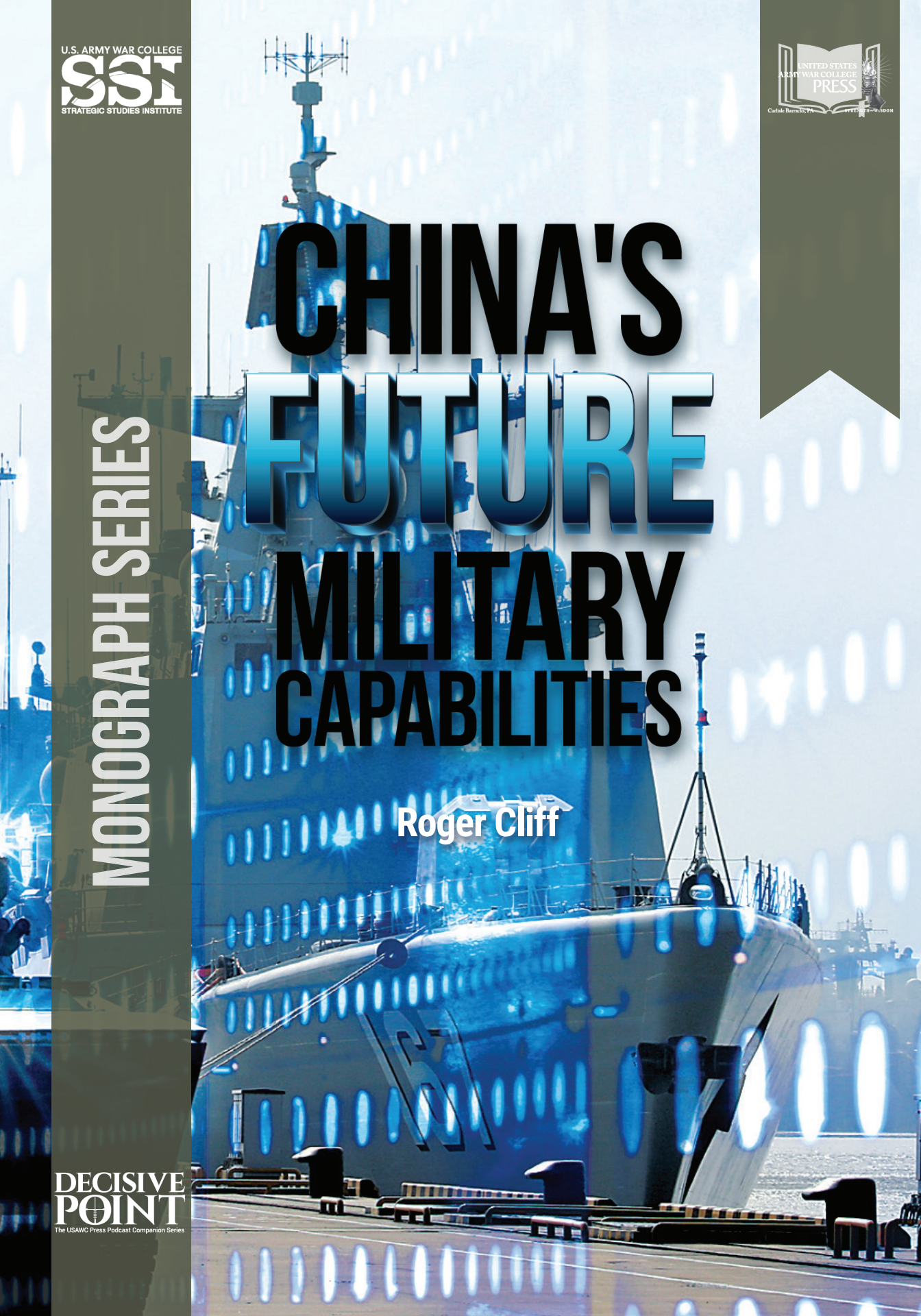
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China's Future Military Capabilities

Roger Cliff

April 2023

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Comments pertaining to this publication are invited and should be forwarded to: Director, Strategic Studies Institute and US Army War College Press, US Army War College, 47 Ashburn Drive, Carlisle, PA 17013-5244.

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Foreword

China's growing military power represents a challenge the United States has not faced in more than a generation. The *2022 National Defense Strategy of the United States of America* identifies China as the "pacing challenge" for the US military. Although the People's Liberation Army unveils new weapon systems on a regular basis, its overall plans for developing military capabilities are not well understood. In this monograph, Roger Cliff analyzes the People's Liberation Army's publications to produce the first publicly available description of the process by which China's military capabilities are developed and the specific capabilities the People's Liberation Army is seeking to acquire in the future.

Cliff finds the People's Liberation Army is engaged in a systematic, comprehensive program to field a dominant array of military capabilities. Countering these capabilities will require the United States and its allies to develop an equally systematic and comprehensive program. The United States can no longer take for granted its military's capabilities are the best in the world and sufficient to respond to any challenge it may face. Maintaining military superiority over China will require the development of capabilities and systems designed to address the specific types of problems the People's Liberation Army will present in the future. To maintain military superiority, US planners cannot simply react to the Chinese military's capabilities as they appear. This monograph provides the foundational knowledge planners will require to anticipate and counter the capabilities the People's Liberation Army will acquire in the future.

Carol V. Evans
Director, Strategic Studies Institute
and US Army War College Press

Executive Summary

This monograph examines the process by which China's military modernization priorities are determined and describes what appear to be the current modernization directions and priorities of China's military.

China's Process for Developing Military Capabilities

China's system for the development of military capabilities is far more opaque than that of the United States. Nonetheless, based on official publications of China's military, known as the People's Liberation Army (PLA), assembling a picture of the broad contours of this process is possible. The process is as follows.

At irregular intervals of five to 10 years, the Central Military Commission of the People's Liberation Army issues a set of "military strategic guidelines." Meanwhile, at regular intervals of every five years, based on the prevailing military strategic guidelines, each of the People's Liberation Army's services formulates a service development strategy that addresses the service's expected capability and force structure requirements over the next 20 years. Based on this overall service development strategy, an equipment development strategy that addresses the service's expected equipment needs over the next 20 years is developed. Next, based on the equipment development strategy, an overall, 10-year equipment development plan; a more detailed, five-year equipment development program; and a mid- to long-term "special equipment" development program are formulated.

At the same time the equipment programs are being developed, detailed five-year programs for personnel, operations, construction, and other elements of a defense program are likely also developed. Together with the five-year equipment development program and the first five years of the mid- to long-term special equipment development program, these plans and programs appear to represent the service's force development program. Finally, based on the force development program, annual defense budgets are developed.

The People's Liberation Army of the Future

None of the documents described in the preceding paragraphs appear to be publicly available. But China's periodic defense white papers, textbooks

used at the People's Liberation Army's military educational institutions, and other sources describe the broad directions of development the organization is pursuing. Based on these sources, the following can be concluded.

The PLA Army of the future will be smaller in size and organized into smaller units, with each unit capable of carrying out multiple types of combat missions. Infantry will primarily be transported by armored vehicles or helicopters rather than trucks, and most artillery will be self-propelled. Armored forces will include a mix of wheeled and tracked and light and heavy armor. The People's Liberation Army's organic air defense systems will become longer ranged and more capable. In addition, although the traditional branches of the PLA Army are being reduced and modernized, newer types of force elements will be expanded. The aviation forces will be enlarged in particular, but special operations, information operations, and electronic warfare forces will also receive a boost.

The PLA Navy of the future will be increasingly capable of operating far from China's shores. The mainstays of this navy will be aircraft carriers, nuclear submarines, and multipurpose, amphibious ships. Supporting these ships will be large destroyers, long-range underway replenishment ships, early-warning aircraft, and satellites. At the same time, the PLA Navy will continue to maintain an inshore defense force consisting of fast and lethal platforms and will have highly capable information warfare, electronic warfare, and special operations forces.

The PLA Air Force of the future will have reduced numbers of pure air superiority fighters but increased numbers of multirole fighters and bombers. In addition, the service will have a greater proportion of transport, early-warning and control, and electronic warfare aircraft. Furthermore, the PLA Air Force will promote the creation of an integrated air and missile defense system. Although the People's Liberation Army's space forces are currently controlled primarily by the PLA Strategic Support Force, the PLA Air Force may have its own space forces in the future as well.

If the PLA Rocket Force continues on its current trajectory, within a decade, China could field a nuclear force that is roughly comparable in size to those of the United States and Russia. The nuclear missiles operated by the rocket force will have improved responsiveness, range, accuracy, reliability, and lethality, and their penetration capabilities will be aided by warhead maneuvers, stealth, decoys, jamming, and the use

of multiple warheads per missile. Meanwhile, the rocket force's conventional missile forces will continue to increase in number, range, and accuracy. In addition, the rocket force apparently intends to develop a strategic missile defense system.

In the future, China's space forces, which are controlled by the PLA Strategic Support Force, will evolve from simply supporting terrestrial operations to being capable of conducting warfighting operations in space. Capabilities to support terrestrial operations will include systems for detecting and tracking enemy missile launches, reconnaissance and surveillance, surveying and mapping, meteorology, communications, information integration and combat management, and positioning, navigation, and timing. Capabilities for space warfighting will include space situational awareness, attacking targets in space using both soft-kill and hard-kill methods, and conducting space-to-Earth strikes.

The Strategic Support Force also controls China's cyberwarfare capabilities. As such, the force will continue to develop its capabilities for network espionage, technical espionage, and human espionage as well as its capabilities to paralyze adversarial information systems, steal information, tamper with adversarial information, harass adversarial networks, and provide adversaries with false intelligence.

Countering the People's Liberation Army of the Future

To counter such a force, US and allied militaries will need a range of capabilities. One is the capability of ground forces to evade and survive attack by highly mobile and lethal armor, infantry, artillery, and helicopter forces. Another is the capability to find, fix, and destroy such forces, which may be operating in complex terrain and will be defended by modern air defense systems, information operations, and electronic warfare forces.

In the naval arena, an important capability will be the ability to degrade the People's Liberation Army's naval reconnaissance and surveillance capabilities. The United States and its allies will need to develop the capability to detect, intercept, and destroy PLA satellites and early-warning aircraft as well as unmanned reconnaissance aircraft, surface vessels, and undersea systems. The countries will also need to develop the capability to blind, jam, or spoof the sensors carried by such systems. Also important will be the capability to defend US Navy ships against attack by long-range,

precision strike weapons such as anti-ship ballistic missiles and supersonic, anti-ship cruise missiles.

Another important capability will be the ability to find and sink the People's Liberation Army's ships and submarines, including the capability to locate PLA ships and submarines in a contested air and space environment and to attack them with weapons capable of penetrating the defenses of PLA Navy vessels. The latter capability will require the United States and its allies either to acquire weapons capable of being launched from platforms operating beyond the range of most PLA anti-ship, anti-submarine, and antiair systems or to carry weapons in platforms that are capable of surviving within the engagement envelopes of the People's Liberation Army's weapons.

In the air arena, the United States and its allies will need to be able to defend their air bases and other key targets from attacks by large numbers of aircraft armed with long-range, precision strike weapons. Such defense will require the ability to detect and track Chinese aircraft and cruise missiles in an intense electronic warfare environment, and then engage and destroy them from standoff ranges.

When conducting offensive air operations, the United States and its allies will need the capability to penetrate a Chinese air defense system that includes advanced fighter aircraft supported by reconnaissance, early-warning and control, and electronic warfare aircraft as well as ground-based radars and jamming systems and long-range, surface-to-air missiles.

On the rocket force, the US military must be prepared to be attacked by large numbers of conventional ballistic and cruise missiles. Even in a "limited" war, these attacks might not be confined to targets in the western Pacific; the rocket force could also target forces and facilities in Hawaii, Alaska, or the contiguous United States. Countering such attacks will require active and passive missile defenses; the ability to operate from dispersed, austere locations far from Chinese territory; and the ability to recover from the effects of the attacks rapidly.

In the face of the Strategic Support Force's space, counterspace, and cyber capabilities, US and allied militaries will need to be capable of operating with some or all of their space systems degraded or destroyed. In view of these circumstances, the US military should either acquire counterspace capabilities that are at least as effective as those the People's Liberation Army is acquiring or reach a verifiable, enforceable arms control agreement with China that prevents the development and employment of such weapons. In the meantime,

the United States should aggressively bring to the world's attention Beijing's hypocrisy in claiming to oppose the weaponization of space while the People's Liberation Army openly declares its intention to engage in it.

In the cyber arena, the US military must continue to increase its capabilities to prevent Strategic Support Force cyber forces from infiltrating US military systems, detect such intrusions if they do occur, and purge and repair or reconstitute the affected systems.

Conclusion

China's military is engaged in a systematic, comprehensive program to field a dominant array of military capabilities. Countering these capabilities will require the United States and its allies to pursue an equally systematic and comprehensive program.

Introduction

The *2022 National Defense Strategy of the United States of America* calls on the Department of Defense to sustain and strengthen US deterrence, noting China is the pacing challenge.[1] Although the current capabilities of China's military, known as the People's Liberation Army (PLA), are well documented, much less information is publicly available on the capabilities the military intends to acquire in the future.[2] This monograph examines the process by which China's military modernization priorities are determined and describes the People's Liberation Army's apparent current modernization directions and priorities.

In his official report to the 19th National Congress of the Chinese Communist Party in October 2017, China's top leader and General Secretary of the Chinese Communist Party, Xi Jinping, called on the nation to strive to have "largely realized" (基本实现) the modernization of national defense and the military by 2035. In addition, in Xi's report to the 20th National Congress of the Chinese Communist Party in October 2022, he referred to the "goals for the centenary of the People's Liberation Army in 2027."[3] But an extensive search of Chinese sources did not turn up a definition of what "largely realizing" the modernization of national defense and the military means or what the "goals for the centenary of the People's Liberation Army" are.

Indeed, very few official documents describing the People's Liberation Army's modernization plans are publicly available. Given this challenge, the analytic approach taken for this project consisted of two parts. First was examining authoritative PLA publications such as encyclopedias, textbooks, and defense white papers to understand the generic features of the People's Liberation Army's

1. Department of Defense (DoD), *2022 National Defense Strategy of the United States of America* (Washington, DC: DoD, October 27, 2022).

2. Office of the Secretary of Defense (OSD), *Military and Security Developments Involving the People's Republic of China 2022* (Washington, DC: OSD, 2022).

3. Xi Jinping, "习近平: 决胜全面建成小康社会 夺取新时代中国特色社会主义伟大胜利—在中国共产党第十九次全国代表大会上的报告" [Xi Jinping: Decisively and comprehensively create moderately prosperous society, seize the great victory of socialism with Chinese characteristics in the new era – Report to the 19th National Congress of the Chinese Communist Party] (speech, 19th National Congress of the Chinese Communist Party, Beijing, China, October 10, 2018), http://www.gov.cn/zhuanti/2017-10/27/content_5234876.htm; and Xi Jinping, "Hold High the Great Banner of Socialism with Chinese Characteristics and Strive in Unity to Build a Modern Socialist Country in All Respects" (speech, 20th National Congress of the Chinese Communist Party, Beijing, China, October 16, 2022), https://www.fmprc.gov.cn/eng/zxxx_662805/202210/t20221025_10791908.html.

capability development process. This endeavor provided a framework and context for understanding how capabilities or programs emerge. The second part was analyzing some of these same sources as well as PLA newspapers and academic journals to identify the People's Liberation Army's long-standing and more recent modernization priorities.

As a note, this monograph does not attempt to assess the People's Liberation Army's prospects for actually acquiring the capabilities it seeks. The monograph simply describes the process by which these capabilities are identified and tries to determine, to the extent possible given limitations on publicly available material, the People's Liberation Army's current modernization priorities and direction. Assessing the People's Liberation Army's prospects for actually acquiring these capabilities is outside the scope of this monograph. Readers who wish to know how that topic might be approached may refer to the Evan S. Medeiros et al. RAND monograph, *A New Direction for China's Defense Industry,* and the Roger Cliff book, *China's Military Power: Assessing Current and Future Capabilities*.

The US Military Capability Development System

To understand what types of information might be available about China's future military capabilities, one might consider the US military modernization process and the types of information that are available about the military capabilities the United States plans to possess in 2035. The US government produces multiple documents related to long-term strategy and force development. At the strategic level, these documents include the *National Security Strategy*, issued by the president; the *National Defense Strategy*, issued by the secretary of defense; and the *National Military Strategy*, issued by the chairman of the Joint Chiefs of Staff. Guided by these strategy documents, the Department of Defense (DoD) then produces a document called the *Defense Planning Guidance*, which provides the department's force development planning and resource priorities.[4] Based on the *Defense Planning Guidance*, each service and defense agency then compiles a program objective memorandum (POM) that indicates how much funding the service would like to allocate to each of its

4. "Funds Management Platinum Card," Defense Acquisition University (website), February 2022, https://www.dau.edu/tools/Lists/DAUTools/Attachments/156/Platinum%20Card%20Feb%202022.pdf; *DAU Glossary of Defense Acquisition Acronyms and Terms*, s.v., "Defense Planning Guidance," accessed on July 5, 2022, https://www.dau.edu/glossary/Pages/GlossaryContent.aspx?itemid=27282; and "Defense Planning Guidance (DPG)," School of Strategic Landpower (website), n.d., https://ssl.armywarcollege.edu/dde/documents/jsps/terms/dpg.cfm.

programs and activities for the five-year period following the next budget year (for example, in fiscal year [FY] 2022, each service and defense agency produced a POM for the FY 2024–28 period).[5] The POMs are then reviewed and adjusted by the Department of Defense leadership in consultation with the Office of Management and Budget and combined into a database called the Future Years Defense Program that forms the basis for the Department of Defense's annual budget request, which is typically transmitted to Congress in February of the preceding fiscal year.

Thus, the administration's budget request for FY 2024 (which will begin on October 1, 2023), based on POMs developed in FY 2022, was submitted in March 2023.[6] The Defense Planning Guidance, POMs, and Future Years Defense Program are not publicly available, but the "budget justification materials" the Department of Defense submits to Congress with its budget request contain much of the information in the Future Years Defense Program, including how many of each major weapon system will be procured over the next five years and the amounts programmed for each nonclassified research and development program over the next five years. For instance, the US Air Force's FY 2023 budget estimates show, among other details, how many F-35A Lightning II Joint Strike Fighters the service plans to purchase and how much it plans to spend on its Next Generation Air Dominance program for each fiscal year through fiscal year 2027.[7]

The Department of Defense also produces documents that outline its longer-term acquisition plans. For example, the department publishes the US Navy's 30-year shipbuilding plan, which is publicly available.[8] The department also publishes Selected Acquisition Reports. These reports, which are produced for each major weapon system, usually are not publicly available, but they are unclassified and subject to Freedom of Information Act requests. As a result, some Selected Acquisition Reports, such as those from 2019, have been released to the public. In these reports, one can see

5. *DAU Glossary of Defense Acquisition Acronyms and Terms*, s.v. "Program Objective Memorandum," accessed on July 5, 2022, https://www.dau.edu/glossary/Pages/GlossaryContent.aspx?itemid=28273.

