

STRATEGIC TRENDS RESEARCH INITIATIVE

IMPLICATIONS OF A PRC SHIFT TO A LAUNCH-ON-WARNING NUCLEAR POSTURE

Dr. David C. Logan, Fletcher School, Tufts University

Dr. Phillip C. Saunders, Institute for National Strategic Studies, National Defense University

HDTRA1-24-P-0038 | July 2025

DISCLAIMER: The views expressed herein are those of the author(s) and do not necessarily reflect the official policy or position of the Defense Threat Reduction Agency, the US Department of Defense, or the United States Government.



UNCLASSIFIED – CLEARED FOR PUBLIC RELEASE

TABLE OF CONTENTS

Introduction	3
Findings Summary	3
Methodology	4
Analysis.....	5
Historical Experiences and Requirements for LOW Postures.....	5
Early Warning Capabilities.....	5
Alerted Nuclear Forces	5
Nuclear Command and Control	6
China's Ability to Fulfill the Requirements of a LOW Posture.....	7
Early Warning Capabilities.....	7
Alerted Nuclear Forces	8
Nuclear Command and Control	9
China's LOW Posture Design Decisions.....	9
Early Warning Capabilities.....	9
Alerted Nuclear Forces	11
Nuclear Command and Control	13
Key Findings and Recommendations.....	15
Appendix 1: LOW Design Choices, Associated Risks, and Mitigation Options.....	20
Appendix 2: Methods for Influencing Chinese Thinking about Launch on Warning	22
Acknowledgements.....	24
References.....	24

INTRODUCTION

China is in the midst of a significant expansion and modernization of its nuclear forces, which is unprecedented in the country's history. The 2023 Department of Defense annual report on the Chinese military assesses that, among these changes, "The PLA is implementing a launch-on-warning (LOW) posture, called 'early warning counterstrike' (预警反击), where warning of a missile strike leads to a counterstrike before an enemy first strike can detonate."¹ Such a change in China's nuclear posture would have significant implications for U.S. national security, U.S.-China relations, and stability and security in East Asia. Research suggests that how a state postures its nuclear forces, including whether it adopts features of a LOW posture, can significantly influence deterrence, crisis escalation, and conflict management.² While some previous research has touched on aspects of this potential shift, such as the development of strategic early warning capabilities and the increase in peacetime readiness of nuclear forces, we lack a comprehensive understanding of the requirements for such a posture, whether China fulfills them, how China might adopt a LOW posture, and the implications for U.S. national security policy.

This study assesses the prospects and implications of China's potential adoption of a LOW posture for U.S. national security objectives. The study proceeds in four parts. First, we identify the requirements for a LOW posture and the decisions that other states have confronted in designing their own LOW posture. Second, we evaluate the ability of China to satisfy these requirements and conclude that China likely satisfies or soon will satisfy the requirements. Third, we draw on Chinese primary sources and the security studies literature to evaluate how China might confront design decisions for a LOW posture. Fourth, we discuss potential implications of a Chinese LOW posture for China's nuclear force development and foreign policy, U.S.-China strategic stability, and U.S. national security objectives, and offer policy recommendations.

FINDINGS SUMMARY

China has put in place all three elements needed to support a launch on warning (LOW) posture—1) early warning systems capable of detecting, characterizing, and tracking an incoming nuclear strike; 2) alerted nuclear forces that can be launched on short notice; and 3) command and control structures that can rapidly process the information provided by early warning systems, make decisions about whether and how to respond, and disseminate launch orders.

The PLA Rocket Force (PLARF) now maintains a portion of its nuclear forces on continuous alert to enhance strategic deterrence, increasing the risk of accidental, inadvertent, or unauthorized launches. The PLARF has adjusted its nuclear warhead storage and handling practices and training to support regular alert status.

A LOW posture, which requires ICBM units to be ready to launch within minutes, further increases the risk of mistaken or unauthorized ICBM launches by requiring ICBMs to be ready for immediate launch. A LOW posture also compresses the time available to decide whether an adversary nuclear attack is occurring and how China should respond. This increases risks of mistakenly perceiving an attack to be underway (or misunderstanding its size and intent) and pressures to pre-delegate some decisions about whether and how to retaliate to PLA commanders rather than to civilian leaders.

China's decision to initiate doctrinal research and to develop the technical capabilities needed for a LOW posture likely predates Xi Jinping's decision circa 2015–2016 to dramatically expand the size of China's ICBM force. The heightened risks of a LOW posture may no longer be necessary given the increased survivability of a larger Chinese ICBM force.³ This suggests it might be possible to persuade China's leaders to move away from a risky LOW posture toward a somewhat less risky nuclear posture.

A LOW posture is optimized for strategic deterrence against ICBM attacks, which allow roughly 30 minutes between launch and impact. The shorter flight time of theater-range missiles or submarine-launched

missiles would compress the time available for launch detection, target characterization, and decisions about whether and how to retaliate, further amplifying the risk of a nuclear launch based on misperception or misunderstanding of U.S. intent.

PLA authors argue that mobile basing enhances survivability and flexibility, but increases operational challenges and exposes forces to attack. Silo basing provides greater stability, but missiles are more vulnerable to attack. PLA analysts suggest that the optimum posture would include a mix of both types of basing modes, with a possible emphasis on road-mobile missiles to maximize survivability.

