025 to 2030 detailing matters relating to the PLA's network of overseas military bases and the PLA's global pursuit of military access agreements;
- **Section 1318** would direct DOD to invite the naval forces of Taiwan to any RIMPAC exercise that is to take place following the date of enactment of the FY2025 NDAA; and
- **Section 1319** would direct DOD, in consultation with the heads of other relevant federal departments and agencies, to submit a report on
  - the feasibility of developing and deploying asymmetric naval assets for a potential defense of Taiwan,
  - whether Taiwan's ability to deter or confront a PRC maritime invasion would be enhanced by the deployment of certain new armed boats,
  - the capabilities of certain existing and planned Taiwan corvettes, and
  - the vulnerability of certain existing Taiwan destroyers and frigates.

H.Rept. 118-529 states:

> *Long-range fires*
>
> The committee notes that American adversaries are rapidly developing strike capabilities designed to push U.S. forces to engage at longer ranges. The committee is concerned about the Navy's ability to execute the necessary volume of long-range surface and undersea fires in a contested environment. The committee understands there are various efforts underway to address this concern but is concerned about the planning, progress, and coordination of these efforts.
>
> Therefore, the committee directs the Comptroller General of the United States to conduct a review of the Navy's systems and technologies needed for its long-range fires. The review should examine:
>
> (1) the requirements and digital infrastructure associated with long-range fires in a contested environment including any external information and systems the Navy is reliant on to execute long-range fires;
>
> (2) the Navy's development and acquisition plans for the systems and technologies it seeks in the near- and long-term to improve its long-range fires;

the FY2019 NDAA (H.R. 5515/P.L. 115-232 of August 13, 2018). Section 1306 of H.R. 8070 would amend Section 1259 of P.L. 115-232 by striking subsection (b).

[165] The requirement for the certification was established by subsection (a) of Section 1259 of the FY2019 NDAA (H.R. 5515/P.L. 115-232 of August 13, 2018). Section 1306 of H.R. 8070 would amend Section 1259 of P.L. 115-232 by adding the holding of an internationally recognized free and fair presidential election to the list of things to be certified.

> (3) challenges the Navy faces in developing, acquiring, and fielding systems and technologies needed to implement its plans for long-range fires and the Navy's plans to address those challenges;
>
> (4) the extent to which the Navy is developing and assessing architectures to improve information flow and the ability to integrate new capability quickly; and
>
> (5) any other areas the Comptroller General deems important.
>
> The committee directs the Comptroller General of the United States to provide a briefing to the House Committee on Armed Services not later than February 1, 2025, with one or more reports to follow. (Pages 22-23)

H.Rept. 118-529 also states:

> Maritime De-Risking
>
> The committee is aware that our strategic competitor, the People's Republic of China, is expanding its influence over the high seas. The Chinese Communist Party (CCP) views its control over the oceans as a vital national security interest and has used the authority and resources of their government to direct, resource, and gain the world's most dominant position over shipbuilding, shipping, and international maritime infrastructure. Their actions have often disregarded legal norms, principles, and values shared by the United States and its allies.
>
> The United States faces significant risks to both national security and economic vitality from the Government of China's potential to cripple the critical supplies and lifeline of the American people during peacetime, crisis, or war by shutting off access to the world's oceans, as well as by controlling critical shipping interests and infrastructure. To address this threat, the United States must pursue a strategy of "de-risking," aimed at mitigating reliance and vulnerability to Chinese shipbuilding, shipping, and maritime infrastructure.
>
> Therefore, the committee directs the Secretary of Defense, in consultation with the Secretaries of Transportation, Commerce, Treasury, Homeland Security, State, as well as the U.S. Trade Representative and Office of Management and Budget to provide a report to the House Armed Services and Senate Armed Services committees by November 1, 2024:
>
> (1) An analysis of the current risks posed to US interests by the CCP's dominance of the maritime industry and its civilian and military impacts to security and economic prosperity.
>
> (2) A comprehensive strategy for de-risking America's maritime domain from the People's Republic of China and other asymmetric or emerging maritime threats, recognizing that our security and economic way of life relies on assured access to free, open, safe, and sustainable oceans without coercion from our global competitors.
>
> (3) An assessment of the possible establishment of a National Maritime Council to oversee implementation of the nation's maritime strategies, and requirements for annual reporting to Congress on status of implementing such strategies.
>
> The report shall be submitted in unclassified form but may contain a classified annex. (Pages 251-252)

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

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

U.S. and PRC naval capabilities are sometimes compared by showing comparative numbers of U.S. and PRC ships. Although the total number of ships in a navy (or a navy's aggregate displacement [i.e., 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 PRC 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 displacement) is only a partial metric of its capability.** Many factors other than ship numbers (or aggregate displacement) 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.[166] In light of this, navies with similar numbers of ships or similar aggregate displacements can have significantly different capabilities, and navy-to-navy comparisons of numbers of ships or aggregate displacements 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 displacements 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.

