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

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Summary

In an era of renewed great power competition, China's military modernization effort, including its naval modernization effort, has become the top focus of U.S. defense planning and budgeting. China's navy, which China has been steadily modernizing for more than 25 years, since the early to mid-1990s, has become 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 viewed as posing a major challenge to the U.S. Navy's ability to achieve and maintain wartime control of blue-water ocean areas in the Western Pacific—the first such challenge the U.S. Navy has faced since the end of the Cold War. China's navy forms a key element of a Chinese challenge to the long-standing status of the United States as the leading military power in the Western Pacific. Some U.S. observers are expressing concern or alarm regarding the pace of China's naval shipbuilding effort and resulting trend lines regarding the relative sizes and capabilities of China's navy and the U.S. Navy.

China's naval modernization effort encompasses a wide array of ship, aircraft, and weapon acquisition programs, as well as improvements in maintenance and logistics, doctrine, personnel quality, education and training, and exercises. China's navy has currently has certain limitations and weaknesses, and is working to overcome them.

China's military modernization effort, including its naval modernization effort, is assessed as being aimed at developing capabilities for addressing the situation with Taiwan militarily, if need be; for achieving a greater degree of control or domination over China's near-seas region, particularly the South China Sea; for enforcing China's view that it has the right to regulate foreign military activities in its 200-mile maritime exclusive economic zone (EEZ); for defending China's commercial sea lines of communication (SLOCs), particularly those linking China to the Persian Gulf; for displacing U.S. influence in the Western Pacific; and for asserting China's status as the leading regional power and a major world power.

Consistent with these goals, observers believe China wants its navy to be capable of acting as part of a Chinese 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. Additional missions for China's navy include conducting maritime security (including antipiracy) operations, evacuating Chinese nationals from foreign countries when necessary, and conducting humanitarian assistance/disaster response (HA/DR) operations.

The U.S. Navy in recent years 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 and its best personnel 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; begun development of new operational concepts (i.e., new ways to employ Navy and Marine Corps forces) for countering Chinese maritime A2/AD forces; and signaled that the Navy in coming years will shift to a more-distributed fleet architecture that will feature a smaller portion of larger ships, a larger portion of smaller ships, and a substantially greater use of unmanned vehicles. The issue for Congress is whether the U.S. Navy is responding appropriately to China's naval modernization effort.

Contents

Introduction 1
Issue for Congress 1
Sources and Terminology 1
Background 2
Brief Overview of China's Naval Modernization Effort 2
Numbers of Ships; Comparisons to U.S. Navy 5
Overview 5
Ultimate Size and Composition of China's Navy Not Publicly Known 6
Number of Ships Is a One-Dimensional Measure, but Trends in Numbers Can Be of Value Analytically 6
Three Tables Showing Numbers of Chinese and U.S. Navy Ships 6
Selected Elements of China's Naval Modernization Effort 10
Anti-Ship Missiles 11
Submarines 14
Aircraft Carriers 17
Surface Combatants 23
Amphibious Ships 28
Operations Away from Home Waters 33
U.S. Navy Response 34
Overview 34
Cooperation with Naval Forces of Allies and Other Countries 34
Size of Navy, Fleet Architecture, and Operational Concepts 36
Programs for Acquiring Highly Capable Ships, Aircraft, and Weapons 38
Issues for Congress 38
Overview 38
Discussion 39
Legislative Activity for FY2022 43
Coverage in Related CRS Reports 43
FY2022 National Defense Authorization Act (H.R. 4350/S. 2792) 44
House 44
Senate 45

Figures

Figure 1. DF-21D Anti-Ship Ballistic Missile (ASBM) 11
Figure 2. DF-26 Multi-Role Intermediate-Range Ballistic Missile (IRBM) 11
Figure 3. Reported Image of Anti-Ship Cruise Missile (ASCM) 12
Figure 4. Reported Image of Anti-Ship Cruise Missile (ASCM) 13
Figure 5. Reported Image of Anti-Ship Cruise Missile (ASCM) 13
Figure 6. Yuan (Type 039) Attack Submarine (SS) 15
Figure 7. Shang (Type 093) Attack Submarine (SSN) 15
Figure 8. *Jin* (Type 094) Ballistic Missile Submarine (SSBN) 16
Figure 9. *Liaoning* (Type 001) Aircraft Carrier 18
Figure 10. *Shandong* (Type 002) Aircraft Carrier 19

Figure 11. Type 003 Aircraft Carrier Under Construction 20
Figure 12. J-15 Flying Shark Carrier-Capable Fighter 22
Figure 13. *Renhai* (Type 055) Cruiser (or Large Destroyer) 24
Figure 14. *Renhai* (Type 055) Cruiser (or Large Destroyer) 25
Figure 15. *Luyang III* (Type 052D) Destroyer 26
Figure 16. *Jiangkai II* (Type 054A) Frigate 27
Figure 17. *Jingdao* (Type 056) Corvette 28
Figure 18. *Yuzhao* (Type 071) Amphibious Ship 29
Figure 19. Type 075 Amphibious Assault Ship 30
Figure 20. Type 075 Amphibious Assault Ship 31
Figure 21. Notional Rendering of Possible Type 076 Amphibious Assault Ship 32
Figure 22. Notional Rendering of Possible Type 076 Amphibious Assault Ship 32

Tables

Table 1. Numbers of Certain Types of Chinese and U.S. Ships Since 2005 7
Table 2. Numbers of Chinese and U.S. Navy Battle Force Ships, 2000-2030 9
Table 3. Numbers of Chinese and U.S. Navy Ships, 2020-2040 10

Appendixes

Appendix A. Comparing U.S. and Chinese Numbers of Ships and Naval Capabilities 47
Appendix B. U.S. Navy's Ability to Counter Chinese ASBMs 49

Contacts

Author Information 54

Introduction

Issue for Congress

This report provides background information and issues for Congress on China's naval modernization effort and its implications for U.S. Navy capabilities. In an era of renewed great power competition,[1] China's military modernization effort, including its naval modernization effort, has become the top focus of U.S. defense planning and budgeting.[2] The issue for Congress for this CRS report is whether the U.S. Navy is responding appropriately to China's naval modernization effort. Decisions that Congress reaches on this issue could affect U.S. and allied security, Navy capabilities and funding requirements, and the defense industrial base.

Another CRS report provides an overview of China's military in general.[3]

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,[4] a 2019 Defense Intelligence Agency (DIA) report on China's military power,[5] a 2015 Office of Naval Intelligence (ONI) report on China's navy,[6] published reference sources such as *IHS Jane's Fighting Ships*,[7] and press reports.

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

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[1] For further discussion of the shift to an era of renewed great power competition, see CRS Report R43838, *Renewed Great Power Competition: Implications for Defense—Issues for Congress*, by Ronald O'Rourke.

[2] See, for example, Mark Esper, "The Pentagon Is Prepared for China," *Wall Street Journal*, August 24, 2020; Tom Rogan, "Defense Secretary Mark Esper: It's China, China, China," *Washington Examiner*, August 28, 2019; Melissa Leon and Jennifer Griffin, "Pentagon 'Very Carefully' Watching China, It's 'No. 1 Priority,' Defense Secretary Mark Esper Tells Fox News," *Fox News*, August 22, 2019; Missy Ryan and Dan Lamothe, "Defense Secretary Wants to Deliver on the Goal of Outpacing China. Can He Do It?" *Washington Post*, August 6, 2019; Sandra Erwin, "New Pentagon Chief Shanahan Urges Focus on China and 'Great Power Competition,' *Space News*, January 2, 2019; Ryan Browne, "New Acting Secretary of Defense Tells Pentagon 'to Remember China, China, China,'" *CNN*, January 2, 2019; Paul McCleary, "Acting SecDef Shanahan's First Message: 'China, China, China,'" *Breaking Defense*, January 2, 2019.

[3] CRS Report R46808, *China's Military: The People's Liberation Army (PLA)*, by Caitlin Campbell.

[4] Department of Defense, *Military and Security Developments Involving the People's Republic of China 2021, Annual Report to Congress*, released on November 3, 2021, 173 pp. Hereinafter *2021 DOD CMSD*.

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

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

[7] *IHS Jane's Fighting Ships 2018-2019*, and previous editions. Other sources of information on these shipbuilding programs may disagree regarding projected ship commissioning dates or other details, but sources present similar overall pictures regarding PLA Navy shipbuilding.

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.[8]

Background

Brief Overview of China's Naval Modernization Effort

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

- China's naval modernization effort, which forms part of a broader Chinese military modernization effort that includes several additional areas of emphasis,[9] has been underway for more than 25 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 within the past few years it has surpassed the U.S. Navy in numbers of battle force ships (meaning the types of ships that count toward the quoted size of the U.S. Navy), making China's navy the numerically largest in the world. DOD states that "the PLAN is the largest navy in the world with a battle force of approximately 355 platforms, including major surface combatants, submarines, aircraft carriers, ocean-going amphibious ships, mine warfare ships, and fleet auxiliaries. This figure does not include 85 patrol combatants and craft that carry anti-ship cruise missiles (ASCMs). The PLAN's overall battle force is expected to grow to 420 ships by 2025 and 460 ships by 2030. Much of this growth will be in major surface combatants."[10]
- China's naval ships, aircraft, and weapons are now much more modern and capable than they were at the start of the 1990s, and are now comparable in many respects to those of Western navies. DOD states that "as of 2020, the PLAN is largely composed of modern multi-role platforms featuring advanced anti-ship,

[8] For a map showing the first and second island chains, see *2019 DIA CMP*, p. 32.

[9] 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 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.

[10] *2021 DOD CMSD*, p. 49. See also pp. vi and 48, and *2019 DIA CMP*, p. 63.

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]

- Some U.S. observers are expressing concern or alarm regarding the pace of China's naval shipbuilding effort and resulting trend lines regarding the relative sizes and capabilities of China's navy and the U.S. Navy.[13] China's navy is viewed as posing a major challenge to the U.S. Navy's ability to achieve and maintain wartime control of blue-water ocean areas in the Western Pacific—the first such challenge the U.S. Navy has faced since the end of the Cold War. China's navy forms a key element of a Chinese challenge to the long-standing status of the United States as the leading military power in the Western Pacific.
- China's naval 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),[14] and supporting C4ISR (command and control, communications, computers, intelligence, surveillance, and reconnaissance) systems. China's naval modernization effort also includes improvements in maintenance and logistics, doctrine, personnel quality, education and training, and exercises.[15]

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[11] *2021 DOD CMSD*, p. 48.

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

[13] See, for example, 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," *Forbe*s, 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.

[14] See, for example, Ryan Fedasiuk, "Leviathan Wakes: China's Growing Fleet of Autonomous Undersea Vehicles," Center for International Maritime Security (CIMSEC), August 17, 2021.