The PLA's pursuit of a nuclear triad that includes PLA Navy (PLAN) Type-094 JIN class SSBNs and PLA Air Force (PLAAF) nuclear-capable bombers will complicate PLA nuclear planning. The expansion of nuclear weapons to services and units with limited nuclear experience will likely increase the chances of accidental, inadvertent, or unauthorized use. Technical characteristics of Chinese air and sea-based nuclear weapons and their associated Nuclear Command, Control, and Communication (NC3) systems make them poorly suited for a LOW posture, but it is possible the PLAN and PLAAF will argue for such a role to advance their bureaucratic interests.

The PLARF shift to a LOW posture that includes alerted ICBMs raises its baseline level of readiness and compresses the bandwidth for nuclear signaling, since the peacetime PLA will already have a portion of the force ready to fire on short notice. The PLARF appears to have adopted a progressive alert system that will mobilize a larger percentage of the ICBM force at higher alert levels.

There is significant nuclear-conventional entanglement in aspects of a nuclear force postured for LOW. Disentangling these elements will be challenging given the inherent dual-use characteristics of early warning satellites and radars and some aspects of NC3, which have high value for ballistic missile defense and conventional warfighting. Moreover, Chinese analysts see value in using early warning systems for conventional missions.

A critical aspect of NC3 in a LOW nuclear posture is the "last mile" that loops civilian decisionmakers into urgent decisions about whether and how to retaliate for a nuclear attack that is underway. A nuclear football might not be necessary because PLA nuclear missiles are not believed to include permissive action links that require inputting centrally-held codes to allow for launch. Xi Jinping's inclusion in LOW response decisions is critical, because he may be the only one with the authority to decide not to execute a pre-planned nuclear response to an accidental or limited nuclear attack.

A LOW posture implies making advance decisions about what alerted missiles would target, which is in tension with the U.S.-China bilateral (1998) and P-5 (2000) non-targeting agreements. State Department and the Office of the Secretary of Defense (OSD) should consider whether this would be a good talking point for U.S.-China official dialogues.

METHODOLOGY

The methodology consisted of three lines of effort. First, we conducted case studies of other nuclear-armed states that have adopted LOW postures, focusing on Russia, the Soviet Union, and the United States. From these historical case studies, we identified both the requirements necessary to support a LOW posture and the design decisions that states will confront in adopting a LOW.

Second, we evaluated authoritative Chinese primary sources and the security studies literature to determine both whether China fulfills the requirements for a LOW posture and how Chinese decisionmakers are likely to approach the design decisions for a LOW posture.⁴

Third, we assessed potential risks from a Chinese LOW posture, determined factors that increase or decrease those risks, and identified U.S. policy options to address them. We convened a roundtable with

and received written comments from government and non-governmental experts on nuclear strategy and operations, the PLA, and China's foreign and national security policy.

ANALYSIS

HISTORICAL EXPERIENCES AND REQUIREMENTS FOR LOW POSTURES

Early Warning Capabilities

A launch-on-warning posture requires detecting, characterizing, and tracking ballistic and cruise missile launches from potential adversaries. States must first detect the launch of missiles that could target their own nuclear delivery vehicles. The quicker a state can detect a launch, the more time it has to characterize, track, and respond to it, putting a premium on early detection. Space-based launch detection capabilities have several advantages, including earlier detection, more difficulty masking launch signatures, and providing dual phenomenology.⁵ Once a state has detected a launch, it must be able to characterize and track the inbound missile using ground-based long-range radars.

We identify three design decisions for early warning capabilities. *First, will early warning systems be responsible for detecting strikes only from intercontinental or strategic systems or also from theater-range systems?* Early warning systems originally developed to protect the homeland against intercontinental nuclear strikes eventually were used to protect forward-deployed troops against conventional theater-range missiles. Some experts have argued that the early warning capabilities of the United States and Russia are increasingly dual-capable, meaning that they support both nuclear and conventional missions.⁶ This type of conventional-nuclear entanglement could introduce escalation risks.⁷

Second, will the early warning system incorporate dual phenomenology or other safeguards to confirm an incoming strike? As discussed above, both the United States and the Soviet Union reportedly required dual phenomenology in their early warning systems.⁸ This is a safeguard intended to reduce the chance of false alarms. However, dual phenomenology may be insufficient to avoid false alarms when the false alarm originates from sources outside the early warning system (such as within data processing networks); when overlapping false alarms cause a second false alarm to occur before the first one is resolved; and when the sources of false alarms are not independent.⁹ States may therefore require additional safeguards. Design choices here have an important impact on crisis stability and the potential for inadvertent launches.¹⁰

Third, which part of the military or defense establishment will operate the early warning system? In the United States, the Air Force operated both space- and ground-based early warning capabilities before transferring them to the Space Force. In Russia, the Aerospace Defence Forces operated early warning systems before transferring control to the Russian Space Forces. Choices about which military organization will operate early warning systems may have implications for both military bureaucratic politics and for crisis instability. For example, bureaucratic ownership of a capability may give an organization a vested interest in expanding that capability regardless of its strategic value.¹¹ Similarly, while centralizing ownership of a capability can introduce risks of parochialism, distribution of capabilities can introduce coordination challenges.¹²

Alerted Nuclear Forces

A LOW posture requires nuclear forces that can be launched on short notice. The necessary response time (and thus the alert level) depends on strategic early warning capabilities and the flight times of the missiles in an adversary first strike. Today, at least five nuclear-armed states are believed to place at least a portion

of their nuclear forces on alert: China, France, Russia, the United Kingdom, and the United States. However, the composition and proportion of alerted forces varies across these states.¹³