6. *DAU Glossary of Defense Acquisition Acronyms and Terms*, s.v. "Future Years Defense Program," accessed on July 5, 2022, https://www.dau.edu/glossary/Pages/GlossaryContent.aspx?itemid=27560.

7. Department of the Air Force (DAF), *Department of Defense Fiscal Year (FY) 2023 Budget Estimates: Air Force Justification Book: Aircraft Procurement, Air Force* (Washington, DC: DAF, April 2022), 1:1–1:6; and DAF, *Department of Defense Fiscal Year (FY) 2023 Budget Estimates: Air Force Justification Book: Research, Development, Test & Evaluation, Air Force* (Washington, DC: DAF, April 2022), 2:357.

8. Deputy Chief of Naval Operations (CNO) (Warfighting Requirements and Capabilities – OPNAV N9), *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels* (Washington, DC: Office of the CNO, December 9, 2020).

the Department of Defense's long-term acquisition plans for major weapon systems. For instance, one 2019 Selected Acquisition Report details the number of F-35As theAir Force, Navy, and US Marine Corps planned to purchase each year through 2044 at the time of their FY 2021 budget submissions.[9]

In addition to department-wide strategy documents such as the *National Defense Strategy* and the *National Military Strategy*, the services produce their own long-term strategy documents, some of which are made public. In 2018, for example, the US Army issued a publication called *The Army Strategy*. This document describes the Army's overall strategy for maintaining its capability to conduct combat operations in the near term as well as its plans to modernize for the future over the coming decade. The section on modernization describes how the Army intends to change its concepts and doctrine, material capabilities, and organization in coming years. In particular, the strategy identifies six priority areas for the modernization of the Army's equipment.[10]

In 2019, the Army issued another two strategy documents: the *Army People Strategy* and the *Army Modernization Strategy*. The latter document, which expands on the modernization portion of *The Army Strategy*, is divided into three parts: concepts, doctrine, organizations, and training; material development and procurement; and leader development, education, and talent management. The section on material development and procurement describes the same six modernization priorities as the Army Strategy and also identifies three to five specific weapon development programs for each modernization priority. For instance, four programs are associated with the next-generation combat vehicle priority: an optionally manned fighting vehicle, an armored multipurpose vehicle, mobile protected firepower (that is, a light tank), and a robotic combat vehicle.[11] Thus, these documents describe the types of new systems the Army plans to develop and acquire in the future, in addition to the existing weapon systems the service plans to acquire in coming years, as described in its budget justification documents.

Similarly, in December 2020, the Department of the Navy published a document titled *Advantage at Sea: Prevailing with Integrated All-Domain Naval Power*, which describes the overall strategy of the United States'

9. Defense Acquisition Management Information Retrieval, *F-35 Lightning II Joint Strike Fighter (JSF) Program (F-35)* (Washington, DC: DoD, December 2019).

10. Mark A. Milley and Mark T. Esper, *The Army Strategy* (Washington, DC: Headquarters, Department of the Army, 2018).

11. Michael A. Grinston, James C. McConville, and Ryan D. McCarthy, *2019 Army Modernization Strategy: Investing in the Future* (Washington, DC: Headquarters, Department of the Army, 2019), 1, 6–7.

three maritime forces: the Navy, Marine Corps, and US Coast Guard.[12] Subsequently, in January 2021, the department published the *CNO NAVPLAN*—the chief of naval operations' strategy for the Navy.[13] In addition, as noted earlier, each year the Navy publishes its shipbuilding plan, which is mandated by Congress, for the next 30 years. This report lists how many of each major ship type the Navy plans to build and maintain over a 30-year period.[14] Although the 30-year shipbuilding plan contains little specific information about the capabilities and characteristics of each class of ship, the information can be found in other sources, including the *US Navy Program Guide*, which is published every few years (most recently, in 2017) and the Navy's online "Fact Files," which, in addition to the ships the Navy plans to build, have detailed descriptions of other systems the Navy is acquiring, including aircraft, weapons, and sensors.[15]

Likewise, almost annually since 2018, the Air Force has issued a "posture statement" that effectively serves the service's strategy. The posture statement issued in 2021 describes the capabilities the Air Force plans to acquire by 2030, including specific systems such as the Long-Range Standoff Weapon, Air Launched Rapid Response Weapon, and Advanced Battle Management System as well as programs that are described in more general terms, such as "survivable, relevant" intelligence, surveillance, and reconnaissance platforms.[16]

The People's Liberation Army's Military Strategic Guidelines

China's military capability development system differs from that of the United States. The starting point in the Chinese system is the "military strategic guidelines" (军事战略方针), which the Central Military Commission,

12. Deputy CNO for Warfighting Development (OPNAV 7), Deputy Commandant for Plans, Policies, and Operations, and Deputy Commandant for Operations, *Advantage at Sea: Prevailing with Integrated All-Domain Naval Power* (Washington, DC: Office of the CNO, Headquarters, Marine Corps, and US Coast Guard Headquarters, December 2020).

13. Michael M. Gilday, *CNO NAVPLAN* (Washington, DC: Office of the CNO, January 2021).

14. Deputy CNO (Warfighting Requirements and Capabilities – OPNAV N9), *Report to Congress*.

15. Department of the Navy (DN), *US Navy Program Guide 2017* (Washington, DC: DN, 2017); and "Fact Files," US Navy (website), n.d., https://www.navy.mil/Resources/Fact-Files/.

16. John P. Roth, Charles Q. Brown Jr., and John W. Raymond, *Department of the Air Force Posture Statement: Fiscal Year 2022* (Washington, DC: DAF, 2021).

the highest-level military organization in China, issues or revises every few years.[17]

Different sources describe somewhat different contents for the military strategic guidelines, but, according to the most recent (2020) edition of *Science of Strategy*, an authoritative textbook published by the People's Liberation Army's National Defense University, the guidelines should specify:

> 1. the primary strategic adversary and the primary target of military operations;
>
> 2. the region of strategic emphasis and the "primary strategic direction";
>
> 3. the basis of war preparations;
>
> 4. strategic guiding thought and principles;
>
> 5. fundamental operational concepts;
>
> 6. strategic guidance for military conflict in each theater and realm of conflict;
>
> 7. military strategic posture; and
>
> 8. requirements of military force development and preparations for military conflict.[18]

The complete text of a set of military strategic guidelines does not appear to have ever been made publicly available, and, when describing them, Chinese sources never state the title of a specific publication, as would be indicated by the use of double angle brackets (《》) enclosing the document title. But descriptions of the military strategic guidelines refer to them as having been "formulated" (制定), a verb that is used for official publications such as laws, regulations, and plans, suggesting the guidelines are codified in a document.[19] The reason the title of the publication is never explicitly cited is unclear.

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17. Xiao Tianliang 肖天亮 et al., 战略学,《战略学（2020年修订）》[Science of strategy (2020 revision)] (Beijing: National Defense University Press, 2020), 16–17.

18. Xiao Tianliang et al., *Science of strategy*, 58–61.

19. Zhang Xingxing 张星星, "中国特色强军之路的接续探索和历史统一" [The continuous exploration and unified history of the road to a strong military with Chinese characteristics],《当代中国史研究》[*Contemporary China History Studies*] 26, no. 5 (September 2019): 155–57; State Council Information Office of the People's Republic of China (PRC) 中华人民共和国国务院新闻办公室,《中国的军事战略》[China's military strategy] (Beijing: State Council of the PRC, May 2015); and《现代汉语词典》[Dictionary of modern Chinese], rev. ed. (2002), s.v., "制定" [formulated].

Military strategic guidelines have been issued or revised 10 times since the founding of the People's Republic in 1949. One particularly significant revision of the guidelines occurred in January 1993, in the wake of the overwhelming victory of the US-led coalition in the Persian Gulf War, which shocked the People's Liberation Army by dramatically demonstrating the obsolescence of its weapons and doctrine.[20] The 1993 guidelines were referred to as the "Military Strategic Guidelines for the New Period" (新时期军事战略方针).[21] Among other features, the 1993 guidelines specified the "basis of war preparations" (the third element of the guidelines described in *Science of Strategy*) to be "local wars under conditions of modern technology, especially high technology" (现代技术特别是高技术条件下的局部战争).[22]

But how the 1993 guidelines described the capabilities the People's Liberation Army was to acquire is unknown. According to a 2019 article by two researchers at China's Academy of Military Sciences, the 1993 guidelines were "systematically" described for the first time in a white paper on national defense issued by the Chinese government in 2002, but the paper only contains three paragraphs on the guidelines.[23] These paragraphs summarize what the guidelines say about the types of conflict the People's Liberation Army was focused on preparing for, the military's overall strategy for acquiring the ability to prevail in such conflicts, China's strategy for avoiding and preventing military conflict, the country's nuclear weapon policy, and how China applied the concept of "people's war" (人民战争). But the descriptions are brief and general, and the passage on the capabilities the People's Liberation Army needed to develop simply says "capabilities for joint operations, mobile operations, and conducting multiple types of missions."[24]

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20. Shi Qingren [释清仁], "新中国成立以来人民军队转型建设的历史演变" [Historical evolution of PLA transformation and construction after the founding of P. R. China],《军事历史》[*Military History*] 6 (2019): 5.

21. Zhang Xingxing, "Continuous exploration," 155–56; and Shi Qingren, "Historical evolution," 6.

22. Zhang Xingxing, "Continuous exploration," 156; Li Yinxiang 李银祥 and Song Wenchao 宋文超, "改革开放四十年军事战略方针调整论析" [An assessment of adjustments to the military strategic guidelines during forty years of reform and opening],《军事历史》[*Military History*] 6 (2018): 7; M. Taylor Fravel, *Active Defense: China's Military Strategy since 1949* (Princeton, NJ: Princeton University Press, 2019), 179; State Council Information Office, *China's military strategy*; and Shi Qingren, "Historical evolution," 6.

23. Cao Yanzhong 曹延中 and Deng Bibo 邓碧波, "中国历届国防白皮书创新回顾" [Retrospective on innovation in the history of China's national defense white papers],《国防》[*National Defense*] 8 (2019): 19.

24. State Council Information Office of the PRC,《2002年中国的国防》[China's national defense in 2002] (Beijing: State Council of the PRC, February 2002).

The Central Military Commission revised the 1993 guidelines in June 2004. This revision included changing the basis of war preparations from "local wars under conditions of modern technology, especially high technology" (sometimes abbreviated as "local wars under high technology conditions") to "local wars under informatized conditions" (信息化条件下的局部战争).[25] According to the Academy of Military Sciences researchers, the "fundamental concepts" of the 2004 guidelines are systematically described in China's "2008" defense white paper (which was actually published in January 2009).[26] This white paper contains a total of four paragraphs summarizing the guidelines, but, as with the 2002 white paper, the descriptions are brief and general. The description of the military capabilities called for by the revised guidelines only states the guidelines emphasize improving capabilities to respond to multiple types of security threats and to carry out "diversified" military missions; strengthening the capability to win local wars under informatized conditions; and increasing capabilities to protect the security of the oceans, outer space, and electromagnetic space and to conduct counterterrorism and stability, humanitarian assistance and disaster relief, and international peacekeeping missions.[27]

In July 2014, the Central Military Commission formulated and implemented a new set of military strategic guidelines called the "Military Strategic Guidelines under the New Circumstances" (新形势下军事战略方针). Under these guidelines, the basis of war preparations was changed from "winning local wars under informatized conditions" to "winning informatized local wars" (打赢信息化局部战争). Although the phrases are almost identical (in both English and Chinese), according to an article by a researcher at the Chinese Academy of Social Sciences, the content underwent a "momentous change" (重大变化). Nevertheless, the article does not elaborate on the nature of the change.[28]

The 2014 guidelines being described as having been "formulated," rather than simply "further enriched and refined," as was the case in 2004, and the guidelines being given a new name, "Military Strategic Guidelines

25. Zhang Xingxing, "Continuous exploration," 156; Li Yinxiang and Song Wenchao, "Assessment of adjustments," 8; State Council Information Office, *China's military strategy*; and Shi Qingren, "Historical evolution," 6.

26. Cao Yanzhong and Deng Bibo, "Retrospective on innovation," 19.

27. State Council Information Office of the PRC,《2008年中国的国防》[China's national defense in 2008] (Beijing: State Council of the PRC, January 2009).

28. Zhang Xingxing, "Continuous exploration," 156–57; Li Yinxiang and Song Wenchao, "Assessment of adjustments," 8; and Shi Qingren, "Historical evolution," 9.

under the New Circumstances"—whereas the 1993 and 2004 guidelines were referred to as "Military Strategic Guidelines for the New Period"—suggest the 2014 guidelines were significantly different from the 2004 guidelines. But once again, detailed information explicitly about the substance of the 2014 guidelines is difficult to find. China's 2015 defense white paper contains four paragraphs that summarize the new guidelines, but, as with the 2002 and 2008 white papers, the descriptions are brief and general. And although the text in the 2015 white paper differs in some instances from the description of the 2004 guidelines in the 2008 white paper, the differences do not appear to be any greater than those between the text in the 2008 white paper and that in the 2002 white paper. The most notable change between the 2004 and 2014 guidelines, other than the change in the term for the basis of war preparations, appears to be the prominence given to military conflict at sea and preparations for such conflict. The description of the 2014 military strategic guidelines in the 2015 white paper does not refer to any specific military capabilities required by the new military strategic guidelines.[29]

Sometime after the 19th National Congress of the Chinese Communist Party in 2017, the Central Military Commission apparently established another new set of military strategic guidelines called "Military Strategic Guidelines for the New Era" (新时代军事战略方针). These guidelines are said to have made Xi Jinping's military strategic thought the fundamental guiding thought for military strategy in the "new era" and to provide authoritative guidance for realizing the party's goal of developing a strong military, cultivating a world-class military, and winning informatized wars.[30] According to the article by the Academy of Military Sciences researchers, the new guidelines were systematically explained for the first time in the Chinese government's 2019 defense white paper.[31] The use of a new name for the military strategic guidelines ("Military Strategic Guidelines in the New Era," as opposed to "Military Strategic Guidelines under the New Circumstances") suggests the guidelines were significantly changed. But the discussion of the military strategic guidelines in the 2019 white paper is even briefer than that in previous white papers: The 2019 discussion is about a third of the length of the 2015 discussion,

29. State Council Information Office, *China's national defense in 2002*; State Council Information Office, *China's national defense in 2008*; State Council Information Office, *China's military strategy*; Cao Yanzhong and Deng Bibo, "Retrospective on innovation," 20; and Shi Qingren 释清仁, "历史逻辑视域下的军队转型" [Force transformation from the perspective of historical logic], *PLA Daily*, December 17, 2019, 9.

30. Shi Qingren, "Historical evolution," 9; and Xiao Tianliang et al., *Science of strategy*, 3.

31. Cao Yanzhong and Deng Bibo, "Retrospective on innovation," 19.

and much of the text is similar to text in the 2015 white paper. The 2019 white paper makes no mention of the basis of war preparations and does not use the term "informatized local wars" anywhere. But, in the section entitled "Global Military Competition Is Intensifying," the 2019 white paper states the form of warfare is evolving more rapidly toward informatized warfare (战争形态加速向信息化战争演变).[32] Moreover, the 2020 edition of *Science of Strategy* explicitly states, "For now and a certain period after the present, informatized local wars will be the main form of war that China faces" (在当前和今后一个时期,信息化局部战争是我国未来面临的主要战争形态), suggesting the new guidelines did not change the basis of war preparations.[33]

Equipment and Force Development

According to Chinese sources, the next step in China's process for military capability development is the formulation of an "equipment development strategy" (装备发展战略) or "equipment scientific research development strategy" (装备科研的发展战略).[34] This strategy is said to outline the People's Liberation Army's overall approach to developing equipment over the long term and to describe requirements, concepts, objectives, focus areas, and initiatives for the military's equipment development.[35] According to one source, the strategy normally covers a period of 20 years.[36] The equipment development strategy is said to be revised usually once every five years by the People's Liberation Army's "highest administrative organization for equipment" (装备最高管理部门), which presumably was the General Armaments Department—that is, until 2016, when it was reformed into the Central Military Commission's Equipment Development Department.

32. State Council Information Office of the PRC,《新时代的中国国防》[China's national defense in the new era] (Beijing: State Council of the PRC, July 2019).

33. Xiao Tianliang et al., *Science of strategy*, 3, 5–6, 332.

34. 中国军事百科全书: 学科分册 [China military encyclopedia: Subject volume], 2nd ed. (2008), s.v. "军事装备总论" [Military equipment overview]; Fang Meng 方猛, Bai Haiwei 白海威, and Zhang Liye 张丽叶, "装备费用估算工作管理研究" [Research on management of equipment expenditure estimation work],《理论观察》[*Theoretic Observation*] 5 (2012): 66; Deng Huanlin 邓焕林, "陆军装备论证中存在的问题与对策研究" [Analysis and recommendations for problems existing in army equipment validation],《科技信息》[*Science & Technology Information*] 11 (2013): 141; and Du Panlin 杜盼林, Liu Hongqi 刘红旗, and Yang Lei 杨磊, "议型号装备研制工作特点及组织管理" [Critique of the characteristics and organizational management of system research and manufacturing work],《中国军装民》[*Defense Industry Conversion in China*] 12 (2013): 48.

35. *China military encyclopedia*.

36. Deng Huanlin, "Analysis and recommendations," 141.

The revisions are said to be based on the national development strategy, military strategy, the assigned missions and tasks of the People's Liberation Army, China's national defense science and technology resources, the overall state of China's development and reform, the global revolution in military affairs, and weapon development trends in major countries.[37]

According to these sources, once the equipment development strategy has been issued, a 10-year equipment development plan (装备建设十年规划), a five-year equipment development program (装备建设五年计划), and a mid- to long-term special equipment development program (装备建设中长期专项计划) are formulated.[38] (The Chinese use the term "plan" (规划) to describe general capabilities and objectives, but the term "program" (计划) implies specific funding items and amounts. Since the 11th Five-Year Plan for National Economic and Social Development, which began in 2006, both types of documents have been referred to as "plans.") According to one source, PLA regulations state the five-year equipment development program should include guiding thought; development targets; equipment categories; assessment methods; and the performance requirements, timelines, and financing arrangements of research and manufacturing programs.[39]

Finally, based on the five-year equipment development program and mid- to long-term special equipment development program, annual equipment research and production programs (装备研制年度计划) are formulated.[40]

Although the sources on which the above information is based are not explicit, this information probably describes only the capability development process of the PLA Army, as opposed to that of the entire military. At the time these sources were published, the PLA Army constituted the bulk of the People's Liberation Army. As a result, the PLA Army was often conflated with the People's Liberation Army as whole in PLA publications, with the other services being treated as special cases.