[15] See, for example, Roderick Lee, "The PLA Navy's ZHANLAN Training Series: Supporting Offensive Strike on the

- China's military modernization effort, including its naval modernization effort, is assessed as being aimed at developing capabilities for addressing the situation with Taiwan militarily, if need be; for achieving a greater degree of control or domination over China's near-seas region, particularly the South China Sea; for enforcing China's view that it has the right to regulate foreign military activities in its 200-mile maritime exclusive economic zone (EEZ);[16] for defending China's commercial sea lines of communication (SLOCs), particularly those linking China to the Persian Gulf; for displacing U.S. influence in the Western Pacific; and for asserting China's status as the leading regional power and a major world power.[17]
- Consistent with these goals, observers believe China wants its navy to be capable of acting as part of a Chinese 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. Additional missions for China's navy include conducting maritime security (including antipiracy) operations, evacuating Chinese nationals from foreign countries when necessary, and conducting humanitarian assistance/ disaster response (HA/DR) operations.
- 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 in recent years, China's navy currently is assessed as having limitations or weaknesses in certain areas,[18] including joint operations with other parts of China's military,[19] antisubmarine warfare (ASW), long-range targeting, a limited capacity for carrying out at-sea resupply of combatant ships operating far from home waters,[20] a limited number of overseas bases and support facilities,[21] a need to train large numbers of personnel to crew its new ships,[22] and a lack of recent combat experience.[23] China is working to reduce or overcome such

High Seas," *China Brief*, April 13, 2020.

[16] 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.

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

[18] For a discussion focusing on these limitations or weaknesses, see Mike Sweeney, *Assessing Chinese Maritime Power*, Defense Priorities, October 2020, 14 pp.

[19] 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.

[20] See, for example, Will Mackenzie, "Commentary: It's the Logistics, China," *National Defense*, June 10, 2020.

[21] 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.

[22] 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.

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

limitations and weaknesses.[24] Although China's navy has limitations and weaknesses, it may nevertheless be sufficient for performing missions of interest to Chinese leaders. As China's navy reduces its weaknesses and limitations, it may become sufficient to perform a wider array of potential missions.

- In addition to modernizing its navy, China in recent years has substantially increased the size and capabilities of its coast guard. DOD states that China's coast guard is "by far the largest coast guard force 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 that "the PLAN is the largest navy in the world with a battle force of approximately 355 platforms, including major surface combatants, submarines, aircraft carriers, ocean-going amphibious ships, mine warfare ships, and fleet auxiliaries. This figure does not include 85 patrol combatants and craft that carry anti-ship cruise missiles (ASCMs). The PLAN's overall battle force is expected to grow to 420 ships by 2025 and 460 ships by 2030. Much of this growth will be in major surface combatants."[27] DIA states that "the PLAN is rapidly retiring older, single-

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

[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.) See also Ma Xiu and Peter W. Singer, "How China Steals US Tech to Catch Up in Underwater Warfare," *Defense One*, June 8, 2021; Amanda Rivkin, "German Engine Technology Found in Chinese Warships—Report," *Deutsche Welle (dw.com)*, November 6, 2021.

[25] DOD states that

> The CCG's [China Coast Guard's] rapid expansion and modernization has improved the PRC's ability to enforce its maritime claims. Since 2010, the CCG's fleet of large patrol ships ([i.e., those displacing] more than 1,000 tons) has more than doubled from approximately 60 to more than 130 ships, making it by far the largest coast guard force in the world and increasing its capacity to conduct simultaneous, extended offshore operations in multiple disputed areas. Furthermore, the newer ships are substantially larger and more capable than the older ships, and the majority are equipped with helicopter facilities, high-capacity water cannons, and guns ranging from 30 mm to 76 mm. A number of these ships are capable of long-endurance and out-of-area operations.
>
> In addition, the CCG operates more than 70 fast patrol combatants (more than 500 tons), which can be used for limited offshore operations, more than 400 coastal patrol craft, and approximately 1,000 inshore and riverine patrol boats.
>
> (*2021 DOD CMSD*, pp. 75-76. See also *2019 DIA CMP*, p. 78.)

[26] For additional discussion, see *2021 DOD CMSD*, p. 76, and CRS Report R42784, *U.S.-China Strategic Competition in South and East China Seas: Background and Issues for Congress*, by Ronald O'Rourke.

[27] *2021 DOD CMSD*, p. 49. See also pp. vi, 48, and *2019 DIA CMP*, p. 63.

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]

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.[29] In contrast, China does not release a navy force-level goal or detailed information about planned ship procurement rates, planned total ship procurement quantities, planned ship retirements, or resulting projected force levels. The ultimate size and composition of China's navy might be an unsettled and evolving issue among Chinese military and political leaders. One observer states that "it seems the majority of past foreign projections of Chinese military and Chinese navy procurement scale and speed have been underestimates…. All military forces have a desired force requirement and a desired 'critical mass' to aspire toward. Whether the Chinese navy is close to its desired force or not, is of no small consequence."[30]

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

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

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

Table Showing Figures from Annual DOD Reports

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

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

[29] 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.

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

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

Figures for Chinese ships taken from annual DOD reports on military and security developments involving China for the years 2005-2021

Year of DOD report	SSB	SSN	SS	CV	CG	DD	FF	FFL	PC	LST/ LPD	LSM	Total PLAN ship types shown to right	CCG	U.S. total	U.S. vs. PLAN ship types shown
2005	1	6	51	0	0	21	43	0	51	20	23	**216**	*n/a*	**291**	**+75**
2006	1	5	50	0	0	25	45	0	45	25	25	**221**	*n/a*	**282**	**+61**
2007	1	5	53	0	0	25	47	0	41	25	25	**222**	*n/a*	**281**	**+59**
2008	1	5	54	0	0	29	45	0	45	26	28	**233**	*n/a*	**279**	**+46**
2009	2	6	54	0	0	27	48	0	70	27	28	**262**	*n/a*	**282**	**+20**
2010	2	6	54	0	0	25	49	0	85	27	28	**276**	*n/a*	**285**	**+9**
2011	2	5	49	0	0	26	53	0	86	27	28	**276**	*n/a*	**288**	**+12**
2012	2	5	48	0	0	26	53	0	86	28	23	**271**	*n/a*	**284**	**+13**
2013	3	5	49	1	0	23	52	0	85	29	26	**273**	*n/a*	**287**	**+14**
2014	3	5	51	1	0	24	49	8	85	29	28	**283**	*n/a*	**285**	**+2**
2015	4	5	53	1	0	21	52	15	86	29	28	**294**	*n/a*	**289**	**-5**
2016	4	5	57	1	0	23	52	23	86	30	22	**303**	*n/a*	**271**	**-32**
2017	4	5	54	1	0	21	56	23	88	34	21	**317**	*185*	**275**	**-42**
2018	4	5	57	1	0	28	51	28	86	33	23	**306**	*240*	**279**	**-27**
2019	4	6	50	1	0	33	54	42	86	37	22	**335**	*248*	**286**	**-49**
2020	4	6	46	2	1	32	49	49	86	37	21	**333**	*255*	**296**	**-37**
2021	6	9	56	2	1	32	48	51	86	57		**348**	*223*	**296**	**-52**
2021: change since 2005	+5	+3	+5	+2	+1	+11	+5	+51	+35	+14		**+132**	*n/a*	**+5**	**-127**

Source: Table prepared by CRS based on 2005-2021 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.

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

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

About 65% of the increase since 2005 in the total number of Chinese navy ships shown in the table (a net increase of 86 ships out of a total net increase of 132 ships) resulted from increases in missile-armed fast patrol craft starting in 2009 (a net increase of 35 ships) and corvettes starting in 2014 (51 ships). These are the smallest surface combatants shown in the table. The net 35-ship increase in missile-armed fast patrol craft was due to the construction between 2004 and 2009 of 60 new *Houbei* (Type 022) fast attack craft[31] and the retirement of 25 older fast attack craft that were replaced by Type 022 craft. The 51-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."[32] As can also be seen in the table, most of the remaining increase since 2005 in the number of Chinese navy ships shown in the table is accounted for by increases in amphibious ships (14 ships) and cruisers and destroyers (12 ships).

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

For reference, **Table 1** also shows the total number of ships in the U.S. Navy (known technically as the total number of battle force ships), and compares it to the total number of the types of Chinese ships that are shown in the table. The result is an apples-vs.-oranges comparison, because the Chinese figures exclude certain ship types, such as auxiliary and support ships, while the U.S. Navy figure includes auxiliary and support ships but excludes patrol craft. Changes over time in this apples-vs.-oranges comparison, however, can be of value in understanding trends in the comparative sizes of the U.S. and Chinese navies.

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

Table Showing ONI Figures from February 2020

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

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

[32] 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.

although it could be argued that China's missile-armed coastal patrol craft can be a significant factor for operations within the first island chain.

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

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

	2000	2005	2010	2015	2020	2025	2030
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 China navy battle force ships, including types not shown above	**n/a**	**220**	**220**	**255**	**360**	**400**	**425**
Total U.S. Navy battle force ships	***318***	***282***	***288***	***271***	***297***	***n/a***	***n/a***

Source: 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: "n/a" means not available. 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 this may have been a typo, since the figures for the individual ship types shown for that year total 119, and those ship types account for only part of the total number that would be reported in this cell of the table. Based on a comparison with the figures in the column for the year 2005, the correct figure for this cell might be in the vicinity of 210.

On the basis of the figures in **Table 2,** it might be said that 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.

As noted earlier, DOD stated in the 2021 edition of its annual report on military and security developments involving China that "the PLAN's overall battle force is expected to grow to 420 ships by 2025 and 460 ships by 2030."[33] The figures of 420 and 460 battle force ships are 20 and 35 ships more, respectively, than the figures of 400 and 425 battle force ships shown for 2025 and 2030 in **Table 2.** This suggests that between February 2020 (the date of the figures in **Table 2**) and November 2021 (when the 2021 edition of DOD's annual report was released), DOD revised upward its projections for 2025 and 2030 for the total number of battle force ships in China's Navy. Such a revision might reflect an increase expected construction of new ships, an increase in expected service lives for existing ships, or both.

Table Showing U.S. Navy Figures from October 2020

Table 3 shows numbers of certain types of Chinese navy ships in 2020, and projections of those numbers for 2025, 2030, and 2040, along with the total number of U.S. Navy battle force ships in 2020. The figures for China's ships were provided by the Navy at the request of CRS. As with

[33] *2021 DOD CMSD*, p. 49. See also pp. vi, 48.

Table 1, the result for 2020 is an apples-vs.-oranges comparison between the Chinese navy and U.S. navy totals, because the Chinese total for 2020 excludes certain ship types, such as auxiliary and support ships, while the U.S. Navy total for 2020 includes auxiliary and support ships.

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

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

Ship type	2020	2025	2030	2040	2040 change from 2020
Ballistic missile submarines	4	6	8	10	+6
Nuclear-powered attack submarines	6	10	14	16	+10
Diesel attack submarines	47	47	46	46	-1
Aircraft carriers	2	3	5	6	+4
Cruisers and destroyers	41	52	60	80	+39
Frigates and corvettes	102	120	135	140	+38
LHA-type amphibious assault ships	0	4	4	6	+6
LPD-type amphibious ships	7	10	14	14	+7
LST-type amphibious tank landing ships	30	24	24	15	-15
TOTAL of types shown above	**239**	**276**	**310**	**333**	**+94**
TOTAL number of U.S. Navy battle force ships	***297***	***n/a***	***n/a***	***n/a***	***n/a***

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

Notes: "n/a" means not available.