We identify three design decisions for alerted nuclear forces. *First, which and how many nuclear forces will be placed on alert, particularly during peacetime?* Potential costs of higher alert include higher risks of accidental or unauthorized launch, higher risks of crisis instability and adversary misperception, and increased logistics and operational costs.¹⁴ Potential benefits include improving the survivability of strategic nuclear forces and, by extension, enhancing deterrence of an adversary first strike against those forces. Some delivery systems may be seen as particularly vulnerable, making them attractive candidates for higher alert levels.¹⁵ Nuclear exchange modeling suggests that silo-based ICBMs may be particularly vulnerable.¹⁶ Warheads cannot be attached to SLBMs when an SSBN is at sea, requiring that missiles be armed in port. Placing silo-based missiles on alert may be seen as cheaper, simpler, and safer than placing mobile missiles or SSBNs on alert due to lower requirements for command and control infrastructure and reduced risk of accidents.¹⁷

Second, what kinds of changes to organizational structures or policies are necessary to support alerted nuclear forces? Higher alert levels may reduce negative control as more ICBMs are prepared to launch on short notice, increasing the risks of inadvertent or accidental launches. Nuclear weapon states may introduce safeguards to address these risks. This might include more stringent personnel reliability programs or more rigorous training and exercise regimens.¹⁸ Nuclear weapon states might also restructure organizational relationships to support higher alerts.

Third, will the launch-on-warning posture include a system of progressive alerts by which decisionmakers can decrease or increase the alert status of their nuclear forces? Progressive alert systems may present potential costs and benefits. A progressive alert system can allow nuclear-armed states to tailor the alert level of forces to the perceived dangers of a preemptive strike and may also allow for better signaling in a crisis or conflict.¹⁹ Progressive alert systems may also introduce risks of crisis instability. Moving from lower to higher levels of alert, even if only intended to increase the survivability of one's own forces, may nonetheless be interpreted as preparations for a launch.²⁰ The creation of a progressive alert system may also create a path dependence, pressuring leaders to adopt higher alert levels, regardless of whether they are warranted.²¹

Nuclear Command and Control

Nuclear-armed states must first determine which individuals or bodies have the authority to order nuclear use. While all nuclear-armed states concentrate decision-making authority in national executives, the particular number and configuration of decision-makers can vary significantly.²² Besides the high-level political arrangements determining which entities can issue a nuclear use order, states may also delegate use authority to subordinate elements under certain conditions.²³ Another requirement for a LOW posture is to determine what types of nuclear strikes it plans for and supports.²⁴ Finally, a LOW posture requires a system of communications infrastructure connecting senior decisionmakers with launch authority to military commanders and launch units in the field.²⁵

We identify three design decisions for command and control. *First, will launch authority be delegated to military units?* The benefits of delegation include reducing the vulnerability of nuclear forces and reducing the likelihood of an adversary attempting a disarming first strike in the first place.²⁶ The potential costs of delegating launch authority include higher risks of accidental or unauthorized launches. The balance between positive and negative control will depend on perceptions of external threats and internal civil-military relations.²⁷ Political leaders that perceive serious external threats and trust their own militaries will be more willing to delegate launch authority, while those that see greater internal threats or low levels of trust will be less likely to delegate.

Second, which nuclear strikes are prepared in advance? States adopting a LOW posture put a premium on launching missiles before they can be destroyed. This requires preplanning for the types of strikes that can be ordered including the strike targets as well as which and how many of each missile will be assigned to each target. This is necessary for coordinating and deconflicting nuclear strike operations and for ensuring the efficient allocation of missiles to targets. In the short timeframe between detection of an incoming strike and its arrival, state leaders will likely not have enough time to design a strike from scratch.

Third, how do states configure the “last mile” of command and control between military and civilian leaders? Political arrangements may require approval from only one individual such as the head of state. This is the case in the United States where the president alone has the ability to issue a nuclear launch and is not required to consult with any other personnel prior to issuing an order (though consultations would likely take place). Or political arrangements may require approval from more than one individual or organization. This is believed to be the case in Russia where the president, the minister of defense, and the chief of the general staff are accompanied by emergency communication satchels and a nuclear launch requires approval from two of the three individuals.²⁸

CHINA'S ABILITY TO FULFILL THE REQUIREMENTS OF A LOW POSTURE

We assess that China likely fulfills the requirements for a LOW posture, but some necessary capabilities may be rudimentary or lack the desired resilience.

Early Warning Capabilities

Since the early 2010s, China has emphasized the need to improve its strategic early warning capabilities.²⁹ Since then, PLA officials have claimed significant progress, with one researcher at the Academy of Military Science claiming that “new capabilities in strategic early-warning, long-distance marine defense, long-range strike, strategic power deployment and information support have been extensively strengthened.”³⁰

China appears to have developed rudimentary space-based launch detection capabilities. The Department of Defense assesses that China's space missions include “intelligence collection, counterspace targeting, ballistic missile early warning, spaceflight safety, satellite anomaly resolution, and space debris monitoring.”³¹ DOD reports state that as of 2019, China had at least one early warning satellite and that by 2022 China had at least three early warning satellites.³² Open-source estimates report that a series of TJS (通信技术试验 [communication technology test]) satellites launched under the *Huoyan* (火眼 [fire eye]) program likely serve as early warning satellites.³³ Experts disagree about how many and which of the TJS satellites are part of the *Huoyan* program but estimates range from three to five.³⁴ These satellites are positioned over the Indian Ocean, the South China Sea, and the Pacific Ocean and could likely detect missile launches from the Indian Ocean, Pacific Ocean, and continental United States.³⁵ However, some U.S.-based experts have argued that, while these systems provide a rudimentary early warning system, they may still suffer from several single-point failures due to the limited number of sensors and low redundancy they provide.³⁶ Researchers with Space Engineering University and PLA Aerospace Force (ASF) have argued that China must field multiple sensors to more accurately identify missiles.³⁷