Descriptions of the capability development processes of the PLA Navy, Rocket Force, Strategic Support Force, and Joint Logistic Support Force were not found for this study, but the 2005 China Air Force Encyclopedia

37. *China military encyclopedia*.

38. *China military encyclopedia*; Fang Meng, Bai Haiwei, and Zhang Liye, "Research on management," 66; Deng Huanlin, "Analysis and recommendations," 141; and Du Panlin, Liu Hongqi, and Yang Lei, "Critique," 48.

39. Du Panlin, Liu Hongqi, Yang Lei, "Critique," 48.

40. *China military encyclopedia*; Fang Meng, Bai Haiwei, and Zhang Liye, "Research on management," 66.

describes the capability development process for the PLA Air Force. Much like the process described previously, this process begins with formulating an Air Force equipment development strategy (空军装备发展战略). This strategy is said to describe strategic concepts, focal directions, and policy measures for equipment development. According to the encyclopedia, the Air Force equipment development strategy is formulated based on overall strategic concepts and policy directions; guidance and requirements from PLA headquarters; the overall Air Force development strategy (空军发展战略); analysis and estimates of the international and regional security environments; the expected equipment requirements of future military conflicts; the development level of and trends in the national economy and technology; the current equipment inventory of the PLA Air Force; funding estimates and opportunities; development timelines and capabilities for equipment research and development, procurement, and maintenance; and the current state and support conditions of Air Force equipment.[41]

As with the Army's equipment development strategy, the Air Force equipment development strategy is said to be implemented via an Air Force 10-year equipment development plan (空军装备建设十年规划), an Air Force five-year equipment development program (空军装备建设五年计划), and an Air Force mid- to long-term special equipment development program (空军装备建设中长期专项计划). Also like the Army, the Air Force's "equipment leadership organization" (空军装备领导机关)—presumably, the Air Force's Equipment Department—is said to formulate and compile the Air Force's 10-year equipment development plan based on the service's equipment development strategy, the equipment structure of the service, analysis of and estimations about the international and regional security environments, the expected equipment requirements of future military conflicts, the level and development trends of the national economy and defense technology, funding estimates, equipment research and development and production periods, and the current state and support conditions of the service's equipment.[42] The 10-year equipment development plan is said to include a research and development plan, a procurement plan, a technology insertion plan, and a maintenance plan.[43] Information about the contents of and basis for the Air Force's five-year equipment development

41. 《中国空军百科全书》[China air force encyclopedia] (2005), s.v. "Air Force Equipment Development Strategy."

42. *China air force encyclopedia*.

43. *China air force encyclopedia*.

program and mid- to long-term special equipment development program was not found.

Based on these two examples, China's military equipment development process appears to be as follows: Once every five years, each of the People's Liberation Army's services formulates an overall service development strategy and an equipment development strategy. Next, based on the equipment development strategy, each service formulates 10-year equipment development plans, five-year equipment development programs, and mid- to long-term special equipment development programs. Finally, based on these plans and programs, each service formulates annual equipment research and production budgets (see figure 1).

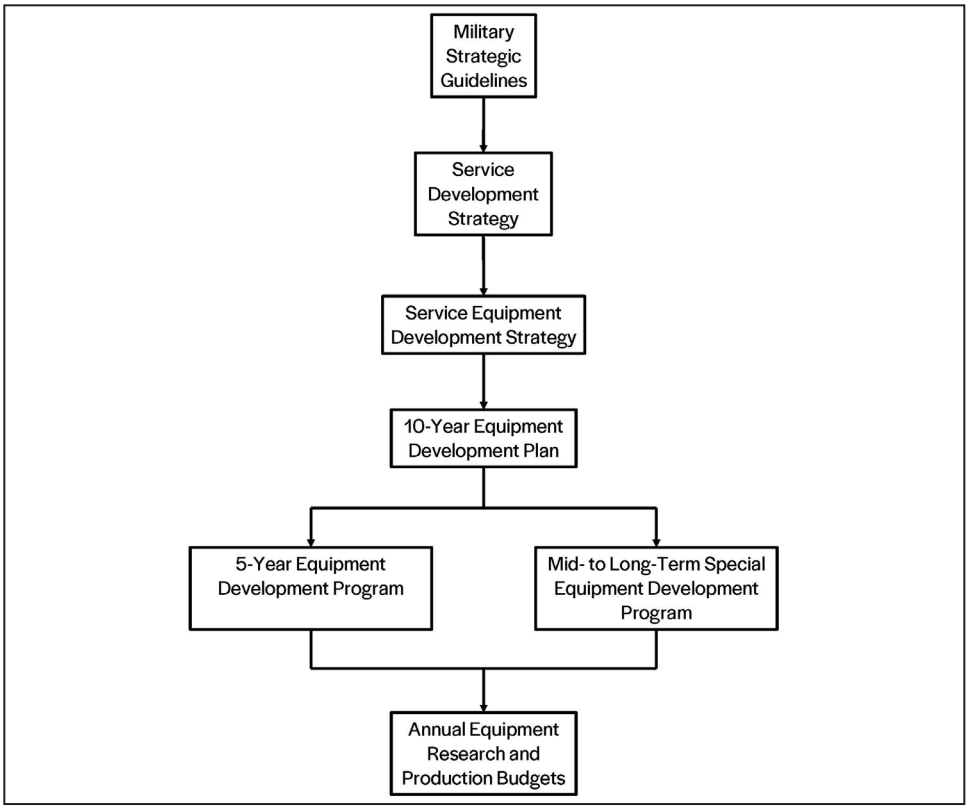

Figure 1: China's military equipment development process

Explicit references in Chinese publications to specific documents containing these strategies, plans, and programs are rare. The national defense white paper issued by the Chinese government in 2006 refers

to an armament development strategy ("武器装备发展战略") as well as an "armament development plan for the Eleventh Five-Year Plan" ("武器装备建设'十一五'规划"), which covered 2006 to 2010.[44] A 2016 article in a journal published by the Academy of Armored Forces Engineering and a 2018 article from the People's Liberation Army's website both refer to an "equipment development plan for the Thirteenth Five-Year Plan" ("'十三五'装备建设规划"), which covered 2016 to 2020.[45] But none of these references specifically cite the name of a document.

Although references to equipment development strategies, plans, and programs are rare, references to force development plans or programs (军队建设发展规划 or 军队建设发展计划) or associated guidance documents are more common. As with equipment development plans and programs, some of these references simply imply the existence of force development plans and programs and do not identify the names of specific documents.[46] But multiple articles state the specific titles of documents. Examples include "Guidance for the Force Development Program for the Ninth Five-Year Plan Period" (《"九五"期间军队建设计划纲要》); "Force Development Program for the Tenth Five-Year Plan and Development Plan for the Period Prior to 2010" (《军队建设"十五"计划和2010 年前发展规划》) (the Tenth Five-Year Plan covered 2001 to 2005); "Force Development Plan for the Eleventh Five-Year Plan" (《军队建设发展"十一五"规划》); "Force Development Plan for the Twelfth Five-Year Plan" (《军队建设发展"十二五"规划》); "Guidance for Force Development Plans for the Period Prior to 2020" (《2020 年前军队建设发展规划纲要》), and "Guidance for the Force

44. State Council Information Office of the PRC,《2006年中国的国防》[China's national defense in 2006] (Beijing: State Council of the PRC, December 2006).

45. Liu Xuyang 刘旭阳 et al., "新时期陆军装备器材保障建设探析" [Investigation of army equipment support development in the new period], 《装甲兵工程学院学报》 [*Journal of Academy of Armored Forces Engineering*] 30, no. 3 (June 2016): 8; and Li Dayong and Wu Keru, "陆军对'十三五'装备建设规划进行完善" [Army implements refinement of equipment development plan for "thirteenth five-year plan"], China Military Network (website), January 9, 2018, http://www.81.cn/zt/2017nzt/qjqj/tt_199652/7901293.html.

46. Liu Shenyang 刘沈扬, "对陆军武器装备建设发展的思考" [Thoughts on the development of ground force armaments], 《装甲兵工程学院学报》 [*Journal of Academy of Armored Forces Engineering*] 20, no. 1 (February 2006): 7; Geng Kui 耿奎, Wu Longgang 吴龙刚, and Xie Zongren 谢宗仁, "对战略规划评估体系研究的思考" [Thoughts on strategic plan assessment research],《军事运筹与系统工程》[*Military Operations Research and Systems Engineering*] 32, no. 3 (September 2018): 5; and Shi Qingren, "Force transformation," 7.

Development Plan for the 13th Five-Year Plan" (《军队建设发展"十三五"规划纲要》).[47]

No references were found to the specific title of a force development plan for the 14th Five-Year Plan for National Economic and Social Development and Long-Range Objectives for 2035, which covers 2021 to 2025, but a 2019 article in the journal of the PLA Naval University of Engineering makes recommendations for items that should be included in the "14th national defense and force development five-year plan" ("国防和军队建设发展'十四五'规划"), suggesting, as would be expected, such a plan exists.[48]

Information about the contents of these force development plans and programs does not appear to be publicly available. But, likely, the plans and programs are roughly analogous to the Department of Defense's POMs—that is, because the documents are called force development plans and programs, rather than just equipment development plans and programs, the documents likely contain information about the People's Liberation Army's plans for the acquisition of equipment as well as personnel, operations, and construction.[49] If this analogy holds, then the five-year force development plans probably contain the five-year equipment development programs and the mid- to long-term special equipment development programs referred to previously. Put another way, the People's Liberation Army's five-year equipment development programs

47. Wang Xingwang 王兴旺, "新中国成立以来党和国家领导人论军事战略规划" [Discourses on military strategy and planning by party and state leaders since the founding of new China],《军事历史》[*Military History*] 1 (2009): 42; "国防和军队建设科学发展取得历史性进步" [Scientific development of national defense and military forces achieves historic progress], *PLA Daily*, May 30, 2012, 6; Sun Yanhong 孙艳红, "军民融合战略规划" [Strategic plan for military-civil fusion],《军事政治学研究》[*Military Politics Review*] 2 (2015): 6–7; Deng Lei 邓磊, "国防战略规划浅谈" [National defense strategic plans],《国防》[*National Defense*] 3 (2016): 20; "《军队建设发展'十三五'规划纲要》颁发" ["Guidance for force construction and development during the 13th five-year plan period" issued],《办公室业务》[*Office Operations*] 5 (2016): 4; "《军队建设发展'十三五'规划纲要》颁发" ["Guidance for force construction and development during the 13th five-year plan period" issued],《办公室业务》[*Office Operations*] 6 (2016): 4; "《军队建设发展'十三五'规划纲要》出台" ["Guidance for force development during the 13th five-year plan" released],《政策》[*Policy*] 6 (2016): 77; Qu Dingguo 瞿定国, "新时代习近平对台思想的科学建构" [Scientific framework of Xi Jinping's thoughts on Taiwan in the new era],《统一论坛》[*Reunification Forum*] 6 (2017): 9; and "确保如期完成军队建设发展'十三五'规划目标任务为实现强军目标, 建设世界一流军队打下扎实基础" [Ensure the timely completion of the target tasks of the 13th force development five-year planso as to realize the goal of a strong military, create a solid basis for developing a world-class military],《网信军民融合》[*Civil-Military Integration on Cyberspace*] (March 2019): 20.

48. Xiao Changpeng 肖常鹏, "智能化作战特点规律研究" [Characteristics and laws of intelligent warfare],《海军工程大学学报 (综合版)》[*Journal of the Naval University of Engineering* (Main Edition)] 16, no. 3 (September 2019): 37.

49. Wang Xingwang, "Discourses," 41.

may be roughly analogous to the acquisition portion of the Department of Defense's POMs, and the mid- to long-term special equipment development programs may be roughly analogous to the research, development, test, and evaluation portion of the POMs. But, although POMs are rolling, five-year programs that are updated each year, the People's Liberation Army's force development plans are fixed to a specific, five-year period. Only after this five-year period has ended are the plans replaced by a new force development plan covering the next five-year period.

Documents mentioned previously that have the word "guidance" (纲要) in their titles (for example, "Guidance for the Force Development Program for the Ninth Five-Year Plan Period," "Guidance for Force Development Plans for the Period Prior to 2020," and "Guidance for the Force Development Plan for the 13th Five-Year Plan") may be more analogous to the Defense Planning Guidance—that is, the documents do not contain detailed descriptions of specific program lines and the associated monetary amounts; rather, the documents specify particular capabilities the People's Liberation Army plans to develop over the coming five-year period.

Information System–Based System Combat Capability

As discussed earlier, the military strategic guidelines issued in June 2004 identified the basis of war preparations in the new period as "local wars under informatized conditions." In a December 2005 speech, China's top leader at the time, Hu Jintao, stated the "fundamental form of combat power" (战斗力的基本形态) under informatized conditions was "information system-based system combat capability" (基于信息系统的体系作战能力). Consequently, Hu stated, for the People's Liberation Army, "the focal point of informatized development should be on increasing" this capability.[50]

This speech was significant because it specified the fundamental form of combat power under the conditions that were expected to dominate

50. Ren Liansheng 任连生, "对基于信息系统的体系作战能力的初步认识" [Understanding of the operational capability of systems operations based on information systems],《中国军事科学》[*China Military Science*] 4 (2010): 26; Jiang Zhiping 姜志平 et al., "基于信息系统的体系作战能力生成模式研究" [A study of the generation pattern of the assault operational capability based on the information system],《国防科技》[*National Defense Technology*] 5 (2012): 33; and Shi Qingren, "Force transformation," 7.

warfare in the future. Furthermore, the speech stated this capability should be the focal point of the People's Liberation Army's development efforts. But the speech was not widely publicized at the time, and little open discussion about "information system-based system combat capability" occurred for the first few years afterward. China's 2006 defense white paper, for instance, does not mention this form of combat power.[51] But beginning in 2009, multiple books and articles were published that discussed, defined, and described "information system-based system combat capability." These books and articles, including the defense white papers issued in 2009, 2011, 2013, and 2015, reiterated information system-based system combat capability is "the fundamental form of combat power" under informatized conditions and the People's Liberation Army should strengthen this capability.[52]

The phrase "system combat capability" (体系作战能力) comes from the PLA doctrine that under informatized conditions, warfare should be viewed as a battle between the overall warfighting complexes of the two sides, rather than as a clash between collections of platforms and weapon systems.[53] Thus, combat capability is not simply the summation of the capabilities of a military's individual platforms and weapons; rather, combat capability is the result of how effectively the military integrates these platforms and weapons into a unified, synergistic complex or system (体系, sometimes translated as "system-of-systems"). This capability is said to be "information system-based" (基于信息系统) because information systems are the essential ingredient that fuses and integrates different combat forces, unit, and elements together.[54]

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51. State Council Information Office, *China's national defense in 2006*.

52. Ji Yafu 姬亚夫, "扎实推进国防后备力量『双应一体化』建设" [Firmly advance the "unification of the dual responsibilities" development of the national defense reserve forces],《国防》[*National Defense*] 8 (2006): 26; State Council Information Office, *China's national defense in 2008*; Ren Liansheng, "Understanding of the operational capability," 26; Huang Xing 黄星, Wang Jinzhou 王晋周, and Li Yun 李云, "解读基于信息系统的体系作战能力" [Understanding information system-based system combat capability],《中国国防报》[*China Defense News*], September 30, 2010, 3; State Council Information Office of the PRC,《2010年中国的国防》[China's national defense in 2010] (Beijing: State Council of the PRC, March 2011); State Council Information Office of the PRC,《中国武装力量的多样化运用》[The diversified employment of China's armed forces] (Beijing: State Council of the PRC, April 2013); Zhu Daming 朱大明 et al., "'综合集成防护'与'作战体系防护'" ["Comprehensive integrated protection" and "combat system protection"),《防护工程》[*Protective Engineering*] 35, no. 3 (June 2013): 7–8; and State Council Information Office, *China's military strategy*.

53. Shi Qingren, "Historical evolution," 7.

54. Huang Xing, Wang Jinzhou, and Li Yun, "System combat capability," 3; Ren Liansheng, "Understanding of the operational capability," 26–33; Zhu Daming et al., "'Comprehensive integrated protection'"; and Ren Liansheng 任连生 and Qiao Jie 乔杰,《基于信息系统的体系作战能力教程》[Lessons on information system-based system combat capability] (Beijing: Military Science Press, n.d.), 25–26, 55, 57.

"Information system-based system combat capability" is said to result from the integration of "real-time sensing, high-efficiency command and control, precision strike, full-dimensional protection, [and] comprehensive support" (实时感知、高效指控、精确打击、全维防护以及综合保障) as well as "rapid mobility" (快速机动) in some versions.[55] Clearly, this concept was at least partly influenced by the Department of Defense's Joint Vision 2010 and Joint Vision 2020 documents published in 1996 and 2000, respectively, which described the operational concepts the US military expected to employ in 2010 and 2020 and how it intended to acquire the capabilities needed to implement the concepts. In particular, Joint Vision 2010 and Joint Vision 2020 delineated four primary operational tasks for US military forces in the future: "dominant maneuver," "precision engagement," "full-dimensional protection," and "focused logistics," all enabled by information superiority. Moreover, Joint Vision 2010 states these concepts are based on the improved intelligence and command and control available in the information age.[56] Nonetheless, rather than simply imitating Joint Vision 2010 and Joint Vision 2020, information system-based system combat capability clearly also reflects distinct thinking and perspectives.

Mission Capabilities

According to authoritative sources, including a textbook used in professional military education courses in the People's Liberation Army, information system-based system combat capability is composed of three "levels" of capabilities: mission capabilities (任务能力),

55. Ren Liansheng, "Understanding of the operational capability," 27; Jiang Zhiping et al., "Study of the generation pattern," 35; Jiang Jun 姜军, Wang Chen 汪陈, and Li Jinghui 李敬辉, "对海军体系作战力量战斗力建设的思考" [Research on system operation force combat capability construction],《海军工程大学学报(综合版)》[*Journal of Naval University of Engineering*] 14, no. 1 (March 2017): 47; Han Lin 韩林 and Li Daguang 李大光, "新质战斗力从哪里来?" [Where do new types of combat power come from?], *PLA Daily*, April 18, 2017, 7; Ma Peibei 马培蓓, Ji Jun 纪军, and Dan Yuechun 单岳春, "提高海军航空兵体系作战能力问题研究" [Raising the system combat capability of naval aviation forces],《国防科技》[*National Defense Technology*] 38, no. 4 (August 2017): 117; and Ren Liansheng and Qiao Jie, *Lessons*, 25.