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

Selected Elements of China's Naval Modernization Effort

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

Anti-Ship Missiles

Anti-Ship Ballistic Missiles (ASBMs)

China is fielding two types of land-based ballistic missiles with a capability of hitting ships at sea—the DF-21D (**Figure 1**), a road-mobile anti-ship ballistic missile (ASBM) with a range of more than 1,500 kilometers (i.e., more than 910 nautical miles), and the DF-26 (**Figure 2**), a road-mobile, multi-role intermediate range ballistic missile (IRBM) with a maximum range of about 4,000 kilometers (i.e., about 2,160 nautical miles) that DOD says "capable of conducting both conventional and nuclear precision strikes against ground targets as well as conventional strikes against naval targets."[34]

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

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

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

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

[34] *2021 DOD CMSD*, p. vii. See also pp. 60, 61, 78.

Until recently, reported test flights of DF-21s and SDF-26s have not involved attempts to hit moving ships at sea. A November 14, 2020, press report, however, stated that an August 2020 test firing of DF-21 and DF-26 ASBMs into the South China resulted in the missiles successfully hitting a moving target ship south of the Paracel Islands.[35] A December 3, 2020, press report stated that Admiral Philip Davidson, the commander of U.S. Indo-Pacific Command, "confirmed, for the first time from the U.S. government side, that China's People's Liberation Army has successfully tested an anti-ship ballistic missile against a moving ship."[36] China reportedly is also developing hypersonic glide vehicles that, if incorporated into Chinese ASBMs, could make Chinese ASBMs more difficult to intercept.[37]

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

Anti-Ship Cruise Missiles (ASCMs)

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

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

Source: Detail of photograph accompanying Pierre Delrieu, "China Promotes Export of CM-302 Supersonic ASCM," *Asian Military Review*, July 3, 2017. (The article states "This is an article published in our December 2016

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

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

[37] See, for example, Christian Davenport, "Why the Pentagon Fears the U.S. Is Losing the Hypersonic Arms Race with Russia and China," *Washington Post*, June 8, 2018; Keith Button, "Hypersonic Weapons Race," *Aerospace America*, June 2018.

[38] *2021 DOD CMSD*, pp. 50, 83.

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

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

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

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

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

Source: Dennis M. Gormley, Andrew S. Erickson, and Jingdong Yuan, *A Low-Visibility Force Multiplier, Assessing China's Cruise Missile Ambitions*, Published by National Defense University Press for the Center for the Study of Chinese Military Affairs, Institute for National Strategic Studies, Washington, D.C., 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.

Submarines

Overview

China has been steadily modernizing its submarine force, and most of its submarines are now built to relatively modern Chinese and Russian designs.[39] Qualitatively, China's newest submarines might not be as capable as Russia's newest submarines,[40] but compared to China's earlier submarines, which were built to antiquated designs, its newer submarines are much more capable.

Types and Numbers

Most of China's submarines are non-nuclear-powered attack submarines (SSs). China also operates a small number of nuclear-powered attack submarines (SSNs) and a small number of nuclear-powered ballistic missile submarines (SSBNs). The number of SSNs and SSBNs may grow in coming years, but the force will likely continue to consist mostly of SSs. DOD states that "the PLAN has placed a high priority on modernizing its submarine force, but its force structure continues to grow modestly as it works to mature its force, integrate new technologies, and expand its shipyards.... The PLAN will likely maintain between 65 and 70 submarines through the 2020s, replacing older units with more capable units on a near one-to-one basis."[41] 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.[42]

China's newest series-built SS design is the Yuan-class (Type 039) SS (**Figure 6**), its newest SSN class is the Shang-class (Type 093) SSN (**Figure 7**), and its newest SSBN class is the Jin (Type 094) class SSBN (**Figure 8**). In May 2020, it was reported that two additional Type 094 SSBNs had entered service, increasing the total number in service to six.[43]

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[39] 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.

[40] 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.

[41] *2021 DOD CMSD*, p. 49.

[42] 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.

[43] See, for example, Peter Suciu, "China Now Has Six Type 094A Jin-Class Nuclear Powered Missile Submarines," *National Interest*, May 6, 2020.

Figure 6. Yuan (Type 039) Attack Submarine (SS)

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

Figure 7. 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 8. *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 that "the PRC continues to increase its inventory of conventional submarines capable of firing advanced anti-ship cruise missiles (ASCMs). Between the mid-1990s and mid-2000s, the PLAN purchased 12 Russian-built Kilo class SS units, eight of which are capable of launching ASCMs. China's shipyards have delivered 13 Song class SS (Type 039) and 17 Yuan class diesel-electric (SSPs) (Type 039A/B). The PRC is expected to produce a total of 25 or more Yuan class submarines by 2025."[44] DOD states further:

> Over the past 15 years, the PLAN has constructed twelve nuclear submarines–two Shang I class SSNs (Type 093), four Shang II class SSNs (Type 093A), and six Jin class SSBNs (Type 094). Equipped with the CSS-N-14 (JL-2) submarine-launched ballistic missile (SLBM), 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 JL-2 SLBMs. In 2019, Beijing displayed these missiles at the PRC's 70th anniversary parade, revealing that at least a full complement of 12 JL-2s are complete and operational. The PRC's next-generation Type 096 SSBN, which likely began construction in the early 2020s, will reportedly carry a new type of SLBM. The PLAN is expected to operate the Type 094 and Type 096 SSBNs concurrently and could have up to eight SSBNs by 2030. This would align with Chairman Xi Jinping's 2018 directive for the SSBN force to achieve "stronger growth."
>
> By the mid-2020s, the PRC will likely build the Type 093B guided-missile nuclear attack submarine. 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 (LACMs).[45]

[44] *2021 DOD CMSD*, p. 49.

[45] *2021 DOD CMSD*, p. 49.

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. Each Jin-class SSBN is armed with 12 JL-2 nuclear-armed submarine-launched ballistic missiles (SLBMs).[46] A May 2, 2021, press report stated that China's latest Jin-class SSBN is armed with a new and longer-ranged SLBM called the JL-3.[47]

Aircraft Carriers

Overview[48]

China's first aircraft carrier, *Liaoning* (Type 001) (**Figure 9**), entered service in 2012. China's second aircraft carrier (and its first fully indigenously built carrier), *Shandong* (Type 002) (**Figure 10**) entered service on December 17, 2019. An April 2021 press report stated that Shandong "might soon be heading out on the high seas as it continues its preparations to become combat-ready."[49] *Liaoning* and *Shandong* launch fixed-wing aircraft using a "ski ramp" at the ship's bow.

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

China's third carrier, the Type 003 (**Figure 11**), is under construction; ONI expects it to enter service by 2024,[50] It is expected to be conventionally powered, closer in size to U.S. Navy aircraft

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[46] DOD estimates the range of the JL-2 at 7,200 km (*2021 DOD CMSD*, p. 63). Such a range could permit Jin-class SSBNs to attack targets in Alaska (except the Alaskan panhandle) from protected bastions close to China, targets in Hawaii (as well as targets in Alaska, except the Alaskan panhandle) from locations south of Japan, targets in the western half of the 48 contiguous states (as well as Hawaii and Alaska) from mid-ocean locations west of Hawaii, or targets in all 50 states from mid-ocean locations east of Hawaii. DOD states that

> The current range limitations of the JL-2 will require the JIN to operate in areas north and east of Hawaii if the PRC seeks to target the east coast of the United States. As the PRC fields newer, more capable, and longer ranged SLBMs such as the JL-3, the PLAN will gain the ability to target the continental United States from littoral waters, and thus may consider bastion operations to enhance the survivability of its sea-based deterrent. The South China Sea and Bohai Gulf are probably the PRC's preferred options for employing this concept.
>
> (*2021 DOD CMSD*, p. 91.)

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

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

[49] Minnie Chan, "China's Shandong Aircraft Carrier Ready for High Seas Test, Insider Says," *South China Morning Post*, April 8, 2021.

[50] 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

carriers, and equipped with catapults rather than a ski ramp for launching aircraft. China's fourth carrier reportedly may begin construction as early as 2021.[51]

Figure 9. *Liaoning* (Type 001) Aircraft Carrier

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

ONI states that "China has two shipyards expected to be used for aircraft carrier production, though several other large commercial yards could, in theory, also build carriers." Observers have speculated that China may eventually field a force of four to six (or possibly more than six) aircraft carriers. In late November 2019, it was reported that the Chinese government, while deciding to proceed with the construction of the fourth carrier, had put on hold plans to build a fifth carrier, known as the Type 004, which was to be nuclear-powered, due to budgetary and technical considerations. Observers expect that it will be some time before China masters carrier-based aircraft operations on a substantial scale.

Liaoning (Type 001)

Liaoning is a refurbished ex-Ukrainian aircraft carrier that China purchased from Ukraine in 1998 as an unfinished ship.[52] It is conventionally powered, has an estimated full load displacement of 60,000 to 66,000 tons, and reportedly can accommodate an air wing of 30 or more fixed-wing airplanes and helicopters, including 24 fighters. The *Liaoning* lacks aircraft catapults and instead launches fixed-wing airplanes off the ship's bow using an inclined ski ramp.

committee's permission.

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

[52] 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.

Figure 10. *Shandong* (Type 002) Aircraft Carrier

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

Some observers have referred to the *Liaoning* as China's "starter" carrier. China has been using *Liaoning* in part for pilot training. In May 2018, China reportedly announced that the aircraft carrier group formed around *Liaoning* had reached initial operational capability (IOC),[53] although that term might not mean the same as it does when used by DOD in connection with U.S. weapon systems.

Shandong (Type 002)

Shandong is a modified version of the *Liaoning* design that incorporates some design improvements, including features that reportedly will permit it to embark and operate a larger air wing of 40 aircraft that includes 36 fighters.[54] Its displacement is estimated at 66,000 to 70,000 tons.

Type 003 Carrier

Earlier press reports had generally stated that China's Type 003 carrier might have a displacement of 80,000 tons to 85,000 tons. A November 29, 2020, press report, however, stated that satellite images of the ship under construction suggest that this estimate may be a bit low, and that the Type 003 carrier might be closer in displacement to U.S. Navy aircraft carriers, which have a displacement of about 100,000 tons.[55] The Type 003 carrier is expected to be equipped with

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

[54] 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.