China appears to have also developed a sufficient system of ground-based radars to track incoming ballistic missiles, though this system may suffer from a lack of redundancy. Starting in 2009, China began constructing several large phased-array radars (LPARs) with the capabilities to detect and track ballistic missiles.³⁸ China appears to operate at least seven LPARs across six sites near Huanan, Yiyuan (two installations), Hangzhou, Korla, Kongtong, and Fengqing.³⁹ The Department of Defense assesses that these radars could support a missile early warning role.⁴⁰ According to Chinese military sources, one of the Yiyuan radars in the eastern part of the country had been used “to monitor missile threats from North Korea, South

Korea, and Japan.”⁴¹ Chinese media reports indicate that some of these systems may have an estimated maximum detection range of 4,000 km.⁴² Experts have assessed that these radars may have capabilities similar to the U.S. Pave Paws radars with an array face diameter of roughly 30 meters capable of covering an azimuth angle of 90 to 120 degrees.⁴³ Together, these systems can cover the main avenues for attack, including from the Pacific Ocean, the Indian Ocean, and the North Pole. As with the early warning satellites, there may be concerns about the survivability of the system given the low level of redundancy. In addition to fielding these physical assets, PLA researchers have conducted studies on developing early warning systems to support launch-on-warning counterattacks.⁴⁴

Alerted Nuclear Forces

China appears to have developed the technical and operational capabilities to maintain nuclear forces on higher levels of alert. Over the last decade, China has emphasized the need to improve the reaction time of its missile forces, including its nuclear units.⁴⁵ We find evidence that LOW work began earlier than previously reported. In 2010, the Second Artillery Force issued a directive to strengthen research on major issues related to “early warning counterstrike.”⁴⁶ In late 2011, the service newspaper for the missile forces revealed that the Second Artillery Academy had established a specialized “nuclear issues research group,” with “early warning counterstrike” listed alongside nuclear deterrence and force development as core areas of operational theory.⁴⁷ Today, China fields several advanced solid-fueled missiles, including road-mobile variants with off-road capability and the ability to fire without a prepared launch site.⁴⁸ These missiles can be stored and transported without the need for fueling, allowing higher levels of day-to-day alert. The Department of Defense reports that China’s nuclear-powered ballistic missile submarines (SSBNs) are conducting regular “at sea deterrent patrols,” implying they leave port with warheads on missiles (SLBMs).⁴⁹

China’s missile forces also appear to have improved their reaction times. Military reporting describes Rocket Force exercises that feature launch-on-warning elements. In one exercise, a Rocket Force brigade received warning of an incoming nuclear strike shortly after completing launch preparations.⁵⁰ The brigade managed to fire its missile and disperse the equipment just a minute before the incoming strike occurred.⁵¹ In another report of a separate exercise, a Rocket Force brigade successfully launched its missiles after being warned of an incoming strike.⁵² One retired Rocket Force strategist has claimed that the response time of missile force units has been improved “from days and hours to minutes.”⁵³ The U.S. Department of Defense assesses that Rocket Force brigades conduct “‘combat readiness duty’ and ‘high alert duty,’ which include assigning a missile battalion to be ready to rapidly launch. This readiness posture allows the PLA Rocket Force (PLARF) to maintain a portion of its units on a heightened state of readiness while leaving the other portion in peacetime status with separated launchers, missiles, and warheads.”⁵⁴

Rocket Force training and policies also reflect higher alert levels. In the months immediately following the 20th Party Congress, *Rocket Force News* exhibited notable rhetorical shifts that suggest growing internal comfort with sustained alert posture and readiness normalization. Multiple articles from October and November 2022 use vivid language—such as “missiles on the rack, on high alert” (弹在架上，高度戒备) and “duty is battle” (值班就是战斗)—to equate routine peacetime alert duty with wartime operational posture. In one case, a newly certified operations officer reports earning his duty qualification certificate (值班资格证) after undergoing intense live drills.⁵⁵ Meanwhile, a launch battalion is shown conducting full-process, full-protection training while on combat readiness duty (战备值班任务), and is described as maintaining constant readiness. These examples suggest not only a rhetorical reframing of duty status, but also a cultural shift toward institutionalizing the mindset and procedures required for a credible LOW posture.

Nuclear Command and Control

China appears likely to have the necessary command and control structures for implementing a LOW posture, though there is uncertainty about what political decisions are necessary to order a nuclear strike and whether they can be made on short notice. Information as of the mid 2010s suggests that a nuclear strike must be ordered by both the members of the Central Military Commission and the members of the Politburo Standing Committee.⁵⁶ China has at least some experience placing its units on alert in a crisis as evidenced by its experience in the 1969 border clashes with the Soviet Union.⁵⁷ Besides the necessary political arrangements for ordering a nuclear strike, China appears to have fielded a range of communications systems connecting political decisionmakers to launch units in the field, including a fiber-optic cable network, microwave communication system, troposcatter, and satellite systems.⁵⁸ Rocket Force units train to transmit commands when electronic communications systems have been disrupted, including by using flag signals or in-person messages.⁵⁹ PLA writings describe the communications network as “reliable and redundant” nuclear communications systems consisting of radio, cables, fiber-optic cables, and satellites.⁶⁰ Reporting on PLARF exercises notes that thanks to PLARF communications networks, “important combat data such as command orders, enemy dynamics, meteorological and hydrological information, etc. are quickly transferred to the firepower unit to provide solid information support for combat operations.”⁶¹ Internal PLA documents state that China’s ground-based missile forces employ an automated command and control system capable of transmitting commands, synthesizing intelligence, and monitoring missile launches.⁶² Chinese sources report that the country has fielded perhaps a dozen very low frequency transmitters for use in communicating with SSBNs.⁶³

CHINA’S LOW POSTURE DESIGN DECISIONS

Although China appears to satisfy the basic requirements for a LOW posture in terms of early warning systems, alerted nuclear forces, and command and control structures, there remain questions about the details of a potential Chinese LOW posture. Here we review nine design decisions identified earlier across the three requirements categories.