56. Chairman of the Joint Chiefs of Staff, *Joint Vision 2010* (Washington, DC: Joint Chiefs of Staff, July 1996), 1, 17–27; and Director for Strategic Plans and Policy (J5), *Joint Vision 2020* (Washington, DC: Joint Chiefs of Staff, June 2000), 6–11.

essential capabilities (要素能力), and basic information support capabilities (信息基础支撑能力).[57]

Mission capabilities are defined as the "capabilities to perform different forms of joint operations and actions according to the military's missions." Most sources, including the textbook used in the professional military education courses referred to in the previous paragraph, present nine main mission capabilities: nuclear deterrence and counterattack, joint firepower strike, joint blockade operations, joint island offensives, joint border defense operations, joint line-of-communication protection, joint air defense, joint space operations, and joint information operations.[58]

The textbook used in professional military education courses also lists subordinate capabilities that support (支撑) each of the nine mission capabilities. The capabilities that support nuclear deterrence and counterattack capability, for example, are said to include land-based, sea-based, and air-based nuclear deterrence and counterattack capabilities.[59]

The capabilities that support joint firepower strike capabilities are said to include information sharing, firepower strike, battlefield control, and comprehensive support capabilities.[60]

The capabilities that support joint blockade operation capabilities are said to include sea blockade, air blockade, firepower blockade, troop blockade, and obstacle blockade capabilities.[61]

The capabilities that support joint island offensive capabilities are said to include capabilities for seizing "comprehensive control" (综合控制权,

57. Zhu Lei 朱蕾, "基于物元分析法的体系作战能力检验评估" [Research on the operational capacity inspection and evaluation of system based on methods of dynamism-metadata],《舰船电子工程》[*Ship Electronic Engineering*] 31, no. 8 (2011): 46; Zhao Cunru 赵存如, "军事系统工程专业委员会第二十二届学术年会成果综述" [Summary of findings of 22nd annual academic meeting of military systems engineering special committee],《军事运筹与系统工程》[*Military Operations Research and Systems Engineering*] 26, no. 4 (December 2012): 68; Zhu Daming et al., "'Comprehensive integrated protection,'" 8; Yuan Wei 袁伟, Du Haoning 杜浩宁, and Su Honglei 苏红磊, "对编制国防和军队建设发展规划的几点思考" [Thoughts on compiling national defense and force development programs],《国防》[*National Defense*] 4 (2016): 30; Jiang Jun, Wang Chen, and Li Jinghui, "Combat capability construction," 47; Liu Dong 刘东 and Yang Guang 杨光, "基于能力的指挥信息系统评估研究" [Research on evaluation of C4ISR system based on capability],《舰船电子工程》[*Ship Electronic Engineering*] 39, no. 10 (2019): 11–12; and Ren Liansheng and Qiao Jie, *Lessons*, 53, 58–59.

58. Zhao Cunru, "Summary," 68; Yuan Wei, Du Haoning, and Su Honglei, "Thoughts," 30; and Ren Liansheng and Qiao Jie, *Lesson*s, 59.

59. Ren Liansheng and Qiao Jie, *Lessons*, 59.

60. Ren Liansheng and Qiao Jie, *Lessons*, 59.

61. Ren Liansheng and Qiao Jie, *Lessons*, 59.

which probably refers to seizing sea, air, and information control), conducting rapid landing operations, conducting "three-dimensional" (that is, land, sea, and air) expeditionary offensive and defensive operations, controlling occupied areas, and engaging in special warfare.[62]

The capabilities that support joint border defense operation capabilities are said to include capabilities for the prevention of enemy incursions, encroachment, seizure, large-scale border crossings, and provocations; border expulsion; and border sealing and control.[63]

The capabilities that support joint line-of-communication protection capabilities are said to include counterblockade, sea escort, and other sea combat capabilities for protecting the security of sea transportation, along with border control, ground attack and defense, and other land combat capabilities for protecting land lines of communication.[64]

The capabilities that support joint air defense capabilities are said to include joint early warning, joint strike defense, and joint counterstrike capabilities.[65]

The capabilities that support joint space operations capabilities are said to be capabilities for destroying and defending space-based targets and related ground and sea facilities.[66]

The capabilities that support joint information warfare capabilities are said to be electronic warfare and network warfare capabilities for protecting national information security and ensuring the normal operation of command information systems.[67]

The nine mission capabilities and their associated supporting capabilities are shown in table 1.

62. Ren Liansheng and Qiao Jie, *Lessons*, 59.

63. Ren Liansheng and Qiao Jie, *Lessons*, 60.

64. Ren Liansheng and Qiao Jie, *Lessons*, 60.

65. Ren Liansheng and Qiao Jie, *Lessons*, 60.

66. Ren Liansheng and Qiao Jie, *Lessons*, 60.

67. Ren Liansheng and Qiao Jie, *Lessons*, 60.

Table 1: Mission capabilities and supporting capabilities

Mission Capability	Supporting Capabilities
Nuclear deterrence and counterattack	Land-based nuclear deterrence and counterattack Sea-based nuclear deterrence and counterattack Air-based nuclear deterrence and counterattack
Joint firepower strike	Information sharing Firepower strike Battlefield control Comprehensive support
Joint blockade operation	Sea blockade Air blockade Firepower blockade Troop blockade Obstacle blockade
Joint island offensive	Seizing comprehensive control Rapid landing operations "Three-dimensional" expeditionary offensive and defensive operations Controlling occupied areas Special warfare
Joint border defense operations	Capabilities to prevent enemy incursions, encroachment, separation, large-scale border crossings, and provocations Border expulsion Border sealing and control
Joint line-of-communication protection	Sea combat capabilities, such as counterblockade and sea escort, for protecting the security of sea transportation Land combat capabilities, such as border control and ground attack and defense, for protecting land lines of communication
Joint air defense	Joint early warning Joint strike defense Joint counterstrike capabilities

Mission Capability	Supporting Capabilities
Joint space operations	Destroying space-based targets Destroying space-related ground and sea facilities Defending space-based targets Defending space-related ground and sea facilities
Joint information operations	Electronic warfare for protecting national information security Network warfare for protecting national information security Electronic warfare for ensuring the normal operation of command information systems Network warfare for ensuring the normal operation of command information systems

Some sources omit or change the descriptors for some of the mission capabilities. A 2013 article in *Protective Engineering*, for instance, omits joint space operations from its list of mission capabilities, and a 2019 article in *Ship Electronic Engineering* omits both nuclear deterrence and counterattack and joint border defense operations. But the lists presented in both articles are not explicitly described as being exhaustive. The omissions may simply be oversights or deliberate elisions of capabilities that were not relevant to the topics of the articles.[68]

In addition, the 2013 *Protective Engineering* article replaces joint information operations capability with "joint information organization capability." This change may be the result of an unintentional error. But a 2017 article in the *Journal of Naval University of Engineering* by researchers from that university presents a completely different list of mission capabilities: capability to conduct strategic deterrence, capability to seize air superiority and sea control over a portion of the sea, capability to attack and destroy an enemy's sea and air forces and transport ships, capability to protect sea lines of communication, capability to attack enemy land-based targets, and capability to support and protect landing operations. No source for this list of capabilities is provided. Capability to conduct strategic deterrence appears to be similar (though not necessarily identical) to nuclear deterrence and counterattack capability, but the others appear to represent specifically naval capabilities needed to support the standard mission capabilities. Thus, although the article does not explicitly

68. Zhu Daming et al., "'Comprehensive integrated protection,'" 8; and Liu Dong and Yang Guang, "Evaluation of C4ISR system," 12.

say so, possibly, the capabilities listed are intended to be understood as the specifically naval capabilities required to support the nine joint mission capabilities.[69]

Essential Capabilities

According to multiple sources, including the textbook used in professional military education courses, essential capabilities are general purpose capabilities the People's Liberation Army requires to fulfill its range of operational missions.[70] Both the textbook and the 2013 article in *Protective Engineering* state the nine types of essential capabilities are intelligence and reconnaissance capabilities, command-and-control capabilities, firepower strike capabilities, offensive and counteroffensive capabilities, three-dimensional mobility capabilities, information attack and defense capabilities, full-dimensional protection capabilities, overall support capabilities, and "three warfare" (that is, "public opinion warfare," "information warfare," and "legal warfare") capabilities.[71] But other sources enumerate only eight essential capabilities, omitting offensive and counteroffensive capabilities, with a 2016 article in the authoritative journal *National Defense* specifically referring to only eight essential capabilities.[72]

Moreover, the 2017 *Journal of Naval University of Engineering* article mentioned in the previous section enumerates only seven essential capabilities, omitting both offensive and counteroffensive capabilities and "three warfare" capabilities, but the article does not state its list of essential capabilities is exhaustive.[73] A 2019 article in the journal *Fire Control & Command Control* provides a list of essential combat capabilities (作战要素能力) that

69. Zhu Daming et al., "'Comprehensive integrated protection,'" 8; and Jiang Jun, Wang Chen, and Li Jinghui, "Combat capability construction," 47.

70. Zhu Lei, "Inspection and evaluation of system," 46–47; Zhu Daming et al., "'Comprehensive integrated protection,'" 8; Jiang Jun, Wang Chen, and Li Jinghui, "Combat capability construction," 47; Sun Shengzhi 孙盛智, Hou Yan 侯妍, and Pei Chunbao 裴春宝, "面向远程精确打击的作战能力构成研究" [Research on operational capability construction for long-range precision strike],《火力与指挥控制》[*Fire Control & Command Control*] 4, no. 8 (August 2019): 48; Liu Dong and Yang Guang, "Evaluation of C4ISR system," 11–12; and Ren Liansheng and Qiao Jie, *Lessons*, 61.

71. Zhu Daming et al., "'Comprehensive integrated protection,'" 8; and Ren Liansheng and Qiao Jie, *Lessons*, 68–69.

72. Zhu Lei, "Inspection and evaluation of system," 46–47; Zhao Cunru, "Summary," 68; Yuan Wei, Du Haoning, and Su Honglei, "Thoughts," 30; and Liu Dong and Yang Guang, "Evaluation of C4ISR system," 12.

73. Jiang Jun, Wang Chen, and Li Jinghui, "Combat capability construction," 47.

differs somewhat from the lists of essential capabilities described in earlier books and articles. This list consists of only six capabilities. The list omits offensive and counteroffensive capabilities, three-dimensional mobility capabilities, full-dimensional protection capabilities, and "three warfare" capabilities; adds mobile protection capabilities; and uses the term "information combat capabilities" rather than "information attack and defense capabilities."[74]

The textbook used in professional military education states each of the nine essential capabilities is composed of several other capabilities. Specifically, the textbook says intelligence and reconnaissance capabilities are composed of land-based intelligence and reconnaissance capabilities, sea-based intelligence and reconnaissance capabilities, air-based intelligence and reconnaissance capabilities, and space-based intelligence and reconnaissance capabilities (the last of which includes intelligence and reconnaissance capabilities operating in "near space"—the region around Earth above the altitude at which airplanes can fly but below the altitude at which satellites can sustain orbit).[75]

According to the textbook, command-and-control capabilities consist of planning and organization capabilities, control and coordination capabilities, and "command-and-control combat capabilities," which are capabilities for protecting one's own command systems and attacking the enemy's command systems. Thus, command-and-control combat capabilities appear to be a type of information warfare capability, though information attack and defense are listed as a separate, essential capability.[76]

Firepower strike capabilities are said to consist of capabilities for firepower strikes against land, sea, and air targets.[77]

According to the textbook, offensive and counteroffensive capabilities are capabilities to use combat forces to attack, seize, or occupy regions or targets. These capabilities are said to consist of capabilities for offensive actions and counteroffensive actions (the difference between offensive action capabilities and counteroffensive action capabilities is not specified).[78]

74. Sun Shengzhi, Hou Yan, and Pei Chunbao, "Operational capability construction," 47–48.

75. Ren Liansheng and Qiao Jie, *Lessons*, 61–64.

76. Ren Liansheng and Qiao Jie, *Lessons*, 64–67.

77. Ren Liansheng and Qiao Jie, *Lessons*, 67–68.

78. Ren Liansheng and Qiao Jie, *Lessons*, 68–69.

Three-dimensional mobility capabilities are said to consist of ground mobility capabilities, sea mobility capabilities, and air mobility capabilities.[79]

Information attack and defense capabilities are said to consist of information attack capabilities and information defense capabilities.[80]

Full-dimensional protection capabilities are said to consist of capabilities to defend against reconnaissance and observation; air and missile defense capabilities; and nuclear, biological, and chemical protection capabilities.[81] Thus, full-dimensional protection seemingly does not include protection against ground or sea attack.

Comprehensive support capabilities are said to consist of combat support capabilities (defined as capabilities employed to ensure command decisions and combat actions proceed smoothly), logistic support capabilities (defined as capabilities that employ human, material, and financial resources to ensure the smooth implementation of combat operations), and equipment support capabilities (defined as capabilities to ensure weapons and equipment are in good technical condition and can carry out combat missions at any time).[82]

The textbook states "three warfare" capabilities consist of "capabilities that comprehensively use public opinion warfare, psychological warfare, and legal warfare to guarantee the initiative in legal principles, the advantage in politics, and demolition of the enemy force in psychology."[83]

The nine essential capabilities and their associated constituent capabilities are shown in table 2.

79. Ren Liansheng and Qiao Jie, *Lessons*, 69–71.

80. Ren Liansheng and Qiao Jie, *Lessons*, 72–74.

81. Ren Liansheng and Qiao Jie, *Lessons*, 74–76.

82. Ren Liansheng and Qiao Jie, *Lessons*, 76–78.

83. Ren Liansheng and Qiao Jie, *Lessons*, 78–79.

Table 2: Essential capabilities and constituent capabilities

Essential Capability	Constituent Capabilities
Intelligence and reconnaissance	Land-based intelligence and reconnaissance Sea-based intelligence and reconnaissance Air-based intelligence and reconnaissance Space-based intelligence and reconnaissance
Command and control	Planning and organization Control and coordination "Command-and-control combat"
Firepower strike	Firepower strikes against land targets Firepower strikes against sea targets Firepower strikes against air targets
Offensive and counteroffensive	Offensive action Counteroffensive action
Three-dimensional mobility	Ground mobility Sea mobility Air mobility
Information attack and defense	Information attack Information defense
Full-dimensional protection	Defense against reconnaissance and observation Air and missile defense Nuclear, biological, and chemical protection
Comprehensive support	Combat support Logistic support Equipment support
"Three warfare"	Public opinion warfare Psychological warfare Legal warfare

Basic Information Support Capabilities

According to the textbook used in professional military education courses and the 2019 article in *Ship Electronic Engineering*, basic information support capabilities are "capabilities that support different combat capabilities in realizing functional coupling and unified action by the entire combat system."[84] Multiple sources refer to seven basic information support capabilities.[85] According to the textbook and a 2012 article in *Military Operations Research and Systems Engineering*, these capabilities are information collection, information processing, information storage, information transmission, information distribution management, information security and secrecy, and navigation and positioning.[86] But two other sources use slightly different descriptors for some of these capabilities. The 2013 article in *Protective Engineering*, for example, uses information management rather than information distribution management and information security rather than information security and secrecy.[87] The 2017 article in the *Journal of Naval University of Engineering* also uses information security rather than information security and secrecy and information distribution in place of information distribution management.[88] Whether these variant terms have any significance is unclear. Moreover, the 2019 article in *Ship Electronic Engineering* only refers to six basic information support capabilities, omitting information collection capabilities. This article also uses information distribution rather than information distribution management and security protection (安全防护) rather than information security and secrecy.[89] None of the sources examined for this study identify subordinate capabilities that support the basic information support capabilities.

The seven most commonly mentioned basic information support capabilities are listed in table 3.

84. Liu Dong and Yang Guang, "Evaluation of C4ISR system," 11–12.

85. Zhao Cunru, "Summary," 68; Zhu Daming et al., "'Comprehensive integrated protection,'" 8; Jiang Jun, Wang Chen, and Li Jinghui, "Combat capability construction," 47; and Ren Liansheng and Qiao Jie, *Lessons*, 81–84.

86. Zhao Cunru, "Summary," 68; and Ren Liansheng and Qiao Jie, *Lessons*, 81–84.

87. Zhu Daming et al., "'Comprehensive integrated protection,'" 8.

88. Jiang Jun, Wang Chen, and Li Jinghui, "Combat capability construction," 47.

89. Liu Dong and Yang Guang, "Evaluation of C4ISR system," 11–12.

Table 3: Basic information support capabilities

Basic Information Support Capabilities
Information collection
Information processing
Information storage
Information transmission
Information distribution management
Information security and secrecy
Navigation and positioning

Network Information Complex–Based Joint Combat Capability

Around 2015, the People's Liberation Army began to refer to a new type of capability: "network information complex-based joint combat capability" (基于网络信息体系的联合作战能力). The earliest open use of this phrase found while conducting research for this monograph is in a September 4, 2015, article in *People's Daily* that describes the military parade that had been held in Beijing the previous day in commemoration of the 70th anniversary of the defeat of Japan in World War II. The article states, "The 27 equipment formations . . . reflected the People's Liberation Army's network information complex-based joint combat capability."[90]

The following year, the phrase appeared in the section on "National Defense and Force Development" in the national 13th Five-Year Plan guidance document that was published on March 17, 2016. The section calls upon the People's Liberation Army to "strive to increase its network information complex-based joint combat capability."[91]

The 2017 edition of *Science of Strategy*, published in May of that year, explicitly states under the "new historical conditions," "network information complex-based joint combat capability has become the fundamental form

90. Troop Review Leadership Group 阅兵领导小组, "弘扬抗战精神 维护世界和平" [Cultivate the spirit of the war of resistance, protect world peace), *People's Daily*, September 4, 2015, 9.