[55] See, for example, H. I. Sutton, "China's New Super Carrier: How It Compares To The US Navy's Ford Class," *Naval News*, July 2, 2021; H. I. Sutton, "China's New Aircraft Carrier Is In Same League As US Navy's Ford Class," *Naval News*, April 15, 2021. See also Ryan Pickrell, "Satellite Photos Show China's New Aircraft Carrier Coming Together Quickly and Reveal More About its Design," *Business Insider*, July 20, 2021.

electromagnetic catapults rather than a ski ramp, which will improve the range/payload capability of the fixed-wing aircraft that they operate. A July 14, 2021, blog post stated that the ship might be launched (i.e., put into the water for the final stages of its construction) before the end of 2021.[56]

Figure 11. Type 003 Aircraft Carrier Under Construction

Source: Photograph accompanying Matthew P. Funaiole, Joseph S. Bermudez Jr., and Brian Hart, "Signs Point to China's Third Aircraft Carrier Launching Soon," Center for Strategic and International Studies (CSIS), November 9, 2021. The caption to the photograph states, "China's Type 003 aircraft carrier is seen under construction at Jiangnan Shipyard."

The start of construction of the Type 003 carrier was announced in the Chinese press in November 2018.[57] A November 9, 2021, blog post states

> Steady progress on the construction of China's third aircraft carrier has continued throughout 2021, and the vessel—commonly known as the Type 003—may launch [i.e., be put into the water for the final stages of its construction] in the coming months. Commercial satellite imagery of Jiangnan Shipyard captured on October 23, 2021, reveals that the installation of the carrier's main external components is nearing completion....
>
> Based on available information and observed progress at Jiangnan, the authors estimate that the Type 003 will launch in roughly three to six months. The technical challenges of building a modern aircraft carrier could, however, extend this timeline. Even after launch,

[56] Matthew P. Funaiole and Joseph S. Bermudez Jr., "Progress Report on China's Type 003 Carrier," Center for Strategic and International Studies (CSIS), July 14, 2021. See also Ryan Pickrell, "Satellite Photos Show China's New Aircraft Carrier Coming Together Quickly and Reveal More About its Design," *Business Insider*, July 20, 2021; Minnie Chan, "China's Third Aircraft Carrier Could Launch This Year—But Still Needs the Right Jets," *South China Morning Post*, July 16, 2021.

[57] See, for example, Zhao Lei, "China Launches Work on Third Aircraft Carrier, Xinhia Says," *China Daily*, November 26, 2018; Liu Xuanzun (Global Times), "China's 3rd Aircraft Carrier Under Construction, to Be Equipped with New Technologies, *People's Daily Online*, November 27, 2018.

it will still be years before the Type 003 is commissioned into the PLAN and achieves initial operating capability.[58]

China's Fourth Carrier

Some sources have stated that China's fourth aircraft carrier would be built to the Type 003 design. A March 13, 2021, press report, however, states that the ship is likely to be nuclear-powered rather than conventionally powered.[59]

Possible Type 076 Catapult-Equipped Amphibious Assault Ship

See also the discussion of the possible catapult-equipped Type 076 amphibious assault ship (**Figure 21** and **Figure 22**) 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.[60]

Carrier-Based Aircraft

China's primary carrier-based fighter aircraft is the J-15 or Flying Shark (**Figure 12**), 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 carrier-based operations.[61]

China reportedly plans to develop a carrier-capable variant of its J-20 fifth-generation stealth fighter and/or a carrier-capable variant of its FC-31 fifth-generation stealth fighter (reportedly now designated J-35) to complement or succeed the J-15 on catapult-equipped Chinese carriers.[62]

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[58] Matthew P. Funaiole, Joseph S. Bermudez Jr., and Brian Hart, "Signs Point to China's Third Aircraft Carrier Launching Soon," Center for Strategic and International Studies (CSIS), November 9, 2021. For examples of press reports based on this CSIS report, see Colin Clark, "China's Newest Aircraft Carrier May Launch Early Next Year; How Many Aircraft?" *Breaking Defense*, November 11, 2021; Bloomberg News, "China Nears Launch of First Modern Aircraft Carrier, Report Says," *Bloomberg*, November 9, 2021; Ben Westcott, "China's New High-Tech Aircraft Carrier Could Launch in Early 2022, Satellite Imagery Analysis Shows," *CNN*, November 9, 2021; Ryan Pickrell, "Satellite Photos Suggest China Could Launch Its Newest Aircraft Carrier in a Matter of Months, Experts Say," *Business Insider*, November 9, 2021. See also H. I. Sutton, "China's Massive New Aircraft Carrier Is As Big As It Can Be," *Naval News*, October 27, 2021.

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

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

[61] 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.

[62] See *2021 DOD CMSD*, p. 52; 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'?" *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

China reportedly is also developing a carrier-based airborne early warning (AEW) aircraft, called the KJ-600, that is similar to the U.S. Navy's carrier-based E-2 Hawkeye AEW aircraft,[63] and stealth drone aircraft.[64]

Figure 12. 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.

Roles and Missions

Although aircraft carriers might have some value for China in Taiwan-related conflict scenarios, they are not considered critical for Chinese operations in such scenarios, because Taiwan is within range of land-based Chinese aircraft. Consequently, most observers believe that China is

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.

[63] See, for example, 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.

[64] Minnie Chan, "China to Deploy Sharp Sword Stealth Drone for New Type 001A Aircraft Carrier," *South China Morning Post,* September 17, 2019.

acquiring carriers primarily for their value in other kinds of operations, and to demonstrate China's status as a leading regional power and major world power. Chinese aircraft carriers could be used for power-projection operations, particularly in scenarios that do not involve opposing U.S. forces, and to impress or intimidate foreign observers.[65]

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

Surface Combatants

Overview

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

These new classes of surface combatants demonstrate a significant modernization of PLA Navy surface combatant technology. DOD states that China's navy "remains engaged in a robust shipbuilding program for surface combatants, producing new guided-missile cruisers (CGs), guided-missile destroyers (DDGs) and corvettes (FFLs). 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."[66] DIA states that "the era of past designs has given way to production of modern multimission destroyer, frigate, and corvette classes as China's technological advancement in naval design has begun to approach a level commensurate with, and in some cases exceeding, that of other modern navies."[67] China is also upgrading its older surface combatants with new weapons and other equipment.[68]

Type 055 Cruiser/Large Destroyer

China is building a new class of cruiser (or large destroyer), called the Renhai-class or Type 055 (**Figure 13** and **Figure 14**), that reportedly displaces between 12,000 and 13,000 tons.[69] A March

[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.

[66] *2021 DOD CMSD*, p. 50.

[67] *2019 DIA CMP*, p. 70.

[68] 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.

[69] One article from a Chinse media outlet, for example, states, "According to sources, it has a displacement of more than 12,000 metric tons…." (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

7, 2021, press report by a Chinese media outlet states that the ship displaces more than 12,000 tons.[70] 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 9,300 tons, respectively, while the U.S. Navy's three Zumwalt (DDG-1000) class destroyers displace about 15,600 tons.

Figure 13. *Renhai* (Type 055) Cruiser (or Large Destroyer)

Source: Cropped version of photograph accompanying Kyle Mizokami, "Can the U.S. Navy Beat China's New Type 055 Destroyer In a Fight?" *National Interest*, September 29, 2019.

ONI states that Type 055 ships are being built by two shipyards, and that multiple ships in the class are currently under construction.[71] The first Type 055 ship was reportedly commissioned into service on January 12, 2020, about two and a half years after it was launched (i.e., put into the water for the final stages of its construction). The second and third ships in the class were reportedly commissioned into service in March and April 2021, respectively.[72] A November 2021 press report stated that the fourth ship was expected to enter service in December 2021.[73] The sixth ship in the class was reportedly launched in December 2019.[74] In August 2020, it was

Developmental Trajectory," Royal United Services Institute (RUSI), October 19, 2020.

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

[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] 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.

[73] Minnie Chan, "China's Fourth Type 055 Destroyer to Enter Service Next Month, Sources Say," *South China Morning Post*, November 6, 2021.

[74] Kristin Huang, "China Steps Up Warship Building Programme as Navy Looks to Extend Its Global Reach," *South China Morning Post*, December 31, 2019. See also Liu Xuanzun, "Chinese Navy Commissions First Type 055 Destroyer," *Global Times*, January 12, 2020. Another press report states that eight Type 055 ships are expected to enter service over the next four years, and that more than two dozen such ships might be in service by the late 2020s. (Franz-Stefan Gady, "China's Navy Commissions First-of-Class Type 055 Guided Missile Destroyer," *Diplomat*, January 13,

reported that the seventh ship in the class was delivered to the navy in May 2020,[75] that the eighth ship in the class was launched on August 30, 2020,[76] and that the eighth ship "will complete the first group of Type 055 destroyers."[77]

Figure 14. *Renhai* (Type 055) Cruiser (or Large Destroyer)

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

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 15**), 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. Type 052D ships have been in serial production for some time, and the 25th such ship was reportedly launched (i.e., put into the water for the final stages of its construction) on August 30, 2020.[78] One observer states that "at present the PLAN fields 20 aegis-type [i.e., Type 052] destroyers in service; however in four to five years it is likely that the PLAN will field 39 aegis-type destroyers in service (or 40, depending on whether a 26th 052D is built or not)."[79] Press reports in March

2020.)

[75] Minnie Chan, "Chinese Navy May Launch Eighth Type 055 Stealth Destroyer Later This Year," *South China Morning Post*, August 20, 2020.

[76] Liu Xuanzun, "PLA Launches New Type 055, Type 052D Destroyers After Decommissioning All Type 051 Destroyers: Reports," *Global Times*, August 30, 2020.

[77] Minnie Chan, "Chinese Navy May Launch Eighth Type 055 Stealth Destroyer Later This Year," *South China Morning Post*, August 20, 2020. See also Peter Suciu, "Chinese Navy to Launch 8th New Type 055 'Stealth' Destroyer," *National Interest*, August 22, 2020. A November 18, 2020, press report that cited a November 16, 2020, Chinese-language press report stated that "China's Type 055 destroyer is equipped with a microwave anti-missile system which can disable the electronic equipment of incoming enemy aircraft and missiles, and even burn the enemy's pilots." ("China Uses Microwave Weapons against India," *Chinascope*, November 18, 2020, which cited the following as its source: "Lianhe Zaobao, November 16, 2020, https://www.zaobao.com.sg/realtime/china/story20201116-1101404.")

[78] Liu Xuanzun, "PLA Launches New Type 055, Type 052D Destroyers After Decommissioning All Type 051 Destroyers: Reports," *Global Times*, August 30, 2020.

[79] Rick Joe, "The Chinese Navy's Destroyer Fleet Will Double by 2025. Then What?" *Diplomat*, July 12, 2020. See

2021 stated that China is now commissioning an upgraded version of the Type 052D, informally called the Type 052DL, that incorporates an extended-length helicopter flight deck and a new radar.[80] A July 4, 2021, press report from a Chinese media outlet discussed what it said was the fourth Type 052D destroyer to be commissioned into service during 2021.[81]

Figure 15. *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 16**), which displaces about 4,000 tons. ONI stated in February 2020 that 30 Type 054As entered service between 2008 and 2019, and that no additional Type 054As were then under construction.[82] An August 2021 press report from a Chinse media outlet, however, stated that "China is reportedly building another batch of Type 054A frigates for the People's Liberation Army Navy (PLA Navy) after it had launched two new ships of this class over the past few months." The press report noted that a report from the *Jane's* organization had stated that the 32nd Type 054A ship had recently been launched (i.e., put into the water for the final stages of its construction).[83]

also Kris Osborn, "Double the Destroyers: China Will Soon Have Almost 40 of These Modern Warships," *National Interest*, July 17, 2020.