Early Warning Capabilities

First, will China use its early warning capabilities only for detecting launches of nuclear-armed intercontinental-range ballistic missiles or will it also use them for detecting launches of theater-range conventional-armed missiles? Chinese writings appear to laud the ability of early warning systems, including satellite-based detectors, to support conventional military missions and intelligence operations. One extensive text on the technical and operational elements of early warning systems from scholars at the National University of Defense Technology opens with two case studies demonstrating the value of early warning systems. In the first, the authors note how U.S. Defense Support Program (DSP) satellites helped detect and defend against launches of Iraqi Scud missiles during the Gulf War.⁶⁴ In the second, the authors describe how U.S. early warning capabilities helped detect and characterize China’s first test of an anti-ballistic missile interceptor.⁶⁵ The authors conclude that “Through these two examples, it can be seen that the early warning system plays a very important role in determining the outcome of war and national security.”⁶⁶ While other sources acknowledge that U.S. and Soviet early warning capabilities were originally designed to detect launches of nuclear-armed ICBMs, they largely discuss early warning systems as useful for military operations generally, not only within the nuclear domain.⁶⁷

Chinese conceptions of “strategic warning” appear to include detection of theater-range conventional-armed missiles. One assessment of “strategic warning” from an expert at the PLA Information Engineering University explains that “Strategic warning mainly includes early warning of ground-to-ground strategic

missiles, submarine-to-ground strategic missiles, strategic bombers and other air attack weapons. Obviously, this 'strategic warning' is very different from the so-called 'strategic warning' of the United States. Instead, it is closer to their understanding of 'tactical warning.'"⁶⁸ PLA researchers have discussed the need to field mobile detection systems given that "Fixed long-range ground-based radars still have notable blind spots—particularly when it comes to detecting medium- and short-range ballistic missiles."⁶⁹ Researchers with the Air Force Early Warning Academy and Joint Logistic Support Force have analyzed the ability of space-based detection systems to cue ground-based radars for detecting, identifying, and tracking cruise missiles.⁷⁰

Second, will China require dual phenomenology or other safeguards in its strategic early warning systems? China has historically prioritized negative control (never launching without a valid order) over positive control (always launching with a valid order), suggesting that it may follow the U.S. and Soviet models by requiring dual phenomenology.⁷¹ However, the fact that Chinese leaders are considering a LOW posture, coupled with heightened concerns over force survivability, might lead China to emphasize positive control in the future.

Chinese writings on strategic early warning systems and LOW only occasionally mention the possibility of false positives, accidents, and unauthorized launches, and they rarely discuss them in depth. This aligns with other recent research indicating the Chinese strategists may be overly sanguine in their assessments of the risks of inadvertent nuclear escalation.⁷² One 2018 review of hundreds of Chinese academic writings determined that Chinese analysts were far more concerned with the possibility of false negatives than false positives, suggesting China might be reluctant to require dual phenomenology.⁷³ Two recent military textbooks on strategic early warning systems and dozens of academic articles on the subject include very little discussion of the possibility of false alarms.⁷⁴ One 2017 report on Rocket Force activities suggests, at least on the margins, a willingness to adopt less stringent security measures if it means enhancing operational speed. The Director of the Rocket Force Equipment Research Academy's 2nd Office was praised for determining that excessive security checkpoints in the command and control process slowed down command operations and developing a solution that better balanced operational security and information flow.⁷⁵ Articles in the widely used China National Knowledge Initiative (CNKI) database include no mention of "dual phenomenology."⁷⁶

Chinese strategists also express confidence in the ability of automation and artificial intelligence to improve early warning systems in a way that suggests less concern with false alarms.⁷⁷ Some Chinese researchers believe that artificial intelligence capabilities could improve strategic warning systems, writing that "early warning systems equipped with artificial intelligence can provide accurate warnings of sudden attacks, improve the speed and quality of information processing in advanced nuclear early warning systems, and give decision makers more time to react."⁷⁸ Some writers believe that incorporating artificial intelligence into early warning systems, command and control, and delivery systems could enhance nuclear deterrence, including by "distinguishing between false warnings of a nuclear attack and real ones."⁷⁹ Researchers at the National University of Defense Technology's International Studies College argue that automating early warning systems, including through the introduction of artificial intelligence, can provide decisionmakers more time to respond.⁸⁰ However, in one of the few clear warnings of false positives, they also caution that algorithmic bias or the adversarial poisoning of training datasets can undermine the reliability of early warning systems and that "Due to the immaturity of algorithms and autonomous systems themselves, premature application in the field of nuclear strategic intelligence may increase the risk of false alarms and misjudgments, and shake the stability of the crisis."⁸¹ Despite PLA interest in automation, in 2021, U.S. President Joe Biden and Chinese President Xi Jinping issued a statement saying that "The two leaders affirmed the need to maintain human control over the decision to use nuclear weapons. The two leaders also stressed the need to consider carefully the potential risks and develop AI technology in the military field in a prudent and responsible manner."⁸²