91. Xinhua News Agency, 第七十七章: 全面推进国防和军队建设《中华人民共和国国民经济和社会发展第十三个五年规划纲要》[Outline of the 13th five-year plan for national economic and social development of the People's Republic of China], State Council of the PRC (website), March 17, 2016, http://www.gov.cn/xinwen/2016-03/17/content_5054992.htm.

of combat power," apparently replacing information system-based system combat capability.[92] The book states network information complex-based joint combat has gradually become the fundamental form of combat, and, like the 13th Five-Year Plan document, calls on the People's Liberation Army to strengthen this capability.[93] In October 2017, in his official report to the 19th National Congress of the Chinese Communist Party, Xi Jinping called on the People's Liberation Army to "increase network information complex-based joint combat capability and multidomain combat capability" (提高基于网络信息体系的联合作战能力、全域作战能力).[94]

As noted earlier, the 2015 defense white paper still named information system-based system combat capability as the fundamental form of combat power.[95] But by the time of the issuance of the 2017 edition of *Science of Strategy*, the People's Liberation Army had apparently determined the fundamental form of combat power had changed to network information complex-based joint combat capability. While conducting research for this monograph, no reports were found describing the source or timing of this decision, but as described previously, based on the origin of the phrase "information system-based system combat capability," likely, the decision was first announced in an internal speech by the chairman of the Central Military Commission—at the time, Xi Jinping—and articles eventually began using the phrase as well.

The significance for the Chinese military's capability development of the transition from information system-based system combat capability to network information complex-based joint combat capability is unclear. Most books and articles in which the latter phrase is used simply repeat Xi's 2017 call to "increase network information complex-based joint combat capability and multidomain combat capability." The phrase does not appear in China's 2019 defense white paper, even though the phrase's predecessor had appeared in the 2009, 2011, 2013, and 2015 white papers.[96]

92. Xiao Tianliang 肖天亮 et al.,《战略学 (2017年修订)》[Science of strategy (2017 revision)] (Beijing: National Defense University Press, 2017), 31.

93. Xiao Tianliang et al., *Science of strategy* (2017 revision), 88, 189, 332, 334, 344, 382, 386.

94. Xi Jinping, "Decisively and comprehensively create."

95. State Council Information Office, *China's military strategy*.

96. State Council Information Office, *China's national defense in 2008*; State Council Information Office, *China's national defense in 2010*; State Council Information Office, *Diversified employment*; State Council Information Office, *China's military strategy*; and State Council Information Office, *China's national defense in the new era*.

In particular, whether the mission capabilities, essential capabilities, and basic information support capabilities described in the previous section have been affected by the change in terminology is unclear. While conducting research for this monograph, no books, reports, or articles were found that explicitly associated specific capabilities with network information complex-based joint combat capability. Moreover, after the phrase first appeared in authoritative Chinese documents, articles discussing information system-based system combat capability and its associated mission capabilities, essential capabilities, and basic information support capabilities continued to be published. For instance, although the 13th Five-Year Plan guidance document issued in March 2016 uses the phrase "network information complex-based joint combat capability," an April 2016 article in the authoritative journal *National Defense* uses the older phrase and provides lists of mission capabilities, essential capabilities, and basic information support capabilities associated with it that are essentially identical to lists found in earlier books and articles.[97] An April 2017 article in the newspaper *PLA Daily* also includes a discussion on information system-based system combat capability but does not associate it with more specific capabilities.[98] In addition, the October 2019 article in *Ship Electronic Engineering* uses the phrase "information system-based system combat capability" and lists most of the standard mission capabilities, essential capabilities, and basic information support capabilities, though, as noted earlier, the article omits nuclear deterrence and counterattack and joint border defense operations from its list of mission capabilities, omits information collection capabilities from its list of basic information support capabilities, and uses slight variants for the descriptors of two other basic information support capabilities.[99]

Conversely, although the March 2017 article in *Journal of Naval University of Engineering* does not use either of the two phrases, the article provides lists of mission capabilities, essential capabilities, and basic information support capabilities that are entirely different from the standard list.[100] But, as noted previously, the capabilities listed in this article may simply be the specifically naval versions of the standard mission capabilities, essential capabilities, and basic information support capabilities. Thus, the lists should not necessarily be construed as representing new lists of capabilities that are a result of the change in the basic form of combat capability.

97. Yuan Wei, Du Haoning, and Su Honglei, "Thoughts," 30.

98. Han Lin and Li Daguang, "New types of combat power," 7.

99. Liu Dong and Yang Guang, "Evaluation of C4ISR system," 11–12.

100. Jiang Jun, Wang Chen, and Li Jinghui, "Combat capability construction," 47.

As noted earlier, a 2019 article in the journal *Fire Control & Command Control* provides a list of "essential combat capabilities" that differs somewhat from the lists of essential capabilities described in previously published books and articles. Significantly, this article references network information complex-based joint combat capability but does not explicitly associate it with essential combat capabilities.[101] Thus, the essential combat capabilities described in the article may have replaced the essential capabilities associated with information system-based system combat capability. Unfortunately, no other discussions of capabilities associated with network information complex-based joint combat capability were found while conducting research for this monograph.

Modernization Priorities and Force Structure Adjustments

Although a total of 25 different mission capabilities, essential capabilities, and basic information support capabilities and 59 supporting or constituent capabilities are associated with information system-based system combat capability and network information complex-based joint combat capability, these capabilities are still quite generic. By contrast, instead of a generic list, the US *Army Modernization Strategy* provides six specific modernization priorities: long-range precision fires, next-generation combat vehicles, future vertical lift platforms and technologies, network technologies, air and missile defense capabilities, and soldier lethality. Moreover, each of these modernization priorities is associated with three or four "signature efforts," for a total of more than 25 programs to develop specific systems, such as the "mobile protected firepower" system mentioned previously.[102]

China does not publish reports with comparable levels of detail. As noted previously in this monograph, the PLA services' force modernization plans and their associated guidance documents are not publicly available. But the defense white papers published every few years provide some information about the People's Liberation Army's modernization priorities. The 2019 white paper, for example, states the PLA Army is increasing its capabilities for precision, three-dimensional, all-domain, multifunctional, sustained operations; the PLA Navy is increasing its capabilities for strategic deterrence and counterstrike, maritime maneuver operations, joint maritime operations,

101. Sun Shengzhi, Hou Yan, and Pei Chunbao, "Operational capability construction," 47–48.

102. Grinston, McConville, and McCarthy, *Army Modernization Strategy*, 6–7.

comprehensive defense operations, and comprehensive support; the PLA Air Force is increasing its capabilities for strategic early warning, aerial strike, air and missile defense, information warfare, airborne operations, strategic lift, and comprehensive support; and the PLA Rocket Force is strengthening the security and reliability of its nuclear deterrent and counterstrike capabilities, accelerating the development of its intermediate-range precision strike capabilities, and strengthening its "strategic counterbalance capabilities" (战略制衡能力)—a term that is not explained but apparently is distinct from nuclear deterrent and counterstrike capabilities.[103]

The 2020 edition of *Science of Strategy* is the only authoritative document found for this study that provides detailed descriptions of planned adjustments to the People's Liberation Army's force structure and capabilities in the coming years. Although *Science of Strategy* cannot be considered an official policy document or definitive statement of the People's Liberation Army's force development plans, the document's descriptions of the organization's modernization needs seem to reflect the (sometimes conflicting) perspectives of the PLA services and are generally consistent with the statements found in official policy documents, such as the 2019 defense white paper. Thus, the discussions in *Science of Strategy* can be examined for indicators about the force development goals of the PLA services as of 2020.

PLA Army

On the PLA Army, *Science of Strategy* states through multiple rounds of downsizing over the past few decades, the size of the service's combat forces has been moving in the "correct direction," implying an assessment further downsizing is needed. *Science of Strategy* specifically notes one goal of this process is to reduce the number of active-duty army personnel and increase the proportion (but not necessarily the absolute numbers) of civilian officials.[104]

Science of Strategy states under "informatized and intelligentized conditions" (在信息化智能化条件下)—that is, warfare in which information systems and "smart" weapons will play increasingly important roles—combat capability will increasingly depend on quality rather than quantity,

103. State Council Information Office, *China's national defense in the new era*.

104. Xiao Tianliang et al., *Science of strategy* (2020 revision), 350.

and the unpredictability, complexity, and diversity of future threats will require army combat units to have faster reaction capabilities. As a result, a trend toward the reduction in size of the individual units will occur. Nonetheless, *Science of Strategy* notes given the "definite gap" between the capabilities of the PLA Army's weapon systems and those of "military powers" (that is, the United States), the PLA Army will have to maintain "a certain scale" for the time being.[105]

One aspect of the reduction in unit size noted in *Science of Strategy* has been a transition from a division-regiment-battalion organizational structure to a brigade-battalion organizational structure. *Science of Strategy* states although this transition is largely complete in the PLA Army, the organization and structure of battalion-level units needs further refinement and improvement. In particular, units must increase their flexibility and nimbleness so they will be able to organize on the spot in wartime according to need, rapidly constituting units capable of carrying out different combat missions.[106]

Science of Strategy also indicates PLA Army units will become more multifunctional. The units will have the capability to carry out multiple kinds of combat missions in different environments and under different conditions. Basic combat units will be organized so they will not need reinforcement or augmentation to carry multiple types of operations. Unfortunately, *Science of Strategy* does not provide examples of the specific types of missions and operations PLA Army units will be capable of implementing.[107]

In addition, *Science of Strategy* states the PLA Army force structure will become more "three-dimensional" (立体), a reference to developing new types of combat forces other than traditional infantry, armor, and artillery. In particular, becoming more three-dimensional will entail giving priority to the development of army aviation, increasing the army's capability to contest the space "up to the height of a tree" (一树之高). In addition, *Science of Strategy* states becoming more three-dimensional will entail the expansion of the PLA Army's medium- and high-altitude surface-to-air missile and antiaircraft artillery forces, gradually expanding the service's information operation forces, and increasing the numbers of different kinds of electronic countermeasures forces within the

105. Xiao Tianliang et al., *Science of strategy* (2020 revision), 350.

106. Xiao Tianliang et al., *Science of strategy* (2020 revision), 352.

107. Xiao Tianliang et al., *Science of strategy* (2020 revision), 352.

theater commands and group armies. At the same time, according to *Science of Strategy*, the army will gradually shrink or even eliminate elements such as motorized infantry that do not meet the requirements of informatized war.[108]

Science of Strategy states the PLA Army's modernization priorities include resolving the challenges of "seeing far, distinguishing clearly, and locating precisely," which will entail increasing the army's early-warning, target-discrimination, and positioning-and-tracking capabilities, increasing the size of the service's electronic countermeasures forces, and continuing to increase the service's information operation capability. In addition, according to the textbook, the army will focus on increasing the following capabilities.[109]

Sustained ground strike. According to *Science of Strategy*, sustained ground strike entails: (1) increasing the degree of mechanization of infantry and further reducing the proportion of motorized infantry; (2) combining light and heavy armored forces, expanding the size of light armored forces, and accelerating the replacement of older models of tanks with modern designs; (3) increasing the proportion of wheeled and amphibious armored forces; (4) continuing to increase the degree to which artillery is self-propelled; and (5) strengthening the computerization and automation of ground strike forces—especially, their weapon systems.[110]

Intermediate-range precision strike. The PLA Army's definition of "intermediate range" is unclear, but, according to *Science of Strategy*, improving intermediate-range precision strike capabilities requires expanding the size of the army's long-range artillery forces and increasing the range and accuracy of multiple-rocket artillery. Improving the capabilities also entails improving the rapid deployment, rapid firing, and rapid mobilization capabilities of major weapon systems so they can carry out destructive precision strikes against multiple kinds of targets, including buried or partially buried targets and major troop formations.[111]

Three-dimensional mobility and strike. According to *Science of Strategy*, the PLA Army will further increase proportions of army aviation and airborne forces and increase the numbers of large transport aircraft and other strategic airlift platforms. This statement is puzzling because, in

108. Xiao Tianliang et al., *Science of strategy* (2020 revision), 351, 353, 356.

109. Xiao Tianliang et al., *Science of strategy* (2020 revision), 353.

110. Xiao Tianliang et al., *Science of strategy* (2020 revision), 351, 353–54.

111. Xiao Tianliang et al., *Science of strategy* (2020 revision), 354.

the People's Liberation Army, both the airborne force and strategic airlift platforms are controlled and operated by the PLA Air Force, and *Science of Strategy* discusses them in the chapter on air forces. Whether this statement is including the airborne force and strategic airlift platforms in its discussion of PLA Army capability requirements simply because airborne forces can be regarded as ground forces, whether the statement is implying the air force's airborne forces should be incorporated into the PLA Army at some point in the future, and whether the statement is implying the PLA Army should acquire its own fixed-wing airlift aircraft and airborne forces in addition to those controlled by the PLA Air Force are unclear.[112]

Science of Strategy also states aerial strike forces centered around army aviation forces will require the capability for rapid mobility, high-speed strike, and special warfare in complex terrain and weather conditions and should have the capability to reconnoiter, harass, attack, and destroy enemy command-and-control centers and communications nodes.[113]

Battlefield air defense. Science of Strategy indicates the PLA Army will focus on developing an area air and missile defense system in the "main strategic direction" (that is, opposite Taiwan) as well as in other important regions. The interception range as well as the search and response and other capabilities of air defense weapons should be increased and coordination with fixed-wing aviation forces (which belong to the PLA Navy and Air Force) should be strengthened. The focus of battlefield air defenses should be on combating medium-, low-, and extremely-low-altitude air-breathing threats. Specifically, according to *Science of Strategy*, the PLA Army,should increase capabilities to defend against cruise missiles, unmanned aerial vehicles, and armed helicopters.[114]

Special operations. According to *Science of Strategy*, the PLA Army will increase the size of its special operations forces and upgrade their equipment, increasing their reconnaissance, targeting, and strike capabilities as well as their capability to survive in enemy rear areas.[115]

The chapter on army development in *Science of Strategy* does not mention combat engineering forces. Whether this omission is an oversight

112. Xiao Tianliang et al., *Science of strategy* (2020 revision), 350–51, 354.

113. Xiao Tianliang et al., *Science of strategy* (2020 revision), 354.

114. Xiao Tianliang et al., *Science of strategy* (2020 revision), 355.

115. Xiao Tianliang et al., *Science of strategy* (2020 revision), 355.

or reflects this area being a low priority to the People's Liberation Army is unclear.

PLA Navy

Science of Strategy states the PLA Navy needs capabilities both to protect the nation's territorial sovereignty and oceanic rights in China's littoral areas and to protect the security of strategic waterways and the country's national interests further abroad. As a result, the PLA Navy must transform its light force structure designed for combat in the littoral areas to a new force structure organized around aircraft carriers and nuclear submarines.[116]

Science of Strategy suggests the PLA Navy will focus on improving capabilities for seven types of missions: sea-based strategic deterrent and counterstrike, far-seas maneuver operations, near-seas combat, sea control, amphibious warfare, sea support, and military operations other than war.[117]

Sea-based strategic deterrent capabilities are said to include the capability to deploy sea-based strategic forces (that is, ballistic missile submarines) rapidly, strategic reconnaissance and early warning capabilities, and strategic strike capabilities (that is, submarine-launched ballistic missiles capable of reaching an adversary's homeland). Note the capability to deploy sea-based strategic forces rapidly appears to imply China may keep some portion of its strategic missile submarines in port but at relatively high levels of readiness in peacetime and surge them to sea when a crisis or war is anticipated. Sea-based strategic counterstrike capability is said to be the capability of sea-based strategic forces to carry out retaliatory strikes against an enemy.[118] Such a capability presumably requires both the aforementioned strategic strike capabilities and survivable platforms to deliver the strikes, even after an enemy has already struck.

Far-seas maneuver operations are said to include controlling critical strategic waterways, protecting sea lines of communication, defending overseas interests, and deterring military crises at sea. According to *Science of Strategy*, to have these capabilities, one must be able to deter

116. Xiao Tianliang et al., *Science of strategy* (2020 revision), 359, 365.

117. Xiao Tianliang et al., *Science of strategy* (2020 revision), 361–64.

118. Xiao Tianliang et al., *Science of strategy* (2020 revision), 362.

and strike powerful enemies effectively at distances far from China's territorial waters. Accomplishing this feat will entail strengthening the PLA Navy's capabilities for early warning and surveillance of the area of operations; the service's capabilities for collecting, processing, and distributing information; the capabilities of combat command centers; the capability to conduct coordinated action; principal weapon systems with precision-strike capabilities; and the self-protection capabilities of maneuver forces.[119]

According to *Science of Strategy*, *near-seas combat capabilities* are capabilities for defending territorial waters, islands and reefs, and sea lines of communication; performing escort duties; and conducting special operations. These capabilities are said to consist mainly of reconnaissance and early warning, "controlling situations" (对局势的控制), rapidly reacting to sudden contingencies, striking enemy targets, self-protecting, and delivering support. These capabilities will require systems that are mobile, flexible, fast, precise, and lethal.[120]

According to *Science of Strategy*, *sea control* requires capabilities for effectively dominating the surface and subsurface areas of operations and the airspace above them, enabling a navy to seize and maintain control of the primary maritime area of operations. These capabilities include all-weather, omnidirectional, multidomain, multifrequency sensing; target discrimination; target tracking; and positioning capabilities within the area of operations. In addition, these capabilities include seamlessly linked, multichannel, networked, interconnected, high-efficiency, secure shore, sea, air, space, and undersea information transmission and exchange capabilities; effective information destruction, suppression, interference, deception, and protection capabilities; and integrated meteorological, positioning and navigation, mapping, communication, and electronic warfare systems.[121]

Amphibious warfare capabilities are said to include the capability to lift large quantities of troops and weapons amphibiously, reconnaissance and early-warning capabilities, the capability to coordinate and command different types of forces (such as marines and naval forces), and the capability to conduct deep strikes against targets on land.[122] But puzzlingly,

119. Xiao Tianliang et al., *Science of strategy* (2020 revision), 360, 362–63.

120. Xiao Tianliang et al., *Science of strategy* (2020 revision), 361, 363.

121. Xiao Tianliang et al., *Science of strategy* (2020 revision), 363.

122. Xiao Tianliang et al., *Science of strategy* (2020 revision), 364.

Science of Strategy includes no discussion of the capabilities needed by the PLA Navy Marine Corps, despite the PLA Navy Marine Corps having undergone a major expansion in size and responsibilities in recent years. Originally consisting of two maneuver brigades, since 2016, the PLA Navy Marine Corps has grown to six maneuver brigades plus an aviation brigade and a special operations brigade. At the same time, the marine corps' missions have expanded from seizing and defending reefs and small islands in the South China Sea to conducting expeditionary operations in support of China's overseas interests throughout the world.[123] The lack of discussion on the PLA Navy Marine Corps in the navy chapter of *Science of Strategy* (or elsewhere in the book) suggests increasing the marine corps' capabilities is not a priority for the PLA Navy, and the recent expansion of the marine corps was probably mandated by the People's Liberation Army's central leadership.