[80] "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.

[81] Liu Xuanzun, "Type 052D Destroyer Kaifeng Enters PLA Naval Service, Celebrates CPC Centennial with Drill," *Global Times*, July 4, 2021.

[82] 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.

[83] Liu Xuanzun, "Type 054A Frigate Good Choice to Expand PLA Naval Fleet and Boost Combat Preparedness: Experts," Global Times, August 12, 2021.

Figure 16. *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—in large numbers over a relatively short time period—a new type of corvette (i.e., a light frigate, or FFL) called the Jiangdao class or Type 056 (**Figure 17**), which reportedly displaces 1,300 tons to 1,500 tons. 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 its ninth Jiangdao over the year by mid-2020 with over 50 Jiangdao class FFLs in service out of an expected production run of at least 70 ships. The latest FFLs are anti-submarine warfare (ASW) variants with a towed-array sonar."[84] ONI states that as of February 2020, more than 50 had entered service and another 15 were under construction.[85] In February 2021, a Chinese media outlet reported that the final two Type 056 ships—the 71st and 72nd such ships—had been commissioned into service in January and February 2021, and that the completion of Type 056 production could permit a shift to production of greater numbers of larger warships.[86] As shown in **Table 1**, the rapid growth in the

[84] *2021 DOD CMSD*, p. 50.

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

[86] Liu Xuanzun, "PLA Navy Commissions Final Type 056A Corvettes Specialized in Coastal Defense," *Global Times*,

number of Type 056 corvettes since 2013 accounts for a substantial share of the net increase in the total number of ships in China's navy since 2013.

Figure 17. *Jingdao* (Type 056) Corvette

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

Amphibious Ships[87]

Type 071 Amphibious Ship

China's new *Yuzhao* or Type 071 amphibious ships (**Figure 18**) have an estimated displacement of more than 19,855 tons,[88] 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 0721 ship "recently made its first publicly known maritime exercise appearance."[89]

February 17, 2021. See also "Chinese Navy PLAN Commissions Final Type 056A Corvettes," *Navy Recognition*, February 18, 2021.

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

[88] 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.

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

Figure 18. *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

On September 25, 2019, China launched (i.e., put into the water for the final stages of its construction) the first of a new type of amphibious assault ship[90] called the *Yushen* or Type 075 (**Figure 19** and **Figure 20**) that has an estimated displacement of 30,000 to 40,000 tons, compared to 41,000 to 45,000 tons for U.S. Navy LHA/LHD-type amphibious assault ships.[91] On April 11, 2020, it was reported that a fire had occurred on the ship.[92] On August 5, it was reported that the ship had begun its first sea trial,[93] suggesting that some or all of the damage caused by the fire had been repaired. The ship was commissioned into service in April 2021.[94]

[90] 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.

[91] See, for example, Rick Joe, "The Future of China's Amphibious Assault Fleet," *Diplomat*, July 17, 2019; Sebastien Roblin, "Bad News: China is Building Three Huge Helicopter 'Aircraft Carriers,'" *National Interest*, July 27, 2019; Tyler Rogoway, "China's New Amphibious Assault Ship Is A Monster," *The Drive*, August 22, 2019; Mike Yeo, "Photos Reveal Progress on China's Largest Amphibious Assault Ship," Defense News, August 23, 2019. See also Minnie Chan, "Why China's Type 075 Warship Is More Than It Seems—the Secret Is in Its Hull Number," *South China Morning Post*, May 9, 2021.

[92] See, for example, "China Confirms Fire on Board Type 075 Amphibious Assault Ship," *DefenseWorld.net*, April 11, 2020; Xavier Vavasseur, "China's 1st Type 075 LHD Caught On Fire During Fitting Out," *Naval News*, April 12, 2020; "Fire Breaks Out on China's New Amphibious Assault Helicopter Carrier," *War Is Boring*, April 13, 2020.

[93] Mallory Shelbourne, "China's New Type-075 Amphibious Warship Kicks Off Sea Trials," USNI News, August 5 (updated August 13), 2020; Xavier Vavasseur "China's First Type 075 Landing Helicopter Dock Started Sea Trials," *Naval News*, August 5, 2020. See also Liu Zhen, "Chinese Military's First Type 075 Amphibious Assault Ship Begins Sea Trial," *South China Morning Post*, August 7, 2020; Liu Xuanzun, "PLA 1st Amphibious Assault Ship Appears on Maiden Voyage, Photos Show," *Global Times*, August 5, 2020.

[94] See, for example, Mike Yeo, "China simultaneously commissions three warships on Navy anniversary," *Defense News*, April 26, 2021.

China reportedly launched (i.e., put into the water for the final stages of its construction) the second Type 075 ship on April 22, 2020,[95] and the third on January 29, 2021.[96]

Figure 19. Type 075 Amphibious Assault Ship

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

[95] Liu Zhen, "China Launches Second Type 075 Amphibious Helicopter Assault Ship," *South China Morning Post*, April 23, 2020; Elizabeth Shim, "China Launches Second Type 075 Assault Ship," *UPI*, April 22, 2020; Caleb Larson, "China Just Launched Their Second Type 075 Assault Carrier—Here's Why Everyone Is Worried," *National Interest*, April 22, 2020; Andrew Tate, "China's Second Type 075 Amphibious Assault Ship Launched in Shanghai," *Jane's*, April 22, 2020.

[96] Global Times, "China Launches Two New Warships, One for Pakistan," *Global Times*, January 29, 2021.

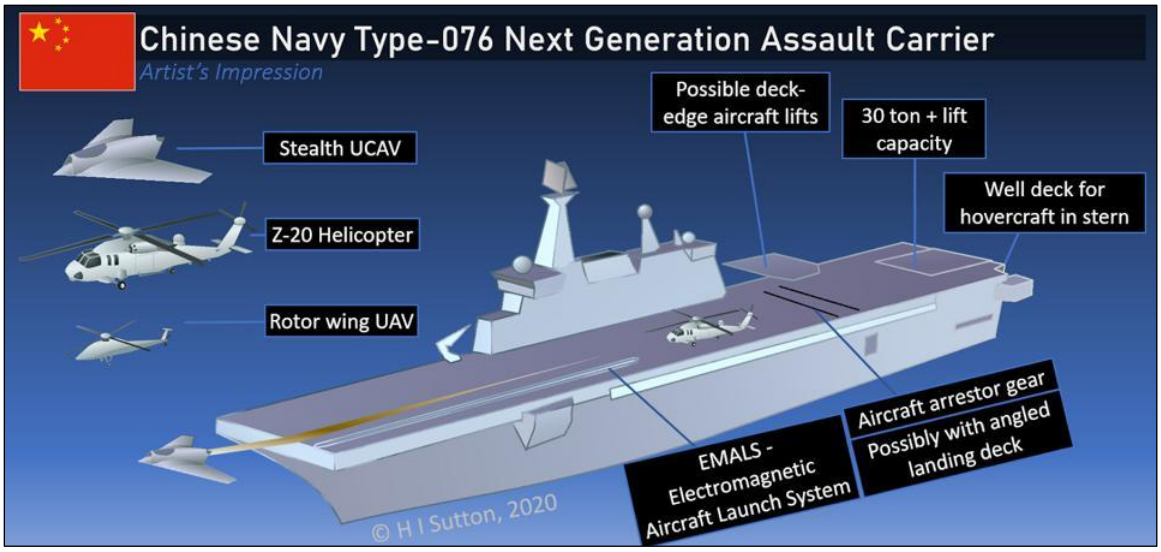
Figure 20. Type 075 Amphibious Assault Ship

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

In July 2020, it was reported that China might be planning to build the first of a new class of amphibious assault ships, called the Type 076 by observers (**Figure 21** and **Figure 22**), that would be equipped with electromagnetic catapults, which would enhance its ability to support operations by fixed-wing aircraft and make it somewhat more like an aircraft carrier.[97]

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

Figure 21. Notional Rendering of Possible Type 076 Amphibious Assault Ship



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

Figure 22. Notional Rendering of Possible Type 076 Amphibious Assault Ship

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

Amphibious Ship Roles and Missions

Although larger amphibious ships such as the Type 071 and Type 075 would be of value for conducting amphibious landings in Taiwan-related conflict scenarios, some observers believe that China is building such ships as much for their value in conducting other operations, such as operations for asserting and defending China's claims in the South and East China Seas, humanitarian assistance/disaster relief (HA/DR) operations, maritime security operations (such as antipiracy operations), and noncombatant evacuation operations (NEOs). Politically, amphibious

ships can also be used for naval diplomacy (i.e., port calls and engagement activities) and for impressing or intimidating foreign observers.[98]

Potential Use of Commercial Ships

In assessing China's capacity for conducting an amphibious invasion of Taiwan, some observers have focused on China's potential for using civilian ferries and other commercial ships to augment the transport and landing capacity of China's amphibious ships. Reported Chinese exercises indicate that China is exploring and testing this concept.[99]

Operations Away from Home Waters

Although China's navy operates primarily in China's home waters, Chinese navy ships are conducting increasing numbers of operations away from China's home waters, including the broader waters of the Western Pacific, the Indian Ocean, and the waters surrounding Europe, including the Mediterranean Sea and the Baltic Sea. A November 23, 2019, DOD news report quoted Admiral Philip Davidson, the commander of the U.S. Indo-Pacific Command, as stating that China's navy had conducted more global naval deployments in the past 30 months than it had in the previous 30 years.[100]

While many of China's long-distance naval deployments have been for making diplomatic port calls, some of them have been for other purposes, including conducting training exercises and carrying out antipiracy operations in waters off Somalia. China has been conducting antipiracy operations in waters off Somalia since December 2008 via a succession of more than 30 rotationally deployed naval escort task forces. China's distant naval operations are supported in part by China's military base in Djibouti, which China officially opened in August 2017 as its first overseas military base.[101]

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

[99] See, for example, J. Michael Dahm, *Chinese Ferry Tales, The PLA's Use of Civilian Shipping in Support of Over-the-Shore Logistics*, China Maritime Studies Institute, U.S. Naval War College, China Maritime Report No. 16, November 2021, 56 pp.; Kris Osborn, "Could China's Civilian Ferries Play a Role in a Taiwan Invasion?" *National Interest*, October 21, 2021; Keoni Everington, "Video Shows Ship Packed with Chinese Tanks for 'Future Battlefield' in Taiwan," *Taiwan News*, October 18, 2021; Michael Dahm and Conor M. Kennedy, "Civilian Shipping: Ferrying the People's Liberation Army Ashore," Center for International Maritime Security (CIMSEC), September 9, 2021; Chris Horton, "China Mobilizes Civilian Ferries for Taiwan Invasion Drills," *Nikkei Asia*, August 25, 2021; Andrew Tate, "Chinese Military Using Commercial Ro-Ro Shipping to Enhance Its Amphibious Capabilities," *Jane's*, August 23, 2021; Thomas Shugart, "Mind the Gap: How China's Civilian Shipping Could Enable a Taiwan Invasion," *War on the Rocks*, August 16, 2021; Mike Yeo, "China Reportedly Converted Civilian Ferries for Amphibious Assault Operations," *Defense News*, August 4, 2021; David Hambling, "China Converts Car Ferries For Amphibious Assault," *Forbes*, July 27, 2021; Courtney Mabeus, "Chinese Navy Using Commercial Car Ferries to Launch Amphibious Landing Craft," *USNI News*, July 26, 2021; Conor Kennedy, "Ramping the Strait: Quick and Dirty Solutions to Boost Amphibious Lift," *China Brief*, July 16, 2021.