Third, which part of the PLA will operate the strategic early warning systems? In the past, the former General Armament Department (GAD), PLA Air Force, and the former Second Artillery Force (SAF) had all vied for control of early warning missions.⁸³ The creation of the former PLA Strategic Support Force (SSF) appeared to have resolved these disputes by centralizing missile early warning within the SSF's Base 37 (32035 部队).⁸⁴ Those missions now appear to belong to the PLA Aerospace Force, created in April 2024 from the former Strategic Support Force, which is responsible for "operation of the satellites vital to the PRC's overhead C4ISR architecture," which makes it the most likely candidate for operating any space-based launch detection capabilities.⁸⁵ Elements of the PLA Aerospace Force and the PLA Air Force both appear to operate radars with early warning capabilities.⁸⁶ According to the U.S. Department of Defense, "In 2023, the PLA transferred significant portions of PLAN shore-based, fixed-wing combat aviation units, facilities, air defense, and radar units to the PLAAF."⁸⁷ The PLA Air Force is responsible for operating China's integrated air defense systems, including "an extensive early warning radar network."⁸⁸ Researchers affiliated with the unit have published studies on a range of topics relevant to the operation of early warning capabilities, including jamming tracking and data relay satellites, ballistic missile target identification, maintenance of large phased array radars, and the analysis and improvement of satellite telemetry, tracking, and command systems.⁸⁹

Since the dissolution of the SSF, Base 37 appears to have been transferred to the newly created PLA Aerospace Force.⁹⁰ Base 37 appears to control at least the LPAR located in Shandong. Evidence from land transactions and academic publications suggest that the military entity in the area is subordinated to Base 37.⁹¹ Base 37 may also operate some of China's other LPARs. However, some evidence suggests that at least one of the country's LPARs continues to be operated by the PLA Air Force.⁹² This has led one U.S. analyst to conclude that "Continued tensions between the PLAAF and the ASF on this issue may produce two networks of LPAR stations with overlapping roles, but different command structures and potentially different data management systems that may complicate the PLA's space-situational awareness capabilities and inject confusion into their command-and-control systems. The fact that this may be an issue is supported by the fact that Base 37 appears to be responsible for data analysis of its LPAR stations. It is unknown if the PLAAF LPAR station will be integrated into this data management system."⁹³ Alternatively, independent reporting chains could reinforce the value of dual phenomenology and provide a safeguard against false alarms.

Alerted Nuclear Forces

First, which elements of China's nuclear forces will be placed on alert, particularly during peacetime? Different delivery systems present tradeoffs for nuclear signaling, negative control, positive control, survivability, and operational costs. If the PLARF intends to conceal launch preparations then it may prioritize silo-based ICBMs to minimize visible alert and launch preparation signatures. However, the PLARF could also deliberately incorporate visible signatures into standard operating procedures for silo-based ICBMs.⁹⁴ In addition to deciding the composition of forces on alert, Chinese decisionmakers will also have to decide how much of the force to alert. Chinese leaders have historically believed that the ability to deliver even a few warheads to an adversary's homeland is sufficient for deterrence.⁹⁵ This judgment might be updated based on the assessed size and effectiveness of U.S. ballistic missile defenses (BMD).

One model would be to limit nuclear alert to the best trained, most politically reliable ICBM brigades. This might reflect political reliability assessments of unit commanders or personnel reliability scores of PLA operators.⁹⁶ This would maximize capability and minimize risks, but would place a much greater burden on the best units. Another approach would be to share the burden of nuclear alert and raise the level of training and readiness across the force. This approach is consistent with general PLA practices in other areas. The PLA introduced Su-27 aircraft equally across former Military Region Air Force components and has similarly introduced J-20s to all Theater Command Air Forces.⁹⁷ The PLA Navy rotates counter-piracy

patrols between Theater Command navies to distribute training opportunities fairly.⁹⁸ All parts of the PLA are given an equal share of promotions rather than favoring elite units in the Eastern TC opposite Taiwan.⁹⁹

This design decision also has implications for how nuclear alert responsibilities are spread across the services. The PLAN and PLAAF forces may advocate for a share of nuclear alert responsibilities and the PLARF may argue that it should maintain primary responsibility. Rocket Force researchers urge avoiding interservice rivalries from derailing “rational” force development: “The Soviet nuclear force belonged to three services, making its nuclear force organization extremely complex. When there were differences among the top leaders of the country on the strategic focus of nuclear weapons development, it was easy for each service to have conflicts and internal frictions due to the allocation of development resources.”¹⁰⁰

Chinese strategists appear attuned to these tradeoffs and advocate for using a mix of systems. Researchers at the Rocket Force Engineering University write that “Land-based launch has the advantages of mature technology, low cost, multiple launch platforms, and convenient camouflage and protection. However, it has the disadvantages of insufficient mobility, easy detection and positioning, poor battlefield survivability, and easy adverse impact on the environment. Although railway mobile launch can greatly improve mobility and battlefield survivability, it has problems such as high difficulty in development and high cost.”¹⁰¹ They write that sea-based missiles have the advantages of mobility, flexibility in launch location, and reduced vulnerability to one’s own population. Downsides include technological complexity, development difficulties, high cost, and long preparation times.¹⁰²