Sea support capabilities are said to include information support, navigation support, logistics support, and technical equipment support. According to *Science of Strategy*, the PLA Navy needs to strengthen its capabilities for information collection, transmission, and control as well as information warfare; increase the maritime combat survivability of the service's platforms (why this capability is included as a sea support capability is unclear, unless it is a reference to improved damage control capabilities or only refers to the combat survivability of the PLA Navy's support ships); expand the service's mobile support forces; accelerate the construction of repair ships, hospital ships, and large supply ships; and increase the construction of oceanic rescue vessels and other rescue craft.[124]

Capabilities for military operations other than war include capabilities for "rights protection" operations (that is, enforcing China's territorial claims), counterterrorism operations, far-seas escort operations (such as those the PLA Navy has been conducting in the Gulf of Aden since 2008), rescue at sea, noncombatant evacuations, and overseas exercises and training.[125]

To carry out these missions, *Science of Strategy* implies that the PLA Navy will construct aircraft carriers and the ships, aircraft, and support forces that complement the aircraft carriers. At the same time, according to *Science of Strategy*, the navy also needs to accelerate the

123. OSD, *Military and Security Developments*, 56–57.

124. Xiao Tianliang et al., *Science of strategy* (2020 revision), 364.

125. Xiao Tianliang et al., *Science of strategy* (2020 revision), 365.

development of reconnaissance and early warning, long-range precision strike, special operations, information warfare, and other new types of combat forces.[126]

Far-seas operations are said to require larger platforms and platforms for long-range operations, such as aircraft carriers; large destroyers; strategic nuclear submarines; large, long-range replenishment ships; and long-range shipborne aircraft. In addition, *Science of Strategy* states the PLA Navy should increase its lift capabilities by developing and deploying large transport ships; large, multipurpose landing ships; and helicopters.[127]

Furthermore, *Science of Strategy* states the PLA Navy needs to increase its intelligence and reconnaissance capabilities. Specifically, the navy needs information collection methods that cover the land, sea, air, space, and cyberspace, including multiple types of day/night, all-weather reconnaissance capabilities. *Science of Strategy* asserts reconnaissance satellites and early warning aircraft have become the main surveillance forces for naval combat and implies the PLA Navy will emphasize the development of ocean reconnaissance, maritime early-warning, surveillance, and positioning and navigation satellites in particular. This passage makes no mention of over-the-horizon radar or civilian/maritime militia vessels as a means for conducting maritime surveillance and reconnaissance.[128]

Science of Strategy indicates the PLA Navy is seeking to develop a unified combat command system that integrates air, space, sea, and land and connects a range of intelligence systems, command-and-control systems, and the Internet. This system will enable commanders to have real-time battlespace awareness at all times, in all weather, and under all conditions and will become the primary command platform for command organs at all levels of the navy.[129]

Science of Strategy states the PLA Navy needs to strengthen its far seas support capabilities greatly, and its approach to support will evolve from a shore-based support model to a sea-based model. Specifically, the navy will rationalize its shore-based support system by organizing it around a few designated ports and airfields,

126. Xiao Tianliang et al., *Science of strategy* (2020 revision), 366.

127. Xiao Tianliang et al., *Science of strategy* (2020 revision), 360–61, 367–68.

128. Xiao Tianliang et al., *Science of strategy* (2020 revision), 360, 367–68.

129. Xiao Tianliang et al., *Science of strategy* (2020 revision), 360, 367.

while strengthening the service's sea-based support system oriented around mobile support vessels, contingency response support system for mobile combat forces, material support system, and support command system. *Science of Strategy* also suggests the navy may develop overseas "sea-based general supply points" (海上综合部几点).[130] This language may be a reference to the creation of floating bases in international waters—a feat the Soviet Union accomplished during the Cold War when the country was unable to obtain basing rights in a key region.[131] Finally, *Science of Strategy* states the PLA Navy will strengthen coordination with overseas organizations—particularly, foreign ministries and commercial entities, including the overseas operations of Chinese companies.[132]

Science of Strategy indicates in the future, the PLA Navy will employ increasing numbers of unmanned platforms. Unmanned shipborne aircraft will be used to carry out long-range, wide-area reconnaissance and early warning as well as long-range precision strike. Unmanned surface vessels will be used to expand the size of the area of operations commanders can observe and control as well as to conduct close-in reconnaissance, minelaying, and minesweeping. Unmanned surface vessels carrying long-range missiles will also be used to attack enemy carrier strike groups at sea and to conduct strikes on enemy islands and reefs. Unmanned undersea systems will be used to carry out tasks such as attacks, early warning, broad-area searches, reconnaissance, surveillance, tracking, mine detection, mine destruction, and communications relay. Targets of these operations will include surface ships, submarines, naval ports, and undersea facilities.[133]

A notable omission from the chapter on navy development is anti-submarine warfare capabilities. Although anti-submarine warfare is mentioned elsewhere in the volume, these mentions are mainly in reference to the difficulty other nations—especially, the United States—have experienced in employing this capability. The book does contain at least one reference to China developing anti-submarine warfare capabilities (in a chapter about military conflict in new realms), but the mention occurs in a statement about deep-sea warfare capabilities China should develop in addition to "traditional" (传统)

130. Xiao Tianliang et al., *Science of strategy* (2020 revision), 367–69.

131. David Brewster, "The People's Liberation Army and Operational Access in the Indian Ocean Region: Geographic Constraints and Lessons from the Cold War," in *Enabling a More Externally Focused and Operational PLA*, ed. Roger Cliff and Roy D. Kamphausen (Carlisle, PA: Strategic Studies Institute, US Army War College Press, 2022), 71, https://press.armywarcollege.edu/monographs/951/.

132. Xiao Tianliang et al., *Science of strategy* (2020 revision), 369.

133. Xiao Tianliang et al., *Science of strategy* (2020 revision), 361–62.

capabilities, such as conventional submarines, nuclear submarines, mines, countermine warfare, and anti-submarine warfare.[134] The discussions on the difficulty of anti-submarine warfare suggest its omission from the chapter on navy development reflects a view investment in this area would not be fruitful. But, potentially, anti-submarine warfare is a priority for the People's Liberation Army, but the organization's objectives in this area are considered too sensitive for discussion in an open publication. According to the Department of Defense, the PLA Navy's anti-submarine warfare capabilities have been improving, but, apparently, not rapidly, and the service continues to lack a robust capability to conduct anti-submarine warfare beyond China's coastal areas.[135]

PLA Air Force

Science of Strategy identifies several overall trends that will guide the development of the PLA Air Force. These trends include the increasing use of stealth technology; the increasing employment of various types of support aircraft, such as jamming, early warning and control, communications, and aerial refueling aircraft; an increasing orientation toward offense, with most combat aircraft having ground attack capabilities, rather than just air-to-air combat capabilities; an increasing reliance on precision-guided munitions—especially, long-range, precision-guided munitions; and increasing use of unmanned aircraft, with unmanned "aerospace vehicles" (that is, vehicles capable of operating both within the atmosphere and in outer space) and unmanned combat aircraft being a particular focus of development. As a result of these trends, according to *Science of Strategy,* the requirements for "traditional" (传统) air force capabilities, such as those for offensive air operations, airlift, airborne operations, and base support, have become even stronger, and requirements for "new" capabilities, such as airborne early warning, air and missile defense, and information warfare have become even more urgent.[136]

Science of Strategy describes the requirements associated with five capability areas in particular: airborne early warning, offensive air operations, air and missile defense, airlift, and base support. On *airborne early warning*, *Science of Strategy* states the PLA Air Force should seek to create a unified

134. Xiao Tianliang et al., *Science of strategy* (2020 revision), 156–58, 162.

135. OSD, *Military and Security Developments*, vi, 48–50, 78, 83.

136. Xiao Tianliang et al., *Science of strategy* (2020 revision), 370–74.

air, space, land, and sea reconnaissance, early warning, and detection system, building on the service's base of airborne early warning and control aircraft by adding space-based early warning forces—primarily, satellites—and accelerating the upgrading of land-based and sea-based radar systems.[137] (This last point is notable because the PLA Air Force is not known to operate sea-based radar systems. Whether this statement is suggesting the PLA Air Force deploy its own sea-based radar systems or simply calling on the PLA Navy to upgrade its shipborne radars, which would imply the PLA Navy and Air Force share radar information, is unclear.)

Science of Strategy states strengthening the PLA Air Force's airborne early warning capabilities will also entail accelerating the improvement of service's unified, interconnected, airborne and land-based, fixed and mobile, command-and-control system, gradually realizing the automated linkage of the service's airborne early warning systems to its command-and-control systems. In addition, the PLA Air Force will seek to accelerate the development of equipment for offensive and defensive information warfare, constructing an information attack capability that unifies soft and hard methods and an information defense capability that focuses on defending against precision-guided munitions.[138] (This discussion of information warfare appears to encompass electronic warfare.)

According to *Science of Strategy*, improving the PLA Air Force's capabilities for conducting *offensive air operations* will require the air force to develop a complete array of offensive warfare forces, including both precision strike and other hard-kill capabilities as well as information attack and other soft-kill capabilities. At the same time, the PLA Air Force will need to increase the number of aircraft that have ground attack capabilities. In addition, the PLA Air Force will need long-range precision attack capabilities so the area the service can attack covers all regions from which threats to China's national security could originate.[139]

According to *Science of Strategy*, an effective *air and missile defense* capability will require an integrated air, space, land, and sea strategic warning capability—particularly, one capable of detecting and tracking ballistic missiles, cruise missiles, and stealth aircraft. The People's Liberation Army will also need to create a long-range, medium-range, and short-range air

137. Xiao Tianliang et al., *Science of strategy* (2020 revision), 375, 379.

138. Xiao Tianliang et al., *Science of strategy* (2020 revision), 375.

139. Xiao Tianliang et al., *Science of strategy* (2020 revision), 375.

and missile interception network that is unified, interconnected, and layered and operates in the air, in space, on land, and at sea. (Currently, these capabilities are controlled by multiple organizations within the People's Liberation Army, including the PLA Air Force, PLA Army, PLA Navy, and PLA Strategic Support Force. Thus, such a network would not belong solely to the PLA Air Force; rather, such a network would be an integrated, joint system, the creation of which would appear to require direction and oversight from the Central Military Commission.) In addition, according to *Science of Strategy*, the PLA Air Force needs the capability to conduct counterstrikes against the sources of an enemy's air and missile attacks—that is, the capability to conduct strikes on an enemy's air bases, missile launch sites, sea-based launch platforms (that is, ships and submarines), and other sources of aerial attack.[140]

Science of Strategy states "informatization" and "intelligentization" are causing the missions of the military to expand, creating new requirements for the PLA Air Force's *airlift* capabilities. One requirement is sufficient scale. Airlift capabilities need to be able to satisfy both the wartime requirements of air transportation and supporting airborne operations and the peacetime requirements of humanitarian assistance and disaster relief and the management of overseas crises. Another requirement is said to be appropriate proportions of large, medium, and small transport aircraft. In particular, sufficient numbers of large transport aircraft are needed. (As of 2021, roughly half of the transport aircraft operated by the PLA Air Force were estimated to be light transport aircraft, and less than a quarter were estimated to be heavy transport aircraft. In comparison, less than 5 percent of the US Air Force's transport aircraft were light transport aircraft, and more than 40 percent were heavy transport aircraft.)[141] A third requirement is a rapid response capability. The airlift force must be able to carry out rapid deployment and strategic mobility tasks on short notice throughout the country, its periphery, and across continents.

Just as the discussion of amphibious warfare capabilities in the navy chapter of *Science of Strategy* includes no discussion of the capabilities specifically needed by the navy's marine corps, the air force chapter contains no discussion of the capabilities needed by the PLA Air Force

140. Xiao Tianliang et al., *Science of strategy* (2020 revision), 376, 379.

141. Xiao Tianliang et al., *Science of strategy* (2020 revision), 376–77; and International Institute for Strategic Studies (IISS), *The Military Balance 2021* (London: IISS, 2021), 57–59, 255.

Airborne Corps beyond the airlift capacity needed to transport the corps.[142] This omission suggests upgrading the airborne corps' capabilities may not be a priority for the PLA Air Force. But as noted earlier, the army chapter of *Science of Strategy* refers to airborne forces as if they were part of the PLA Army. The PLA Army's apparent greater interest in airborne forces suggests the airborne corps' capabilities may not increase rapidly unless control of them is transferred to the PLA Army (or the army develops its own airborne forces).

Science of Strategy states development of the air force's *base support* system has lagged, and the continuous increase in the information technology content of air force weapon systems, the rapid increase in the numbers—and the numbers of different types—of new aircraft, and the rapid expansion of support elements are making this problem increasingly prominent. The document notes under the PLA Air Force's traditional support model, each airfield supported a single type of aircraft. But this system means when aircraft deploy away from their home airfields, the aircraft must bring their support capabilities with them, which requires the transport of large amounts of specialized equipment and materials. This requirement both consumes significant amounts of transport capacity and limits the ability of forces to deploy rapidly, and therefore limits the air force's ability to take advantage of the capabilities of its new types of combat aircraft.[143]

To address these limitations, *Science of Strategy* states the air force should implement a support model based on a network of major support bases at a limited number of airfields that are able to provide a range of support functions for multiple aircraft types. These major support bases should be concentrated in the "main strategic direction" (that is, opposite Taiwan) and other regions of possible military conflict. In addition, the air force should create "mobile contingency response support forces" (应急机动支援保障力量) that are equipped with automated command information systems to provide comprehensive, specialized support to new weapon systems.[144]

According to *Science of Strategy*, the proportion of "defensive" aircraft (that is, air superiority fighters) in the fleet should be decreased as much as possible, and the numbers of "offensive" aircraft (attack aircraft, fighter-bombers, and bombers) and, in particular, the proportion

142. Xiao Tianliang et al., *Science of strategy* (2020 revision), 370–80.

143. Xiao Tianliang et al., *Science of strategy* (2020 revision), 377.

144. Xiao Tianliang et al., *Science of strategy* (2020 revision), 377–79.

of support aircraft (reconnaissance, early warning and control, electronic warfare, and aerial refueling aircraft) should be increased. Within the support aircraft category, moreover, early warning and control aircraft and electronic warfare aircraft should see the greatest increases.[145]

Interestingly, the air force chapter of *Science of Strategy* contains no reference to a nuclear role for the PLA Air Force or even the acquisition of strategic bombers. The PLA Air Force has operationally fielded a Xian H-6 bomber that has fuselage modifications, allowing it to carry an air-launched ballistic missile that is believed to have nuclear capability. In addition, in 2016, the PLA Air Force's commander announced China was developing a new generation of bombers that official Chinese state media have stated will have a nuclear mission.[146] Why the PLA Air Force's intentions to acquire the capability to deliver nuclear weapons is not discussed in *Science of Strategy* is unclear.

Although China's space forces are currently under the control of the Strategic Support Force, the air force chapter in *Science of Strategy* includes a discussion of space forces, suggesting an ongoing desire by the PLA Air Force to expand its sphere of operations to include outer space. This discussion notes current space-based platforms are mainly responsible for intelligence collection and transmission, navigation and positioning, secure communications, and other information support tasks. But the document suggests over the longer term, the PLA Air Force will seek to develop aerospace planes and space-based, high-energy lasers so space-based platforms and systems will be able to perform offensive operations, missile defense, and other tasks.[147]

PLA Rocket Force

Science of Strategy states priorities for the PLA Rocket Force are to improve its penetration; rapid reaction; long-range, conventional precision strike; lethality; and survivability and defense capabilities.[148] *Penetration capability* is said to be a function of penetration techniques and tactics. The former includes the use of warhead maneuvers, stealth, decoys, jamming, and multiple warheads. The latter is said to include deception,

145. Xiao Tianliang et al., *Science of strategy* (2020 revision), 378–79.

146. Xiao Tianliang et al., *Science of strategy* (2020 revision), 370–80; and OSD, *Military and Security Developments*, vi–vii, 55–56, 85, 90–92.

147. Xiao Tianliang et al., *Science of strategy* (2020 revision), 379.

148. Xiao Tianliang et al., *Science of strategy* (2020 revision), 384.

the proper timing of a nuclear counterattack (possibly a reference to launching on warning, before an enemy has reduced the number of available missiles), the degradation of the enemy's defense systems, and the coordinated employment of multiple types of forces.[149]

Factors affecting *rapid reaction capability* are said to include strategic warning; the ability of commanders to assess the significance of enemy actions rapidly; command, control, and communications capabilities; the training level of missile forces; and overall support capabilities.[150] (Unstated, but presumably also a requirement for a rapid reaction capability, is missiles physically capable of being launched on short notice.)

Long-range, conventional precision strike capability is said to be a function of the number of missiles available, their range, and their accuracy.[151]

Lethality (毁伤能力) is said to be a function of the extent to which the performance of missile warheads satisfies the requirements for destroying different types of targets. For instance, some targets need to be completely destroyed, and others only need to be functionally disabled. As a result, the rocket force needs to develop and field warheads that employ a range of different destructive principles.[152]

Survivability and defense capabilities are said to be a function of the protective capabilities of the missile launch facility, camouflage and concealment, and the unit's mobility.[153]

On the size of China's nuclear forces, *Science of Strategy* states the rocket force should continue to follow the long-standing approach of "elite and effective" (精干有效). Here, "elite" refers to a relatively small number of highly capable forces. "Effective" is construed as meaning China's nuclear forces are able to deter an invasion of China or a nuclear attack against the country in peacetime and to preserve themselves and carry out effective nuclear counterstrike in wartime.[154] (As a note, although an invasion of China is a highly unlikely prospect, the use of nuclear forces to deter an invasion would entail an implicit threat Beijing would not adhere to its "no first use" principle.)