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

[101] For a brief discussion of Djibouti and other potential Chinese military bases outside China, see *2021 DOD CMSD*, pp. x, 53, 85, and 130-132. For a recent press report about 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.

U.S. Navy Response

Overview

As mentioned earlier, China's navy is viewed as posing a major challenge to the U.S. Navy's ability to achieve and maintain wartime control of blue-water ocean areas in the Western Pacific—the first such challenge the U.S. Navy has faced since the end of the Cold War. China's navy forms a key element of a Chinese challenge to the long-standing status of the United States as the leading military power in the Western Pacific. Some U.S. observers are expressing concern or alarm regarding the pace of China's naval shipbuilding effort and resulting trend lines regarding the relative sizes and capabilities of China's navy and the U.S. Navy.

The U.S. Navy in recent years 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;[102]
- assigned its most capable new ships and aircraft and its best personnel 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;
- begun development of new operational concepts (i.e., new ways to employ Navy and Marine Corps forces) for countering Chinese maritime A2/AD forces; and
- signaled that the Navy in coming years will shift to a more distributed fleet architecture that will feature a smaller portion of larger ships, a larger portion of smaller ships, and a substantially greater use of unmanned vehicles.

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

Cooperation with Naval Forces of Allies and Other Countries

U.S. Navy efforts to increase cooperation with naval forces from allies such as Japan and Australia and other countries such India appear aimed in part at expanding existing bilateral

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

forms of naval cooperation (e.g., U.S.-Japan, U.S.-Australia, U.S.-India) into trilateral (e.g., U.S.-Japan-Australia, U.S.-Australia-India) or quadrilateral (U.S.-Japan-Australia-India) forms that could enhance the ability of the United States and its allies in the Indo-Pacific region to balance against China's growing military capabilities and deter potential assertive actions by China.[103]

A June 15, 2021, press report stated

> The Pentagon is considering establishing a permanent naval task force in the Pacific region as a counter to China's growing military might, according to two people familiar with internal discussions.
>
> The plan would also involve creating a named military operation for the Pacific that would enable the defense secretary to allocate additional dollars and resources to the China problem, said the people, who requested anonymity to discuss pre-decisional plans.
>
> The two initiatives, which are not yet finalized, would add muscle to President Joe Biden's tough talk on China and send a signal that the new U.S. administration is serious about cracking down on Beijing's military buildup and aggressive behavior in the Pacific region.
>
> The news comes as NATO leaders are increasingly aligning themselves with Washington's confrontational stance on Beijing. Four years after former President Donald Trump made countering China a top foreign policy priority, NATO allies this week declared Beijing a security challenge and said the Chinese are working to undermine global order.
>
> The discussions grew out of work by the Pentagon's China Task Force, which Biden commissioned in March to examine the department's China-related policies and processes. The group, led by Ely Ratner, the nominee to serve as the Pentagon's top Indo-Pacific policy official, recently completed its work and presented recommendations to Defense Secretary Lloyd Austin.
>
> A defense official, responding to a request for comment, stressed that none of the plans stemming from the China task force are finalized….
>
> The naval task force would be modeled on a construct NATO launched in Europe leading up to and during the Cold War, the Standing Naval Forces Atlantic, the people familiar with the discussions told POLITICO. The squadron was an immediate reaction force that could rapidly respond to a crisis but spent most of its time steaming around the region, participating in scheduled exercises and making goodwill port calls. Six to 10 ships from multiple NATO nations—destroyers, frigates and auxiliaries—were typically attached to the force for up to six months.
>
> The European task force allowed those nations to "maximize their influence at sea and to specialize their investments simultaneously," said Jerry Hendrix, an analyst for consulting firm Telemus Group and the author of "To Provide and Maintain a Navy". He noted that an effective Pacific task force would also include European allies such as Britain and France, who are increasing their Pacific naval presence, as well as Japan and Australia.
>
> The proposed initiative would be a "deterrent because it demonstrates a unity of effort in countering Chinese excessive threats to the concept of a free sea and free trade with their large territorial sea claims," Hendrix said.
>
> It's not yet clear whether the task force would involve only U.S. ships, or include other nations' militaries as well, the people said.[104]

[103] 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.

[104] Lara Seligman, "Pentagon Considering Permanent Naval Task Force to Counter China in the Pacific," *Politico*, June 15, 2021.

Size of Navy, Fleet Architecture, and Operational Concepts

As discussed in greater detail in another CRS report,[105] the Navy's existing force-level goal, which the Navy released on December 15, 2016, calls for achieving and maintaining a fleet of 355 ships—an increase of 47 ships over the previous 308-ship force-level goal of March 2015.

The Navy and DOD have been working since 2019 to develop a new force-level goal to replace the 355-ship force-level goal. Remarks from Navy and DOD officials since 2019 have indicated that the Navy's next force-level goal will introduce a once-in-a-generation change in fleet architecture, meaning basic the types of ships that make up the Navy and how these ships are used in combination with one another to perform Navy missions. This new fleet architecture is to be more distributed than the fleet architecture reflected in the 355-ship goal or previous Navy force-level goals. In particular, the new fleet architecture is expected to feature

- a smaller proportion of larger ships (such as large-deck aircraft carriers, cruisers, destroyers, large amphibious ships, and large resupply ships);
- a larger proportion of smaller ships (such as frigates, corvettes, smaller amphibious ships, smaller resupply ships, and perhaps smaller aircraft carriers); and
- a new third tier of surface vessels about as large as corvettes or large patrol craft that will be either lightly manned, optionally manned, or unmanned, as well as large UUVs.

Navy and DOD leaders believe that shifting to a more distributed fleet architecture is

- **operationally necessary**, to respond effectively to the improving maritime anti-access/area-denial (A2/AD) capabilities of other countries, particularly China;[106]
- **technically feasible** as a result of advances in technologies for UVs and for networking widely distributed maritime forces that include significant numbers of UVs; and

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

[106] See, for example, David B. Larter, "With China Gunning for Aircraft Carriers, US Navy Says It Must Change How It Fights," *Defense News*, December 6, 2019; Arthur H. Barber, "Redesign the Fleet," *U.S. Naval Institute Proceedings*, January 2019. Some observers have long urged the Navy to shift to a more distributed fleet architecture, on the grounds that the Navy's current architecture—which concentrates much of the fleet's capability into a relatively limited number of individually larger and more expensive surface ships—is increasingly vulnerable to attack by the improving A2/AD capabilities (particularly anti-ship missiles and their supporting detection and targeting systems) of potential adversaries, particularly China. Shifting to a more distributed architecture, these observers have argued, would

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

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

- **affordable**—no more expensive, and possibly less expensive, than the current fleet architecture for a given level of overall fleet capability, so as to fit within expected future Navy budgets.

Regarding the first point above, shifting to a more distributed force architecture, Navy and Marine Corps officials have indicated, will support implementation of the Navy and Marine Corps' new overarching operational concept, called Distributed Maritime Operations (DMO), and a supporting Marine Corps operational concept called Expeditionary Advanced Base Operations (EABO).[107] A key aim of DMO and EABO is to improve the ability of the Navy and Marine Corps to counter China's improving maritime military capabilities.

Some elements of the Navy's new, more distributed fleet architecture are reflected in the Navy's FY2021 and FY2022 budget submissions, including the following:

- procurement of Constellation (FFG-62) class frigates;[108]
- development of a smaller amphibious warship called the Light Amphibious Warship (LAW);[109]
- development of a smaller resupply ship called the Next-Generation Medium Logistics Ship;[110]
- development of two types of larger USVs—Large USVs (LUSVs) and Medium USVs (MUSVs);[111] and
- procurement of large UUVs called Extra Large UUVs (XLUUVs).[112]

On December 9, 2020, the Navy released a long-range Navy shipbuilding document that presented the Trump Administration's emerging successor to the 355-ship force-level goal. The document called for a Navy with a more distributed fleet architecture, including 382 to 446 manned ships and 143 to 242 large UVs.[113]

On June 17, 2021, the Navy released a long-range Navy shipbuilding document that presents the Biden Administration's emerging successor to the 355-ship force-level goal. The document calls

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

[108] 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.

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

[110] For more on the next-generation Medium Logistics Ship, see, for example, Megan Eckstein, "Navy Researching New Class of Medium Amphibious Ship, New Logistics Ships," *USNI News*, February 20, 2020; Rich Abott, "FY 2021 Request Starts Work on Future Amphibs and Logistics Ships," *Defense Daily*, February 20, 2020; Justin Katz, "Navy Announces 'Next Generation Logistics Ship' Program with June 25 Industry Day," *Inside Defense*, May 14, 2020; Paul McLeary, "No Shipbuilding Plan, But Navy Works On New Ships To Counter China," *Breaking Defense*, May 18, 2020.

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

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

[113] U.S. Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels*, December 2020, 23 pp.

for a Navy with a more distributed fleet architecture, including 321 to 372 manned ships and 77 to 140 large UVs.[114]

Programs for Acquiring Highly Capable Ships, Aircraft, and Weapons

Many of the Navy's programs for acquiring highly capable ships, aircraft, and weapon systems can be viewed as intended, at least in part, at improving the U.S. Navy's ability to counter Chinese maritime A2/AD capabilities. Examples of new technologies being developed by the Navy that might be of value in countering Chinese maritime A2/AD capabilities include large unmanned vehicles[115] and lasers.[116]

Issues for Congress

Overview

The overall issue for Congress is whether the U.S. Navy is responding appropriately to China's naval modernization effort. Within this overall issue, specific issues include the following:

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

[114] U.S. Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2022*, June 2021, 16 pp.

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

[116] For more on Navy laser programs, see CRS Report R44175, *Navy Lasers, Railgun, and Gun-Launched Guided Projectile: Background and Issues for Congress*, by Ronald O'Rourke.

technologies and weapons for the Navy—and if so, how those policies or metrics should be modified.

Discussion

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 Chinese naval capability trend lines (such as those shown in **Table 1** and **Table 2**) do not change, China might eventually draw even with or surpass the United States in overall naval capability.