When PLA researchers recommend a particular development approach, they either argue for fielding a diversified nuclear force to maximize the complementary advantages of different delivery systems and basing modes or prioritize land-based mobile systems.¹⁰³ One group of Rocket Force researchers advocate a diversified approach, writing that “The distorted pursuit of a single form will result in ‘useless’ development and construction in the later stages.”¹⁰⁴ PLA researchers note that fixed missile silos are particularly vulnerable, especially given recent developments in remote sensing.¹⁰⁵ The 2020 *Science of Military Strategy* says the PLA will focus on both fixed and mobile basing modes in the future to “achieve complementary advantages and increase the flexibility of strategic choices. ... [T]he implementation of mobile operations by strategic missile forces will become an important combat form in the future.”¹⁰⁶ Silo-based ICBMs are traditionally viewed as simpler and cheaper to operate. However, PLA researchers continue to publish studies on how to improve the function of missile silos, suggesting that they may be dissatisfied with the current state of the country’s silo technology.¹⁰⁷ PLA researchers, while noting that mobility enhances survivability and flexibility, also identify drawbacks to mobile systems including the cost and complexity of operating them and the possibility of advanced intelligence, surveillance, and reconnaissance (ISR) capabilities identifying and tracking mobile missiles.¹⁰⁸

Second, what kinds of changes to organizational structures or policies are necessary to support Chinese alerted nuclear forces? Here we review evidence of two organizational structures or policies that might be necessary to support a LOW posture: warhead handling practices and professional military education. A LOW posture would likely require a relatively more delegated command and control structure than China’s past approach to nuclear weapons. In particular, launch units will need to quickly access warheads and mate them with delivery vehicles. This may require a decentralization of China’s warhead storage and handling institutions and practices. There is tentative evidence, based on patterns in military unit cover designators (MUCDs), that the missile-base-level regiments responsible for warhead management may no longer be subordinate to the missile bases themselves but are now subordinate to the central warhead-handling Base 67.¹⁰⁹

This re-subordination suggests an effort to combine centralized political control over nuclear warheads with more decentralized warhead storage practices, possibly to support regular nuclear alerts without the need to transfer warheads to and from the central warhead storage site. Under this new organization, approval from both the missile base commander and the central warhead-handling Base 67 commander is probably

necessary for the warhead handling regiment to mount a nuclear warhead on a missile. Senior Rocket Force and PLA leadership may have shifted command authority for warhead-handling regiments to offset the greater risks involved in more decentralized warhead storage and regularly placing parts of the force on higher alert status. Analysts should continue to monitor for more direct evidence of peacetime warhead mating or other changes in China's warhead-handling infrastructure and practices.

In addition to more decentralized warhead storage and handling institutions and practices, a LOW posture may also require changes to professional military education and training, particularly if the air- and sea-based legs regularly adopt higher levels of alert. Higher levels of peacetime alert may require personnel to receive more rigorous training in operational security and warhead handling practices. There is no direct open-source evidence about on navy and air force warhead-handling practices. Rocket Force University of Engineering, which provides training and education in command and technical subjects for junior Rocket Force personnel offers 16 academic majors, including 1 in nuclear engineering and technology, which specifically identifies among its competencies the handling of nuclear warheads. While many of the university's descriptions of its majors specify the role that they play in supporting the Rocket Force in particular, nuclear engineering and technology is one of only two majors, along with radiation protection and nuclear safety, that the university says aim to cultivate the relevant abilities for the entire PLA.

PLA Navy and Air Force professional military education institutions do not appear to provide training and education on warhead handling. Instead, the Rocket Force University of Engineering may also train navy and air force nuclear personnel. The description of its nuclear engineering major states, "the nuclear engineering and nuclear technology major aims to train junior command and technical officers engaged in nuclear warhead assembly, testing, management and maintenance, combat application, manufacturing supervision, and applied research for the entire military."¹¹⁰ The description similarly notes, "It is the only major in our country to train nuclear warhead technology and command military talents."¹¹¹ Other PLA educational institutions do not show similar courses in their curricular materials. The Air Force Engineering University does not list any nuclear-specific subjects among its academic programs.¹¹² The Naval University of Engineering does offer studies in nuclear engineering and technology, whose description makes a single reference to weapons safety, but it is clearly focused on naval nuclear propulsion systems.¹¹³

Third, will China's LOW posture include a system of progressive alerts by which leaders can decrease or increase the alert status of their nuclear forces? Open source evidence suggests that China may already have a system of progressive alerts in place. Writing in 2012, John Lewis and Xue Litai described "a four-stage alert system and a two-level order sequence for the launch of nuclear weapons."¹¹⁴

Other Chinese government sources also suggest progressive alert procedures. A submission by the Chinese delegation to the preparatory Committee for the 2020 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons explained that "In accordance with the principles of peacetime-wartime coordination, constant readiness and being prepared to fight at any time, China strengthens its combat-readiness support to ensure effective response to war threats and emergencies. If the country faced a nuclear threat, the alert status would be raised...."¹¹⁵ Classified PLA materials also identify steps that missile brigades should take to increase the credibility of deterrent threats in a way that reflects the logic of a progressive alert system.¹¹⁶

Nuclear Command and Control

First, will launch authority be delegated to military units? Nuclear command and control may be more delegative or assertive with delegative structures giving decisionmaking power to the military and imposing fewer technological or political controls and assertive structures tightly centralizing decisionmaking power within political leadership and imposing more technological or political controls.¹¹⁷ Delegative structures are more likely when the state perceives strong external security threats, especially if they could plausibly

launch a decapitation or disarming first strike and when the state has relatively stable civil-military relations.¹¹⁸ Assertive structures are more likely when the state does not perceive strong external security threats or risks of decapitation or disarming first strikes and when the state has relatively volatile civil-military relations.¹¹⁹ Scholars have used this framework to explain why China has maintained very assertive nuclear command and control structures throughout its history.¹²⁰