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

- **Comparisons of total numbers of ships (or aggregate displacements) 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 PLA naval and other forces would be operating at the end of generally short supply lines.
- **Comparisons of numbers of ships (or aggregate displacement) 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 PRC militaries, this is a particularly important consideration in comparing U.S. and PRC 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 PRC 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 PRC 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 PRC naval capabilities might be changing over time.

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

This appendix provides background information on 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 have in past years sometimes been characterized as "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."[167]

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.[168] 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 and confusing ASBMs as they approach their intended targets. Options for destroying ASBMs in

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

[168] See, for example, also Nick Danby, "Carrier Strike Groups Should Be Ready to Go Dark in Conflict," *War on the Rocks*, August 29, 2023. 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 October 5, 2023, at https://repository.library.georgetown.edu/handle/10822/553587; 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.

flight include the SM-3 midcourse BMD interceptor missile (including the new Block IIA version) and the SM-6 terminal-defense BMD interceptor missile.[169] 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.[170]

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:

[169] 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.

[170] 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."[171]

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?
>
> 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....

[171] 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.

> In the end, the weapon might not be the great "game-changer" that many point it out to be, but a great complicator.[172]

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.[173]
>
> 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

[172] 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.

[173] 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.

> 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.[174]

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."[175]

A February 5, 2024, press report stated:

> A U.S. aircraft carrier would be capable of executing its mission in a conflict with China, a senior Navy official says, responding to the argument that Beijing's "carrier killer" missiles would make the vessel less relevant to a battle in the western Pacific.
>
> "Our highly trained sailors can operate these complex, contested domains and be lethal and survivable, and execute the mission regardless of what the threat is," Rear Adm. Carlos

[174] 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.

[175] 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.

> Sardiello, commander of the USS Carl Vinson strike group, told a few reporters aboard the carrier on Wednesday [January 31].[176]

Ability to Counter Hypersonic Weapons

Another CRS report provides a brief survey of DOD (including Navy) efforts for developing defenses against hypersonic weapons.[177] Regarding the Navy efforts to develop capabilities for countering hypersonic weapons, the Director of the Missile Defense Agency (MDA) testified in April 2024:

> Initially just focused on ballistic missile defense, MDA today is developing weapons systems and sensors to defeat the serious threat posed by hypersonic glide vehicles and maneuvering threats. MDA continues to develop a layered defense capability to defeat regional hypersonic threats with the Glide Phase Intercept (GPI) development program. By the end of FY 2024, MDA will select a single GPI interceptor design with which to complete development. In FY 2025, MDA will continue to develop and mature the GPI capability with a focus on critical technology maturation and risk reduction activities. We will also continue to update the [U.S. navy] Aegis Weapon System to integrate the GPI interceptor. Our FY 2025 budget request supports the planned cooperative development of the glide phase interceptor with Japan. We expect to complete the formal agreement on that project this spring. Japan will fund and develop key missile components, primarily propulsion elements.
>
> The GPI weapon system design will provide a layered defense with currently deployed [U.S. Navy] Sea-Based Terminal (SBT) capabilities. SBT provides terminal defense of assets at sea and forces ashore. We anticipate delivering SBT Increment 3 capabilities in FY 2025 to provide expanded capability. SBT will demonstrate a simulated engagement against an operationally realistic hypersonic glide vehicle target in FY 2025, and an engagement using a [U.S. Navy] Standard Missile (SM)-6 against a hypersonic glide target in FY 2026.[178]

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[176] Ryo Nakamura, "U.S. 'Confident' Carrier Can Operate under China Missile Threat: Admiral," *Nikkei Asia*, February 5, 2024.

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

[178] [Statement of] Lieutenant General Heath A. Collins, USAF, Director, Missile Defense Agency, Before the House Armed Services Committee, Strategic Forces Subcommittee, April 12, 2024, pp. 2-3.

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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