Regarding the current 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),[117] stated that "China is now capable of controlling the South China Sea in all scenarios short of war with the United States."[118] A January 18, 2020, press report quotes James Kraska of the Naval War College as stating that "the US has lost advantage throughout the spectrum of operations, from low-level interaction against China's maritime militia to higher-end conflict scenarios," and that "in other words, China has escalation dominance, because it has the power to deter any US turn towards escalation. The US is outmatched in all of the scenarios."[119] A March 5, 2020, press report stated

> China is on track to overtake the United States as the most powerful military in the Pacific within the decade—potentially as soon as 2026—with the wherewithal sooner than previously expected to establish permanent, regional primacy, the top U.S. military official in the Asia-Pacific region warned March 4.
>
> Adm. Phil Davidson, head of U.S. Indo-Pacific Command, said a potential shift in the balance of military power between Beijing and Washington could come much sooner than U.S. officials have previously said.[120]

A March 6, 2021, press report stated

> China could soon be emboldened to try to "forcely change" the existing order in the western Pacific, the head of U.S. Indo-Pacific Command said.
>
> As its rapidly advancing military approaches "overmatch" with the United States in the region, and absent a convincing deterrent, China could make a move this decade.
>
> "Make no mistake about it, China seeks a new world order—one with Chinese characteristics as they have often said where Chinese national power is more important

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

[118] 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.

[119] John Power, "Has the US Already Lost the Battle for the South China Sea?" *South China Morning Post*, January 18, 2020. See also Gregory B. Poling, "The Conventional Wisdom on China's Island Bases Is Dangerously Wrong," *War on the Rocks*, January 10, 2020; Kerry K. Gershaneck and James E. Fanell, "This Is How China's [Military] Will Fight And Win A War In The South China Sea," *National Interest*, January 18, 2020.

[120] Jason Sherman, "Davidson: China on Track to Unseat U.S. as Dominant Military in the Pacific As Soon As 2026," *Inside Defense*, March 5, 2021.

> than international law," Adm. Phil Davidson said during an American Enterprise Institute forum Thursday [March 4]….
>
> "The most important thing I'd like you all to take away from the discussions |is a fundamental understanding that the period between now and 2026—this decade—is the time horizon in which China is positioned to achieve overmatch in its capability," the Oahu-based commander said.
>
> That's when Beijing could—and he emphasized "could"—"choose to forcibly change the status quo in the region."
>
> Davidson didn't specify what action China might take, but he said with the growing military imbalance comes greater risk that China could move "before our forces might be able to deliver an effective response."
>
> Carl Schuster, a retired Navy captain, former director of operations at U.S. Pacific Command's Joint Intelligence Center and an adjunct professor at Hawaii Pacific University, said he shares Davidson's concerns.
>
> Chinese President Xi Jinping "has accelerated China's military buildup, modernization and combat readiness," Schuster said. "They outnumber us in terms of seaborne missile shooters and, of course, shore-based air power. While I don't think they will be ready to conduct an amphibious assault on Taiwan itself by 2025, I do think Xi is hoping to establish the power ratio and capability to give us pause if he decides to create an incident."…
>
> China has conducted circumnavigations of Guam and the Northern Mariana Islands with surface ships and submarines and conducted bomber runs in the Philippine Sea, creating a 360-degree threat from cruise and ballistic missiles, Davidson said….
>
> Schuster said Chinese surface combatant numbers are growing at five times the rate of those of the United States.
>
> "Those ships' combat capabilities are nearly equal to ours—if not equal to ours—and they are concentrated in the western Pacific, potentially giving them 'local superiority' at a moment of their choosing," Schuster said.[121]

Skeptics of assessments like those above might argue that they do not give adequate weight to relative U.S. strengths (and corresponding Chinese relative weaknesses and limitations) in areas such as undersea warfare; personnel quality, training, and initiative; operational experience (particularly in combat situations); joint operations with other U.S. military services; and potential support from allies and partners, particularly Japan and Australia. A March 5, 2021, press report, for example, states

> While China is expected to field 400 ships by 2025, the goal of the current US Navy shipbuilding plan, a goal with no fixed date, is for a fleet of 355—a substantial numerical disadvantage.
>
> That's not to say the US Navy has seen its days as the world's premier fighting force come to an end.
>
> When counting troops, the US Navy is bigger, with more than 330,000 active duty personnel to China's 250,000.
>
> Analysts point out several other factors in Washington's favor.

[121] William Cole, "China Could Soon Outgun US in Western Pacific, Indo-Pacific Chief Says," *Honolulu Star-Advertiser*, March 6, 2021.

> The US Navy still fields more tonnage—bigger and heavier armed ships like guided-missile destroyers and cruisers—than China. Those ships give the US a significant edge in cruise missile launch capability.
>
> The US has more than 9,000 vertical launch missile cells on its surface ships to China's 1,000 or so, according to Nick Childs, a defense analyst at the International Institute for Strategic Studies.
>
> Meanwhile, the US attack submarine fleet of 50 boats is entirely nuclear powered, giving it significant range and endurance advantages over a Chinese fleet that has just seven nuclear-powered subs in its fleet of 62.[122]

As noted earlier, the above-listed issues of the planned size of the Navy and the shift to a more-distributed fleet architecture are discussed in detail in other CRS reports.[123] The issue of the Navy's ability to counter China's ASBMs is discussed in detail in this report in **Appendix B**. The issue of the Navy's ability to counter wake-homing torpedoes may have been made more pressing by the reportedly poor performance of an anti-torpedo torpedo that the Navy was developing as a means for Navy surface ships to counter hard-to-decoy wake-homing torpedoes and other torpedoes. The Navy now reportedly plans to remove the anti-torpedo torpedo system from the ships that were equipped with it.[124]

The Navy in recent years has initiated efforts to develop and procure longer-ranged ASCMs, but some observers have expressed frustration that these efforts are not moving quickly enough.[125] In support of its efforts, the Navy testified in June 2021 that

> **Strike Weapons**
>
> The Department continues to support a wider, more systematic approach towards delivering offensive weapons balance. By preserving the readiness and capacity of our key strike weapons inventories, pursuing strike weapon capability enhancements, and developing next-generation strike missile capabilities, the DON will increase overall force effectiveness to address emerging threats.
>
> **Tomahawk**
>
> In the FY 2022 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 and recertification of current inventory. For Maritime Strike Tomahawk (MST), the FY 2022 budget request provides continuation of initial shipboard and shore-side mission planning and funds software builds to support first test of all MST system segments

[122] Brad Lendon, "China Has Built the World's Largest Navy. Now What's Beijing Going to Do with It?" *CNN*, March 5, 2021.

[123] See CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke, and CRS Report R45757, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress*, by Ronald O'Rourke.

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

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

> at NSWC in the first quarter of FY 2022. FY 2022 MST Test and Evaluation (T&E) plans include missile functional ground testing and missile test flights from a ground launcher apparatus to assess seeker performance, mature and refine seeker algorithms, and provide verification and validation data for Modeling and Simulation. MST IOC is planned for the FY 2024.
>
> **Offensive Anti-Surface Warfare (OASuW) Increment 1/ Long Range Anti-Ship Missile (LRASM)**
>
> OASuW Increment 1/LRASM provides Combatant Commander the ability to conduct ASuW operations against near/mid-term high-value surface combatants protected by Integrated Air Defense Systems with long-range Surface-to-Air-Missiles and to deny adversaries sanctuary of maneuver. The program achieved Early Operational Capability on the Air Force B-1B in early FY 2019 and on the Navy's F/A-18E/F aircraft in early FY 2020. The FY 2022 President's Budget Continuation of and completion of USN LRASM 1.1 development, which will deliver incremental upgrades to keep pace with emerging threat capability and increase in LRASM quantities through the FYDP.
>
> **Advanced Anti-Radiation Guided Missile (AARGM) & AARGM Extended-Range**
>
> AARGM procurement completed in FY 2021 with deliveries continuing through FY 2024 in support of the transition to AARGM-ER. AARGM-ER provides the Department of the Navy with a 5th Generation compatible extended range asset to project power and provide Suppression of Enemy Air Defenses, both at-sea and on land. There have been 1218 AARGMs (All Up Rounds, Training Missiles, and Spares) delivered to the Fleet (as of 26 May 2021). Program of record delivery is 1803 missiles. The FY 2022 President's Budget supports an AARGM-ER ramp in production through FYDP and supports transition into system-level developmental testing and operational testing of production representative hardware.[126]

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 missile integrated on a left wing pylon of a Boeing F/A-18F Super Hornet in flight."[127]

The issue of the operating range of Navy carrier air wings is a key component of an ongoing debate over the future survivability, utility, and cost-effectiveness of aircraft carriers and their air wings, with critics arguing that the current operating range of Navy carrier air wings will force Navy aircraft carriers to operate well within the ranges of Chinese ASBMs or other A2/AD systems, which could put the carriers' survivability at substantial risk, or alternatively require carriers to operate beyond the range of those Chinese A2/AD systems, in locations that are safer but so far away that the carriers and their air wings will contribute little combat capability.

A key U.S. Navy program for increasing the operating range of Navy carrier air wings is the MQ-25 Stingray program, which is a program to acquire a carrier-based unmanned aerial vehicle (UAV) for use as a tanker for in-flight refueling of manned carrier-based aircraft (with a secondary mission of intelligence, surveillance, and reconnaissance). Some observers, while not

[126] Statement of Frederick J. Stefany, Acting Assistant Secretary of the Navy for Research, Development and Acquisition (ASN (RD&A)) and Vice Admiral James W. Kilby, Deputy Chief of Naval Operations, Warfighting Requirements and Capabilities (OPNAV N9) and Lieutenant General Eric M. Smith, Deputy Commandant, Combat Development and Integration, Commanding General, Marine Corps Combat Development Command, before the Subcommittee on Seapower of the Senate Armed Services Committee on Department of the Navy Fiscal Year 2022 Budget Request for Seapower, June 8, 2021, pp. 26-27.

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

necessarily objecting to the MQ-25 program, argue that the Navy should do more to increase the operating range of Navy carrier air wings, such as developing a stealthy, carrier-based UAV capable of penetrating enemy air defenses and striking land targets at very long ranges.

The issue of acquisition policies and the metrics for judging their success is discussed in more detail in another CRS report.[128]

Legislative Activity for FY2022

The Navy's proposed FY2022 budget was submitted to Congress on May 28, 2021.