149. Xiao Tianliang et al., *Science of strategy* (2020 revision), 385, 389.

150. Xiao Tianliang et al., *Science of strategy* (2020 revision), 384–85.

151. Xiao Tianliang et al., *Science of strategy* (2020 revision), 384–85.

152. Xiao Tianliang et al., *Science of strategy* (2020 revision), 386, 389.

153. Xiao Tianliang et al., *Science of strategy* (2020 revision), 386.

154. Xiao Tianliang et al., *Science of strategy* (2020 revision), 386–87.

Science of Strategy states China should maintain its nuclear forces at "the lowest level needed to protect national security" (维护国家安全需要的最低水平) but immediately follows with a statement the country should work to develop a strategic nuclear force proportionate to China's international standing and appropriate to the country's development interests.[155] Given China has the world's largest population, largest or second-largest economy, and second-largest defense budget, thinking a strategic nuclear force proportionate to the country's international standing would be one comparable to that of the world's largest nuclear powers—the United States and Russia—would not be unreasonable. Such a force would arguably be substantially larger than the "lowest level needed to protect national security."[156] In 2020, for example, China was estimated to have deliverable nuclear warheads numbering in the low 200s. Given this number had been more or less stable for many years, China's leadership presumably judged the number to be sufficient to deter an invasion of China or nuclear attack against the country in peacetime and to carry out an effective nuclear counterstrike in wartime. But this number of deliverable nuclear warheads was approximately one-twentieth the number possessed by the United States and Russia at the time. Thus, developing a strategic nuclear force proportionate to China's international standing would seem to imply a substantial increase in the size of the country's nuclear force. These circumstances may be the reason for China appearing to have been expanding its nuclear forces in recent years; indeed, the country has been projected to reach about 1,000 operational nuclear warheads by 2030.[157]

Science of Strategy states the rocket force must focus on increasing its network information complex-based joint combat capability, which is defined as implying the coordinated development of missile forces, technology and tactics, personnel and equipment, combat systems and engineering facilities, and accompanying command and support equipment. *Science of Strategy* focuses on developing three areas in particular: facilities, force structure, and support systems.[158]

On facilities, *Science of Strategy* states missile bases should have first-rate protective capabilities as well as warfighting and living facilities. On force structure, the document states the rocket force should maintain

155. Xiao Tianliang et al., *Science of srategy* (2020 revision), 387.

156. Xiao Tianliang et al., *Science of strategy* (2020 revision), 387.

157. OSD, *Military and Security Developments*, 97; and "Status of World Nuclear Forces," Federation of American Scientists (website), 2022, https://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/.

158. Xiao Tianliang et al., *Science of strategy* (2020 revision), 387.

its nuclear counterstrike operations capability while rapidly strengthening its conventional missile operations capability. Achieving these objectives requires an organically combined set of short-range, medium-range, long-range, and intercontinental ballistic and cruise missiles as well as major breakthroughs in areas such as response time, range, accuracy, penetration capability, and reliability. In particular, *Science of Strategy* states the rocket force should have sufficient numbers of conventional missiles to strike all the "campaign-level" (战役性的) and "strategic-level" (战略性的) targets that would be required for a campaign in the "primary strategic direction" (that is, a war over Taiwan).[159]

Finally, *Science of Strategy* states the rocket force must accord an equal priority to developing and fielding support systems, such as command, equipment, and logistics support systems, as it does to the development of the weapon systems themselves.[160]

In addition, *Science of Strategy* states China needs to establish and perfect a strategic missile reconnaissance and early warning system and to identify indicators an enemy might launch a nuclear attack—especially, a strategic missile attack. At the same time, China should take full advantage of its capabilities in surface-to-surface missiles, implement advanced information technology, and develop "asymmetric strategic counterbalance forces" (非对称战略制衡力量).[161] As noted earlier, the 2019 defense white paper also refers to "strategic counterbalance" capabilities. The use of the modifier "asymmetric" suggests these are forces that other countries do not possess, but the specific types of forces to which this term refers is unclear. Elsewhere, *Science of Strategy* refers to both the rocket force as a whole and sea mines and submarines as asymmetric, strategic counterbalance forces; thus, developing "asymmetric, strategic counterbalance forces" may simply refer to the development of missile forces in general.[162]

Finally, *Science of Strategy* states the rocket force should develop a "reliable missile force survival and protection system" (可靠的导弹部队生存防护体系), which probably refers to a missile defense system. According to *Science of Strategy*, China's missile force survival and protection system should follow an "economic and practical" development

159. Xiao Tianliang et al., *Science of strategy* (2020 revision), 387–89.

160. Xiao Tianliang et al., *Science of strategy* (2020 revision), 388.

161. Xiao Tianliang et al., *Science of strategy* (2020 revision), 388.

162. Xiao Tianliang et al., *Science of strategy* (2020 revision), 157, 383.

path and be implemented in a decentralized way, as permitted by national technological, financial, and material capabilities, suggesting the rocket force will take a gradual approach to developing such a system and will not be seeking to acquire a large-scale, national missile defense system in the near future.[163]

Military Space Forces

Created at the end of 2015, the Strategic Support Force oversees PLA space operations and information operations. Although the chapter on the air force in *Science of Strategy* includes a discussion on space forces, the text also contains a separate chapter that focuses solely on the topic. This chapter likely reflects the perspective of the Strategic Support Force, and the discussion in the chapter on the air force likely reflects the perspective of the PLA Air Force.

The chapter on military space forces states the People's Liberation Army should prioritize the development of several types of space-related capabilities: space-based information support, space control, space attack and defense, and capabilities to support military space activities.[164]

Space-based information support capabilities are said to include all-weather, day/night, near-real-time reconnaissance and surveillance; surveying and mapping; meteorology; broadband, high-capacity, jam-resistant, and secure communications; autonomous and secure, real-time positioning, navigation, and timing; and information integration and combat management.[165]

Space control capabilities are said to include space situational awareness, soft-kill, hard-kill, and defensive capabilities. Space situational awareness requires the continuous tracking, surveillance, cataloging, and forecasting of targets throughout space—especially, "minute" (微小) targets (perhaps a reference to microsatellites). Soft-kill capabilities, which can be ground based or space based, include jamming, deception, and the use of low-power, directed energy weapons against space targets or their communications links. Hard-kill capabilities are said to include those that employ kinetic energy. High-power, directed energy weapons are not explicitly mentioned as a hard-kill capability but are implied by the

163. Xiao Tianliang et al., *Science of strategy* (2020 revision), 389–90.

164. Xiao Tianliang et al., *Science of strategy* (2020 revision), 397–98.

165. Xiao Tianliang et al., *Science of strategy* (2020 revision), 397.

reference to the use of low-power, directed energy weapons as a soft-kill capability. Defensive capabilities are said to include both "passive" (被动) (积极主动) and active measures, with examples given that include stealth, concealment, deception, maneuvers, hardening, and encryption.[166] (These examples would be considered passive defense measures in the US military. Whether some of them are considered active defense measures by the People's Liberation Army or whether the examples given omit what the People's Liberation Army considers to be active defense measures is unclear.)

Space attack and defense capabilities (空间攻防能力) appears to refer to space capabilities that are used to attack or to help to defend terrestrial targets. According to *Science of Strategy*, these capabilities include capabilities for strategic warning and surveillance; long-range, precision, ballistic missile strike; space-to-Earth firepower strike; and space defense operations. Strategic warning and surveillance capabilities are said to use space-based and ground-based surveillance methods to detect enemy missile launches; predict the origin, destination, trajectory, and travel time of missiles; and assess the results of (adversarial) missile strikes (which may include nuclear detonation detection).

Science of Strategy does not elaborate on long-range, precision, ballistic missile strike capabilities, potentially because, although long-range, ballistic missile strikes may technically be considered space warfare, given ballistic missiles pass through space on their way to their targets, ballistic missiles are controlled by the PLA Rocket Force and were already discussed in the chapter on rocket forces. Space-to-Earth firepower strike methods are said to include "space combat vehicles" (空间作战飞行器) and "orbital weapons" (轨道武器). The exact type of space combat vehicles that are envisioned is unclear. Orbital weapons presumably refers to orbital bombardment systems. Space defense operations capabilities are said to include capabilities to defend against and intercept ballistic missiles as well as to assess the results of intercepts.[167]

Capabilities to support military space activities are said to include space lift; responsive space launch; space telemetry, tracking, and command; space vehicle recovery; logistics support; and command-and-control capabilities.[168]

166. Xiao Tianliang et al., *Science of strategy* (2020 revision), 397–98.

167. Xiao Tianliang et al., *Science of strategy* (2020 revision), 398.

168. Xiao Tianliang et al., *Science of strategy* (2020 revision), 398.

Science of Strategy makes several broad recommendations for how China should develop its space capabilities. One recommendation is to accelerate the development of space weapon systems, taking advantage of what is said to be China's advanced space technology. Another recommendation is to focus on increasing the survivability of China's space systems, which entails making survivability a basic performance requirement during the design and validation phases and taking advantage of international cooperation and the globalization of commercial space activities to increase the diversity of the country's space systems.[169] The latter may refer to making use of third-country or international space systems that an adversary such as the United States would be inhibited from attacking.

A third recommendation is to strengthen the development of "military space theory" to guide the development and employment of space forces. The final recommendation is to intensify the development of military space personnel. According to *Science of Strategy*, military space personnel need to satisfy the requirements for both ordinary military personnel and the special requirements of future space combat.[170]

Cyberspace Forces

Although both the People's Liberation Army's space forces and its information operation forces, including forces that conduct electronic warfare, psychological warfare, and cyberspace operations, are under the control of the Strategic Support Force, space forces and cyberspace forces are discussed in separate chapters of *Science of Strategy*.[171] According to the chapter on cyberspace forces, the People's Liberation Army needs to develop five types of cyberspace capabilities: cyber reconnaissance; cyberattack; cyber defense; operations, administration, and management; and recovery.[172]

Cyber reconnaissance capabilities are said to include network espionage, electromagnetic espionage, and human espionage. Network espionage is said to entail exploiting gaps in an enemy's network security to infiltrate information systems and to reconnoiter adversary "C4ISRK" systems (a Chinese abbreviation meaning "command, control, communications, computers, intelligence, surveillance, reconnaissance, and kill"), electronic

169. Xiao Tianliang et al., *Science of strategy* (2020 revision), 399–400.

170. Xiao Tianliang et al., *Science of strategy* (2020 revision), 401.

171. OSD, *Military and Security Developments*, vii, 67–73.

172. Xiao Tianliang et al., *Science of strategy* (2020 revision), 405–7.

warfare systems, and weapon control systems. Electromagnetic espionage is said to entail using electronic reconnaissance equipment to collect, locate, detect, identify, record, and analyze the electromagnetic signals emitted by the electronic equipment in the enemy's computer information systems. Human espionage is said to entail using spies, hackers, and purchases from third parties to obtain information storage devices and, thereby, intelligence.[173]

In discussing *cyberattack and defense*, *Science of Strategy* asserts the former is the stronger form of combat. Cyberattack is said to employ computer viruses and hacking attacks to paralyze enemy information systems, steal information, tamper with the enemy's information, harass the enemy's network, and provide the enemy with false intelligence. Cyber defense capabilities are said to include intrusion detection systems, firewalls, antivirus software, and data encryption.[174]

Network operations, administration, and management capabilities are the capabilities that enable computer networks to support real-time, day/night, all-frequency surveillance and reconnaissance capabilities and to provide commanders at all levels with timely, comprehensive battlefield sensing capabilities and the capability to closely coordinate weapon platforms on a multidimensional battlefield. Recovery capabilities are the network backup and recovery capabilities that will enable the restoration of services if the networks' hardware, software, or data are damaged by the enemy.[175]

Science of Strategy asserts, in developing its cyberspace combat power, the People's Liberation Army must create a mechanism that unifies cyber reconnaissance, cyberattack, cyber defense, cyber support, and cyber mobilization to create a unified reconnaissance-attack-defense, network-electromagnetic combat power system. *Science of Strategy* notes this system must balance the opposing imperatives of information sharing and security.[176]

Science of Strategy discusses the importance of realistic training for network warfare forces—particularly, training that integrates technology with tactics. The textbook asserts conducting "live-fire" training on actual networks is difficult—presumably because of the social and economic disruption that would result. Therefore, cyberwarfare training

173. Xiao Tianliang et al., *Science of strategy* (2020 revision), 336, 405.

174. Xiao Tianliang et al., *Science of strategy* (2020 revision), 405–6.

175. Xiao Tianliang et al., *Science of strategy* (2020 revision), 407.

176. Xiao Tianliang et al., *Science of strategy* (2020 revision), 408–9.

should be conducted on simulated systems. Through adversarial training on simulated, cyberwarfare systems, both the offensive side and the defensive side can identify new techniques, increasing the combat capabilities of both sides.[177]

This cyberwarfare training system should be able to simulate the steps of target detection, information espionage, network intrusion, destruction of information or services, and other attack methods. The system should allow the observation and inspection of various kinds of network attacks and the accurate assessment of the outcomes of these attacks. The result will be an increase in the information security awareness of the participantsin the training and a strengthening of effective techniques for cyberwarfare.[178] In particular, *Science of Strategy* calls for the creation of a "cyber shooting range" (网络靶场), which appears to be analogous to the US National Cyber Range.[179]

Additionally, *Science of Strategy* calls for a strengthening of cyberspace laws and regulations, stating doing so is of huge significance to guiding, regulating, and promoting the development of China's cyberspace power. The document notes cyberwarfare, like other forms of warfare, is constrained by the laws of war and armed conflict. Therefore, the People's Liberation Army needs to create cyberwarfare regulations that cover all aspects of both the development of the military's cyberspace capabilities and their employment in a future cyberwar.[180]

Finally, *Science of Strategy* discusses the importance of developing specialized cyberwarfare personnel. Specifically, the People's Liberation Army must develop a large cadre of four types of highly trained cyberwarfare personnel as quickly as possible who understand both technology and tactics. First, high-level cyber commanders who specialize in the study of cyberwarfare will be responsible for developing cyberwarfare strategy and tactics and formulating cyberwarfare plans. Second, staff who are experts on cyberwarfare techniques will oversee the development of their units' networks and conduct cyberwarfare. Third is high-level experts who understand specific cyberwarfare technologies and can develop specialized cyberwarfare weapons. Fourth is network support personnel who oversee

177. Xiao Tianliang et al., *Science of strategy* (2020 revision), 409–10.

178. Xiao Tianliang et al., *Science of strategy* (2020 revision), 410.

179. Xiao Tianliang et al., *Science of strategy* (2020 revision), 410; and "National Cyber Range (NCR)," Program Executive Office Simulation, Training and Instrumentation (website), n.d., https://www.peostri.army.mil/national-cyber-range-ncr.

180. Xiao Tianliang et al., *Science of strategy* (2020 revision), 410–11.

ordinary tasks and operations and enforce network security and defense. Finally, *Science of Strategy* states the People's Liberation Army should create a specific cyberwarfare specialty for its personnel (implying one does not currently exist).[181]

Implications

The organization that results from the developmental processes and directions described previously will be substantially different from the People's Liberation Army of the past. The organization will have fewer personnel but more modern equipment and a greater capability to project power beyond China's immediate periphery. This section examines the implications for US defense planning and force development of the developmental directions the *Science of Strategy* states each PLA principal force is taking.

PLA Army

If the objectives the PLA Army is currently seeking reach fruition, the PLA Army of the future will be smaller but more capable than the service of the past, which relied on large formations of unarmored infantry and towed artillery. The PLA Army will be organized into smaller units, each of which will be capable of carrying out multiple types of combat missions in different environments and under different conditions without needing reinforcement or augmentation. Most infantry will be transported by armored vehicles or helicopters, and most artillery will be self-propelled and long range. Armored forces will include a mix of wheeled and tracked, light and heavy armor, as compared to the PLA Army armored forces of the past, which relied predominantly on traditional main battle tanks.Moreover, the PLA Army's remaining, legacy main battle tanks will be retired and replaced by modern designs. In addition, the PLA Army's organic air defense systems will become longer ranged and more capable, particularly in their ability to defend against cruise missiles, unmanned aerial vehicles, and armed helicopters.

Although the traditional branches of the PLA Army are being reduced and modernized, newer types of force elements will be expanding. The aviation forces will be expanding in particular, but special operations, information

181. Xiao Tianliang et al., *Science of strategy* (2020 revision), 412.

operations, and electronic warfare forces will also be expanding. In addition to transport missions, the PLA Army's aviation forces will be designed for conducting reconnaissance, harassment, and strike operations against command-and-control centers and communications nodes. Similarly, the PLA Army's special operations forces will expand, and their equipment will be upgraded, improving their reconnaissance, targeting, and strike capabilities as well as their ability to survive in enemy rear areas. Moreover, the computerization and automation levels of all of the PLA Army's forces will increase, as will their early warning,target discrimination, and positioning and tracking capabilities.

In short, the PLA Army of the future will be organized and equipped very much like the US Army. To defeat such a force, US and allied militaries will first need the capability to find and fix highly mobile armor, infantry, artillery, and helicopter forces that are capable of maneuvering in complex terrain. The militaries of the United States and its allies will also need the capability to evade and survive attack by the aforementioned forces, which will be armed with accurate, long-range, modern munitions and aided by special operations forces. Finally, US and allied militaries will need the capability to counteract and destroy these forces, which will be defended by modern air defense systems as well as information operation and electronic warfare forces.

PLA Navy

If the developments the PLA Navy is currently seeking reach fruition, the service will be increasingly capable of operating far from China's shores. The mainstays of this navy will be aircraft carriers; nuclear submarines; and multipurpose, amphibious ships. This force will be capable of conducting long-range, precision, conventional strikes and nuclear strikes and will have robust self-protection capabilities. Supporting these ships will be large destroyers; long-range underway replenishment ships; early-warning aircraft; and ocean reconnaissance, maritime early-warning, surveillance, and positioning and navigation satellites. At the same time, the PLA Navy will maintain an inshore defense force consisting of fast and lethal platforms and will have highly capable information warfare, electronic warfare, and special operation forces.

All of these forces will be linked together by an integrated land-, sea-, air-, and space-based command-and-control network. In addition, over time, the PLA Navy will employ increasing numbers

of unmanned platforms, including unmanned aircraft for long-range, wide-area reconnaissance; early warning; long-range precision strike; unmanned surface vessels for reconnaissance, minelaying, minesweeping, attacking enemy carrier strike groups at sea, and conducting strikes on enemy islands and reefs; and unmanned, undersea systems for early warning, broad-area searches, reconnaissance, surveillance, tracking, mine detection, mine destruction, communications relay, and attack.

This PLA Navy will no longer be primarily confined to the western Pacific. In the future the service is likely to be increasingly found operating throughout the world, including in the central and eastern Pacific, the Indian Ocean, the Arctic Ocean, the Southern Ocean, and even the Atlantic Ocean. The US Navy will no longer be the uncontested ruler of the world's seas.

In the event of war, the US military and its allies will need multiple capabilities to defeat the PLA Navy. One will be the capability to degrade the People's Liberation Army's naval reconnaissance and surveillance capabilities. Included in this capability is the capability to detect, intercept, and destroy PLA satellites; early warning aircraft; and unmanned aircraft, surface vessels, and undersea systems. Also included in this capability is the capability to blind, jam, and spoof the sensors carried by such systems as well as PLA surface combatants and submarines. These capabilities will reduce US ships' chance of being detected and attacked.

Also important will be the capability to defend US Navy ships against attacks by long-range, precision strike weapons such as anti-ship ballistic missiles and supersonic, anti-ship cruise missiles. Included in this capability is the capability to detect, intercept, and destroy such weapons and to blind, jam, or spoof their sensors. But given the PLA Navy's apparent lesser emphasis on anti-submarine warfare, the threat to US submarines will likely increase less rapidly.