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 include but are not limited to the following:

- CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report RL32418, *Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress*, by Ronald O'Rourke
- CRS In Focus IF11826, *Navy Next-Generation Attack Submarine (SSN[X]) Program: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report RS20643, *Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report RL30563, *F-35 Joint Strike Fighter (JSF) Program*, by Jeremiah Gertler (the JSF program is a joint DOD program with Navy participation)
- CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke
- CRS In Focus IF11679, *Navy DDG(X) Next-Generation Destroyer Program: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report RL33745, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report R44972, *Navy Constellation (FFG-62) Class Frigate Program: Background and Issues for Congress*, by Ronald O'Rourke
- CRS Report R46374, *Navy Light Amphibious Warship (LAW) Program: Background and Issues for Congress*, by Ronald O'Rourke
- CRS In Focus IF11674, *Navy 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 Lasers, Railgun, and Gun-Launched Guided Projectile: Background and Issues for Congress*, by Ronald O'Rourke

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

FY2022 National Defense Authorization Act (H.R. 4350/S. 2792)

House

The House Armed Services Committee, in its report (H.Rept. 117-118 of September 10, 2021) on H.R. 4350, states

> Mine Warfare
>
> Given advances in mine warfare and the important role it could play in a high-intensity conflict, the committee is concerned about the People's Liberation Army Navy (PLAN) in both mine warfare capability and capacity. The committee requires additional information regarding the U.S. Navy's own offensive and defensive mine warfare capabilities. Therefore, the committee directs the Secretary of Defense to provide a briefing to the House Committee on Armed Services, not later than March 1, 2022, detailing the projected impact to U.S. operational plans of PLAN mine warfare operations, including but not limited to, a conflict over Taiwan. The briefing should examine the following questions:
>
> (1) What would be the objectives of Chinese employment of mine warfare in an invasion of Taiwan?
>
> (2) Do present PLAN mine warfare capabilities allow the People's Republic of China to meet the objectives described in paragraph (1)?
>
> (3) What countermeasures are Taiwan, the United States, and other partners able to employ that might reduce the effectiveness of the PLAN's mine warfare?
>
> (4) What would be the optimal use of U.S. and Taiwanese offensive and defense mine warfare capabilities to contribute to efforts to deny a fait accompli against Taiwan?
>
> (5) Do either the U.S. or Taiwanese Navy currently maintain the capabilities described in paragraph (4)? If not, what resources, platforms, or ordinances would be required to obtain said capabilities?
>
> (6) How would the additions described in paragraph (5) contribute to the ability of the Department of Defense to execute its operational plans? (Page 245)

H.Rept. 117-118 also states

> PLA Civilian Strategic Mobility Capacity
>
> The committee remains focused on deterring Chinese aggression, and particularly the threat of military force against Taiwan. To that end, the committee is concerned by the recent reports surrounding the People's Liberation Army Navy's (PLAN's) potential use of civilian vessels to expand the size of its amphibious lift capacity as well as the potential use of other non-military, stateowned or private assets to assist in the invasion of Taiwan. Consequently, the committee directs the Commander of U.S. Indo-Pacific Command to submit a report to the congressional defense committees no later than January 1, 2022, including:
>
> (1) An assessment of the People's Liberation Army Navy amphibious transport capacity, including an analysis of the role that commercial ferries and other relevant private or publicly-owned vessels could play during an invasion of Taiwan;
>
> (2) An assessment of the potential use of civilian airliners for military purposes, including to support of an invasion of Taiwan;
>
> (3) An analysis of how the capabilities outlined in paragraphs (1) and (2) could impact the ability of the People's Republic of China to execute a successful invasion of Taiwan, the operational planning assumptions of Indo-Pacific command, and any required capability

> or force structure changes to successfully prevent a fait accompli against Taiwan. (Page 247)

H.Rept. 117-118 also states

> Report on Anti-Ship Systems for Defense of Taiwan
>
> The committee supports the strategic partnership between the United States and Taiwan, and notes the importance of anti-ship systems in defending the territorial integrity of the Government of Taiwan. The committee further notes the urgent need for ground-based anti-ship cruise missiles, ground-based cruise missiles, and anti-ship mines to defend United States and allied forces in the Indo-Pacific against growing threats and deter conflict in the region. The committee strongly supports an effort to expand defense industrial cooperation with the Government of Taiwan. Therefore, the committee directs the Secretary of Defense to submit to the congressional defense committees a report by January 31, 2022, on what anti-ship systems and capabilities in the extant U.S. military hardware inventory might be used to enhance the defense of Taiwan, and plans on how these systems and capabilities could be incorporated into the current military of the Government of Taiwan to enhance their self-defense capabilities. (Page 248)

Senate

The Senate Armed Services Committee, in its report (S.Rept. 117-39 of September 22 [legislative day, September 21], 2021) on S. 2792, states

> Comparative assessment of naval shipbuilding costs
>
> The committee believes that one aspect of defense strategy implementation is a detailed understanding of the relative purchasing power for similar weapons systems among the great power competitors. To this end, the committee desires a better understanding of the comparative costs of naval shipbuilding in the United States, China, and Russia.
>
> Therefore the committee directs the Secretary of the Navy to submit, not later than March 1, 2022, a report to the congressional defense committees on the comparative costs of naval shipbuilding in the United States, China, and Russia. The report shall include a comparison of the following costs in the United States, China, and Russia:
>
> > (1) The approximate end cost to construct an aircraft carrier, attack submarine, ballistic missile submarine, large surface combatant, small surface combatant, and amphibious ship. For each category of vessel, a description of the key quantitative and qualitative differences of the vessels being assessed with associated cost implications shall be included;
> >
> > (2) The approximate cost of key commodities used in naval shipbuilding, including one ton of steel;
> >
> > (3) The approximate cost of key labor resources used in naval shipbuilding, including one production labor hour, one electrician labor hour, and one design labor hour;
> >
> > (4) The approximate cost of key combat subsystems used in naval vessels, including air and missile defense radars, electronic warfare suites, anti-submarine capabilities, and shipboard combat system software. For each category of subsystem, a description of the key quantitative and qualitative differences of the subsystems being assessed with associated cost implications shall be included;
> >
> > (5) The approximate cost of key hull, mechanical, and electric subsystems used in naval vessels, including main engines, electrical generators, shafting, and air conditioning systems. For each category of subsystem, a description of the key quantitative and qualitative differences of the subsystems being assessed with associated cost implications shall be included; and

(6) Other cost drivers in naval shipbuilding, as identified by the Secretary, with the associated costs.

The report shall be submitted in unclassified form and may include a classified annex. (Pages 236-237)

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

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

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

- **A fleet's total number of ships (or its aggregate tonnage) is only a partial metric of its capability.** Many factors other than ship numbers (or aggregate tonnage) contribute to naval capability, including types of ships, types and numbers of aircraft, the sophistication of sensors, weapons, C4ISR systems, and networking capabilities, supporting maintenance and logistics capabilities, doctrine and tactics, the quality, education, and training of personnel, and the realism and complexity of exercises. In light of this, navies with similar numbers of ships or similar aggregate tonnages can have significantly different capabilities, and navy-to-navy comparisons of numbers of ships or aggregate tonnages can provide a highly inaccurate sense of their relative capabilities. In recent years, the warfighting capabilities of navies have derived increasingly from the sophistication of their internal electronics and software. This factor can vary greatly from one navy to the next, and often cannot be easily assessed by outside observation. As the importance of internal electronics and software has grown, the idea of comparing the warfighting capabilities of navies principally on the basis of easily observed factors such as ship numbers and tonnages has become increasingly less reliable, and today is highly problematic.
- **Total numbers of ships of a given type (such as submarines or surface combatants) can obscure potentially significant differences in the capabilities of those ships, both between navies and within one country's navy.** Differences in capabilities of ships of a given type can arise from a number of other factors, including sensors, weapons, C4ISR systems, networking capabilities, stealth features, damage-control features, cruising range, maximum speed, and reliability and maintainability (which can affect the amount of time the ship is available for operation).

A focus on total ship numbers reinforces the notion that changes in total numbers necessarily translate into corresponding or proportional changes in aggregate capability. For a Navy like China's, which is modernizing by replacing older, obsolescent ships with more modern and more capable ships, this is not necessarily the case. As shown in **Table 1** and **Table 2**, for example, China's attack submarine force today has only a modestly larger number of boats than it had in 2000 or 2005, but it has considerably more aggregate capability than it did in 2000 or 2005, because the force today includes a much larger percentage of relatively modern designs.

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

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

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

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

Although China's projected ASBM, as a new type of weapon, might be considered a "game changer," that does not mean it cannot be countered. There are several potential approaches for countering an ASBM that can be imagined, and these approaches could be used in combination. The ASBM is 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."[129]

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.[130] 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 flight include the SM-3 midcourse BMD interceptor missile (including the new Block IIA

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

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

version), the SM-6 terminal-defense BMD interceptor missile,[131] and accelerating development and deployment of the hypervelocity projectile (HVP), electromagnetic rail gun (EMRG), and solid state lasers (SSLs).[132] 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.[133]

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.

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[131] 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.

[132] For more on HVP, EMRG, and SSLs, see CRS Report R44175, *Navy Lasers, Railgun, and Gun-Launched Guided Projectile: Background and Issues for Congress*, by Ronald O'Rourke.

[133] 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.

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

> 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."[134]

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?

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

> While opinions are clearly mixed—in speaking to many sources over the last several years on this topic—it seems clear there is great nervousness in U.S. defense circles. However, as time has passed, initial fears have turned towards a more optimistic assessment....
>
> In the end, the weapon might not be the great "game-changer" that many point it out to be, but a great complicator.[135]

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.[136]

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[135] 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.

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

> A highly adaptive and deeply networked electronic warfare ecosystem could be particularly useful against long-range anti-ship missile strikes, especially using ballistic missiles, which would require targeting information from offboard platforms and the ability to send updated information to the weapon during the mid-course stage of flight….
>
> The Navy does have Arleigh Burke class destroyers outfitted specifically for ballistic missile defense, including the ability to launch the SM-3 Block IIA interceptor, which is designed to knock down ballistic missiles during the mid-course portion of their flight. Those ships are also slated to get interceptors designed to bring down hypersonic weapons in the future as part of the Regional Glide Phase Weapon System (RGPWS) program….
>
> The Navy, which has been looking to stop deploying Arleigh Burkes on dedicated missile defense missions, could seek to make more widespread use of the SM-3 Block IIA in the future. Those destroyers and other ships could gain additional missile defense capabilities as the improved Block IB variant of the SM-6 missile begins to enter service. Existing Block I and IA versions of the SM-6 already have the ability to intercept ballistic missiles during the terminal phase of their flight, as well as engage various other aerial and surface threats. The SM-6, in particular, potentially provides a potent defense against anti-ship ballistic missiles, especially those that break through mid-course traditional ballistic missile defenses, if mid-course ballistic missile defense assets are available at all.
>
> There's the possibility that Vice Admiral Trussler is aware of other developments in the classified realm that could further mitigate some or all of these threats, as well. Beyond that, there's no discounting that his public comments, which are certain to be scrutinized by the PLA itself, are a form of misinformation designed to prompt concerns within the Chinese military that its priorities may be, in some way, seriously off base.
>
> Whatever the case, the threat posed by China's anti-ship missile arsenal, which continues to grow in capability, including with the development of new anti-ship ballistic missiles, is real. At the same time, while the Navy obviously knows this, the service seems to be strongly hinting that it feels it making very good progress on getting around these challenges, or at least wants to make the Chinese think so.[137]

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."[138]

[137] 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.

[138] 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.

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