Another important capability will be the ability to find and sink the People's Liberation Army's ships and submarines. Included in this capability is the capability to locate PLA ships and submarines in a contested air and space environment in which nonstealthy (and possibly stealthy) satellites and aircraft will be at risk of being intercepted and destroyed. Also included in this capability is the capability to detect modern surface ships that have reduced radar cross sections and employ low-probability-of-intercept communications and radar equipment and submarines that have improved quieting technology.

Attacking and sinking such ships will require weapons capable of penetrating the defenses of PLA Navy vessels, including systems that are designed to blind, jam, or spoof the sensors used by US weapons as well as systems that can intercept the weapons themselves. In addition, the United States and its allies will need to acquire weapons capable of being launched from platforms operating beyond the range of most PLA anti-ship, anti-submarine, and antiair systems or to carry weapons in platforms that are capable of surviving within the engagement envelopes of the People's Liberation Army's weapons.

PLA Air Force

If the developments the PLA Air Force is currently seeking reach fruition, the service will have reduced numbers of pure air superiority aircraft but increased numbers of aircraft with ground attack capabilities, such as fighter-bombers (including multirole fighters), bombers, and attack aircraft. The PLA Air Force of the future will also have a greater proportion of reconnaissance, aerial refueling, transport, early-warning and control, and electronic warfare aircraft—particularly, the last three types. Most of the increase in transport aircraft will come in the form of large aircraft, and the overall readiness level of the PLA Air Force's airlift fleet will be raised. In addition to increasing its numbers of early-warning aircraft, the PLA Air Force will deploy space-based early warning systems. All of the PLA Air Force's systems will be linked by a unified airborne and land-based, fixed and mobile, command-and-control system.

The PLA Air Force of the future will have both improved, hard-kill, precision strike capabilities for attacking enemy air bases, missile launch sites, ships, and other targets as well as strengthened, soft-kill, offensive and defensive, information and electronic warfare capabilities. The PLA Air Force will also support the creation of an integrated air and missile defense system that will include air-, space-, land-, and sea-based warning and intercept systems. In addition, the PLA Air Force will employ a more capable and flexible support system that will enable aircraft to redeploy to and begin operating rapidly from bases other than their home bases, allowing the service to concentrate its forces in different parts of the country. Finally, the PLA Air Force is apparently reacquiring the nuclear mission it once had, though *Science of Strategy* does not mention this undertaking.

Although the People's Liberation Army's space forces are currently controlled primarily by the Strategic Support Force, the PLA Air Force

appears to be seeking to acquire its own space forces. In addition to the previously mentioned space-based early warning systems, the PLA Air Force seeks to develop aerospace planes capable of operating both within the atmosphere and in outer space, along with space-based, high-energy lasers.

The PLA Air Force that results from these changes will in some ways resemble the US Air Force in that it will be centered primarily on multirole fighter aircraft and bombers, supported by a range of special mission aircraft, and using relatively fewer air superiority aircraft. But unlike the US Air Force or PLA Navy, the PLA Air Force does not currently appear to be aiming to become a global power projection force. The acquisition of aerial refueling aircraft appears to be a lesser priority, the PLA Air Force does not yet possess heavy bombers, and the acquisition of airlift aircraft appears to be intended primarily to support the wartime requirements of air transportation and airborne operations, as opposed to expeditionary air operations.

To counter the PLA Air Force of the future, the US military and its allies will first need to be able to defend their own air bases and other key targets from attacks by large numbers of aircraft armed with long-range, precision strike weapons; supported by aerial refueling, reconnaissance, early-warning and control, and electronic warfare and information operations aircraft; and linked by a comprehensive command-and-control system. This defensive capability will require the ability to detect and track Chinese aircraft and cruise missiles, some of which will be stealthy, in an intense electronic warfare environment, and then engage and destroy them from standoff ranges, while simultaneously avoiding being destroyed, despite being outnumbered.

To conduct offensive operations against this air force, the United States and its allies will need the capability to penetrate a Chinese air defense system that includes fighter aircraft supported by reconnaissance, early-warning and control, and electronic warfare aircraft as well as ground-based radars and jamming systems and long-range, surface-to-air missiles, all of which will be linked by a unified command-and-control system.

PLA Rocket Force

If the developments the PLA Rocket Force is currently seeking reach fruition, China may eventually acquire a nuclear force that is roughly comparable in size to those of the United States and Russia, which possessed

approximately 1,700 and 1,600 deployed nuclear weapons respectively in 2022, as compared to the deliverable nuclear warheads numbering in the low 200s China possessed as recently as 2019. (In addition to their deployed weapons, the United States had approximately 2,000 nuclear weapons in storage, and Russia had approximately 2,900.)[182] The nuclear missiles operated by the rocket force (which will control the majority of China's nuclear weapons for the foreseeable future, although the PLA Navy and Air Force will also possess nuclear weapons) will have improved responsiveness, range, accuracy, reliability, and lethality, and their penetration capabilities will be aided by warhead maneuvers, stealth, decoys, jamming, and the use of multiple warheads per missile as well as deception operations, attacks on enemy missile defense systems, and the coordinated employment of multiple types of nuclear missile forces. Moreover, the rocket force's nuclear forces will be supported by a reconnaissance and early-warning system able to detect indications an enemy is about to launch an attack and will likely be kept in a launch-on-warning posture so a counterattack canbe launched before the arrival of an enemy attack.

The rocket force's conventional missile forces will also continue to increase in number, range, and accuracy. In particular, the rocket force apparently aims to acquire sufficient numbers of conventional missiles to strike all campaign-level and strategic-level targets that would be required in a war over Taiwan.

At the same time the rocket force's offensive capabilities are improving, its survivability will be improved by camouflage and concealment, mobility, and the hardening of missile launch facilities. Moreover, over time, the rocket force apparently intends to develop a strategic missile defense system, though, given technological and financial constraints, the pace of development will be measured.

The strategic implications of the growth of China's nuclear forces are unclear. In 2020, the rocket force was estimated to have only about 100 intercontinental ballistic missile (ICBM) launchers. But even this force was probably sufficient to deter all but the most reckless adversary from considering a preemptive nuclear attack on China. Roughly 70 of the rocket force's ICBM launchers were road mobile, meaning, if tensions between China and the United States or Russia were such that a nuclear exchange were plausible, most of these launchers would likely

182. "Status of World Nuclear Forces."

be dispersed away from their bases.[183] A US or Russian force planner would have to be highly optimistic to believe a preemptive first strike could destroy most or all of these dispersed ICBM launchers, along with any ballistic missile submarines that were at sea. (In the case of the United States, planners would have to be confident the 44 unproven, ground-based interceptors at Fort Greely, Alaska, and Vandenberg Space Force Base in California would be able to intercept any remaining missiles that might be launched at the homeland).[184]

Since even a small number of nuclear weapons could cause enormous destruction and suffering in theUnited States or Russia, seemingly, the only circumstances under which one of these countries could have rationally justified a preemptive nuclear attack on China in 2020 would have been if one of the former were convinced the latter would inevitably launch a nuclear attack on one of the former—in which case, the goal of the preemptive attack would be to reduce, not prevent, the destruction caused by the latter's attack. Thus, a growth in the size of China's ICBM force and a shift to a launch-on-warning posture does not appear to be necessary to the security of China's second-strike capability. But from the perspective of a Chinese force planner, these changes may provide a greater sense of security in the sense, though a US or Russian force planner could not be confident of being able to destroy all of China's ICBMs, ballistic missile submarines, and nuclear-capable bombers, doing so was at least theoretically possible in 2020. To that extent, increasing the number of ICBM launchers and shifting to a launch-on-warning posture may increase the People's Liberation Army's confidence in its second-strike capability. Unfortunately, the shift to a launch-on-warning posture also increases the possibility of an accidental or unauthorized launch of China's ICBMs. And greater confidence in the security of China's nuclear-strike capability could make Chinese leaders more willing to engage in conventional conflict with a nuclear adversary such as the United States or Russia.

The implications of these changes for US nuclear posture are also unclear. As noted, by 2020, the United States already lacked the capability to contemplate a disarming first strike against China's nuclear forces. Moreover, the rapid growth of China's ICBM force means an increase

183. IISS, *The Military Balance 2020* (London: IISS, 2020), 249; Shannon Bugos, "Pentagon Sees Faster Chinese Nuclear Expansion," Arms Control Association (website), December 2021, https://www.armscontrol.org/act/2021-12/news/pentagon-sees-faster-chinese-nuclear-expansion; and "China: New START-Type Report," UN Institute for Disarmament Research Project on Transparency and Accountability in Nuclear Disarmament (website), n.d., https://nuclearforces.org/country-profiles/china.

184. IISS, *Military Balance 2020*, 46.

in the number of ground-based interceptors is unlikely to change this equation (China is in the process of building three new ICBM silo fields that will contain a total of 300 additional ICBM silos).[185] Conversely, even 1,600 nuclear weapons, which would put China on par with the United States and Russia, would not provide the former with a significant damage limitation capability, much less a first-strike capability, against the latter, given the latter's nuclear forces are also kept in a launch-on-warning posture, and both have significant ballistic missile submarine forces. Thus, for the foreseeable future, the United States, Russia, and China are likely to remain in the current situation of mutually assured destruction, with little prospect for any of these countries to be able change this fundamental reality.

On the rocket force's conventional missile forces, how many missiles and what types of missiles would be needed to strike all of the campaign-level and strategic-level targets in a war over Taiwan is unclear, but *Science of Strategy* states the number is "very large."[186] Thus, the rocket force can be expected to continue to increase the number, types, and capabilities of its conventional missile forces for the foreseeable future. Therefore, in the event of a conflict with China, the US military must be prepared to face an attack that includes large numbers of conventional ballistic and cruise missiles. Moreover, the reference to strategic-level targets suggests these attacks might not be confined to targets in the western Pacific; the attacks could encompass targets such as Hawaii, Alaska, or the contiguous United States that are outside of the region. Countering such attacks will require active and passive missile defenses; the ability to operate from dispersed, austere locations that are far from Chinese territory; and the ability to recover from the effects of missile attacks rapidly.

PLA Strategic Support Force

The developments the Strategic Support Force is seeking will transform China's space forces from simply supporting terrestrial operations to being capable of conducting warfighting operations in space and will further increase the warfighting capabilities of the Strategic Support Force's cyber forces. Capabilities of the Strategic Support Force's space forces to support terrestrial operations will include using ground-based and space-based systems for detecting and tracking enemy missile launches and assessing the results

185. OSD, *Military and Security Developments*, vii, 64.

186. Xiao Tianliang et al., *Science of strategy* (2020 revision), 389.

of enemy missile strikes. The Strategic Support Force will also develop space-based systems for all-weather, day/night, near-real-time reconnaissance and surveillance; surveying and mapping; meteorology; broadband, high-capacity, jam-resistant, and secure communications; autonomous and secure, real-time positioning, navigation, and timing; and information integration and combat management.

Going beyond the capabilities for supporting terrestrial operations, the Strategic Support Force's space warfighting capabilities will include ground- and space-based capabilities for space situational awareness; attacking targets in space using both soft-kill and hard-kill methods; defending space-based systems through stealth, concealment, deception, maneuvers, and hardening; and conducting space-to-Earth strikes using space combat vehicles and orbital bombardment systems. The soft-kill methods will include jamming; deception; and low-power, directed energy weapons. The hard-kill methods will include kinetic energy weapons and, possibly, high-power, directed energy weapons. Notably, these intentions are inconsistent with Beijing's official position China "opposes any attempt to turn outer space into a weapon or battlefield."[187]

In addition, the Strategic Support Force appears to seek the capability to defend China's territory against attacks by ballistic missiles, though, as noted earlier, the PLA Air Force and PLA Rocket Force also seek such a capability. Whether each organization intends to develop an independent ballistic missile defense capability or whether they intend to collaboratively develop a shared capability is unclear.

Furthermore, the Strategic Support Force seeks to develop its cyberwarfare capabilities, including its reconnaissance, attack, and defense capabilities. Reconnaissance capabilities include network espionage targeting adversarial "C4ISRK"; electronic warfare; and weapon control systems. Reconnaissance capabilities also include technical espionage and human espionage. Attack capabilities include capabilities to paralyze adversarial information systems, steal information, tamper with adversarial information, harass adversarial networks, and provide adversaries with false intelligence. Defense capabilities are said to include intrusion detection systems, firewalls, antivirus software, and data encryption. To practice and improve these capabilities, the Strategic Support Force seeks to create a "cyber shooting range" that simulates the systems the force may wish to attack or defend.

187. State Council Information Office of the PRC, "China's Space Program: A 2021 Perspective" (white paper, State Council of the PRC, January 2022), http://www.china.org.cn/china/2022-01/28/content_78016843.htm.

If the Strategic Support Force succeeds in acquiring the capabilities it seeks, the United States and its allies will face a comprehensive range of space, counterspace, and cyber capabilities. As a result, in a conflict with China, the United States will not be able to enjoy the unrestricted use of space the country has had in all conflicts for over 30 years. Instead, US and allied militaries will need to be capable of operating with some or all of their space-based systems degraded or destroyed. At the same time, the United States will be faced with an adversary whose space capabilities are comparable to those the US military has enjoyed in recent conflicts. In addition, the People's Liberation Army apparently seeks to field capabilities for conducting space-to-Earth strikes. In view of these circumstances, the US military should either acquire counterspace capabilities that are at least as effective as those the People's Liberation Army is acquiring or reach a verifiable, enforceable arms control agreement with China that prevents the development and employment of such weapons. In the meantime, the United States should aggressively bring to the world's attention Beijing's hypocrisy in claiming to oppose the weaponization of space while China's military openly declares its intention to engage in it.

China's long-standing efforts to use its cyber capabilities to steal US defense technology and to conduct other forms of espionage are well known. But the chapter in *Science of Strategy* on cyberspace forces makes clear the primary mission of the Strategic Support Force's cyber forces is to attack the US military's information systems, including its command-and-control, sensor, weapon, and communications systems, while defending the People's Liberation Army's systems from similar attacks. Therefore, in addition to countering Chinese cyber espionage during peacetime, the US military must increase its capabilities to prevent the Strategic Support Force from infiltrating US military systems as well as to detect intrusions and purge and repair or reconstitute the affected systems if intrusions do occur.

Potential Challenges for the People's Liberation Army

Even if the People's Liberation Army's major organizations successfully realize their goals, certain structural weaknesses will remain. As in many militaries, the People's Liberation Army's services do not always prioritize capabilities the services see as being outside their core missions. In the case of the PLA Navy, although developing modern, amphibious warfare platforms

is clearly a priority, whether increasing the capabilities of the ground forces these platforms will carry (that is, the PLA Navy Marine Corps) is as high a priority is unclear. Although the PLA Navy Marine Corps has rapidly expanded in recent years, the PLA Navy has possibly only reluctantly devoted resources to this expansion under pressure from the People's Liberation Army's top leadership. In addition, the PLA Navy does not appear to prioritize the development of anti-submarine warfare capabilities, though the reasons for this lack of prioritization are unclear.

Similarly, although increasing the PLA Air Force's airlift capabilities is clearly a priority for the service, whether increasing the capabilities of the airborne corps is a priority is unclear. But the PLA Army may be interested in acquiring an airborne capability. In addition, how interested the PLA Air Force is in taking on a nuclear mission is unclear, but the service is doing so nonetheless.

Conversely, multiple organizations are interested in other capability areas. The most prominent is air and missile defense. The PLA Army and Air Force both identify land-based air defenses as a priority, and the PLA Air Force, Rocket Force, and Strategic Support Force identify missile defenses as a priority. Moreover, the PLA Air Force seeks to develop a system that integrates air and missile defense. If all of these organizations were to achieve their goals, then the People's Liberation Army would seemingly be acquiring an air and missile defense system that integrates elements from the PLA Army, Air Force, Rocket Force, and Strategic Support Force. Developing such a system would likely be a highly complicated endeavor. Another realm in which more than one organization seeks to acquire capability is space warfare; the PLA Air Force and Strategic Support Force are apparently seeking to develop such capabilities.

The services' lack of enthusiasm for certain capabilities may cause them to stagnate or languish in the future; at the least, PLA leadership would be required to exert pressure on the services continuously to prioritize the capabilities. Conversely, competition among multiple organizations for other missions, such as missile defense or space warfare, could lead to duplication of effort or multiple organizations developing only partial and noncomplementary capabilities.

Conclusion

China's system for the development of military capabilities is far more opaque than that of the United States. Nonetheless, based on official PLA publications, assembling a picture of the broad contours of this process is possible. The process is as follows.

Every five to 10 years or so, the Central Military Commission issues or revises a set of "military strategic guidelines." Once every five years, based on the prevailing military strategic guidelines, each of the PLA services formulates a service development strategy that addresses the service's expected capability and force structure requirements for the next 20 years.[188] Based on this overall service development strategy, an equipment development strategy addressing the service's expected equipment needs over the next 20 years is also developed. Next, based on the equipment development strategy, a 10-year equipment development plan, a five-year equipment development program, and a mid- to long-term "special equipment" development program are formulated.

At the same time the equipment plans and programs are being developed, five-year programs for personnel, operations, construction, and other elements of a defense program are likely also developed. Together with the five-year equipment development program and the first five years of the mid- to long-term special equipment development program, these plans and programs probably collectively represent the service's force development program. Finally, based on the force development program, annual defense budgets are developed.

None of the documents described in the preceding paragraphs appear to be publicly available. But China's periodic defense white papers, textbooks such as *Science of Strategy,* and other sources at least describe the broad types of capabilities the People's Liberation Army seeks to develop. Although these capabilities are usually not described in enough detail to be able to identify the exact specifications of the systems that would provide these capabilities, knowing what capabilities the People's Liberation Army is seeking to acquire can enable US and allied analysts and planners to anticipate the types of systems China is likely to field in the future and to develop capabilities and tactics to counter those systems.

188. *China air force encyclopedia*.

The picture that emerges from this analysis is one of a systematic, comprehensive program to develop China's military capabilities. Countering these capabilities will require the United States and its allies to pursue an equally systematic and comprehensive program.

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About the Author

Roger Cliff is a senior intelligence officer and former research professor of Indo-Pacific affairs in the Strategic Studies Institute at the US Army War College. His research focuses on China's military strategy and capabilities and their implications for US strategy and policy. He previously worked for the Center for Naval Analyses, the Atlantic Council, the Project 2049 Institute, the RAND Corporation, and the Office of the Secretary of Defense. He holds a PhD in international relations from Princeton University; a master of arts degree in Chinese studies from the University of California, San Diego; and a bachelor of science degree in physics from Harvey Mudd College. He is fluent in spoken and written Mandarin Chinese.

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