Chinese leaders perceive growing external threats, especially from the United States and, in recent years, Chinese strategists appear to have been more concerned about the possibility of a U.S. disarming first strike.¹²¹ Chinese strategists are increasingly concerned about U.S. “meddling” in Chinese affairs and about possible U.S. “encirclement” and “containment.”¹²² However, Beijing’s ongoing nuclear expansion and modernization may have reduced concerns about disarming first strikes.¹²³ Nuclear exchange modeling indicates that China’s strategic nuclear forces are more survivable than ever.¹²⁴

At the same time, however, Chinese leaders may also see serious domestic threats.¹²⁵ Experts argue that China suffers from “low levels of civil-military trust” as indicated by continued periodic purges of senior PLA officials, persistent challenges of military corruption, and the lack of trusted agents within the PLA.¹²⁶ Purges of the PLA Rocket Force senior leadership in 2022, and their replacement by senior officers from the Navy and Air Force, suggest that these concerns include the nuclear forces.¹²⁷ In late 2023, China purged nine generals, including three former commanders or vice commanders of the Rocket Force.¹²⁸ Just a few weeks later, U.S. media reported that “corruption inside China’s Rocket Force and throughout the nation’s defense industrial base is so extensive that US officials now believe Xi is less likely to contemplate major military action in the coming years.”¹²⁹ This included reports that Rocket Force silo covers did not operate as intended.¹³⁰ In late 2024, additional senior military officials were purged, indicating persistent concerns among political leadership with their ability to control the military.¹³¹ Xi Jinping has attempted to exert stronger control of the military in recent years.¹³² But poor trust is likely to characterize Party-army relations going forward.¹³³ Together, decreased concern about a disarming first strike and ongoing frictions in Party-army relations suggest that China’s political leaders may be reluctant to delegate launch authority.

Delegation of launch authority requires specifying the circumstances under which PLA commanders should launch their missiles before an inbound adversary strike has exploded and which response options they should execute. Conversely, if Xi Jinping is in the decision loop, he can decide whether and how to respond to an inbound attack based on the precise political and military circumstances.

Second, which nuclear strikes are prepared in advance? Chinese decisionmakers appear to have dedicated relatively little attention to the technical features of nuclear strikes. The Second Artillery, the predecessor to the Rocket Force, reportedly did not begin to draft an operational doctrine until the late 1970s, perhaps nearly 15 years after the country’s first successful nuclear test. The Second Artillery did not publish its first strategic document until the first iteration of *Science of Second Artillery Strategy* in 1996. More recently, PLA texts only describe one nuclear campaign: the “nuclear counterstrike campaign,” consisting of “multiple waves of large- or small-scale retaliatory strikes.”¹³⁴ The shift to a launch-on-warning posture may require the development of a broader array of nuclear strike plans to be executed on short notice. As China grows and diversifies its strategic nuclear forces, a LOW posture may also require more detailed advance planning to coordinate and deconflict nuclear planning.¹³⁵

Third, how will China configure the “last mile” of command and control between military and civilian leaders? China’s past nuclear command and control arrangements may shed light on its preferences. According to one expert, “China’s top military leaders on the Central Military Commission (CMC) and top political leaders on the Politburo Standing Committee must authorize the alerting and use of nuclear weapons.”¹³⁶ One potential drawback of this arrangement is that it would be almost impossible to convene a session of the CMC and PBSC within the half hour necessary to order a launch. The “last mile” must also provide the communications infrastructure to transmit necessary information about an incoming attack to top political

leaders and valid orders to launch units. By the early 2000s, China's land-based missile units "used an automated command and control system for its missile units. That system enabled command and control over mobile missile brigades from either missile bases or the missile force headquarters in Beijing."¹³⁷ In the mid-2010s, military reporting described missile force units training to "establish communications within 30 minutes of entering a drill site."¹³⁸ China reportedly is constructing a new military command center in Beijing which could provide the technical support for rapid nuclear command and control.¹³⁹ Scholars might observe photo and video of China's top political leaders to see if they are regularly accompanied by the same military personnel, perhaps indicating an arrangement analogous to the U.S. nuclear "football." This could include being accompanied by a technician to connect personal communications to China's military command center.

KEY FINDINGS AND RECOMMENDATIONS

Finding: China has put in place all three elements needed to support a launch on warning (LOW) posture—1) early warning systems capable of detecting, characterizing, and tracking an incoming nuclear strike; 2) alerted nuclear forces that can be launched on short notice; and 3) command and control structures that can rapidly process the information provided by early warning systems, make decisions about whether and how to respond, and disseminate launch orders. This conclusion is consistent with the 2024 DOD China report's finding that the PLARF is working to implement a LOW posture this decade, which the PLA calls early warning counterstrike [预警反击].¹⁴⁰

Recommendation: *Adapt U.S. plans to reflect the expectation that a portion of the Chinese ICBM force will be alerted and postured to retaliate quickly against a U.S. nuclear strike. Increased confidence in the survivability of their strategic deterrence may strengthen Chinese resolve and make Chinese leaders less susceptible to U.S. nuclear threats.*¹⁴¹ Assess the implications of this posture through wargaming and simulations of U.S.-China nuclear crises and exchanges, both to understand the technical implications and to explore how a Chinese LOW posture is likely to affect choices and risk tolerance of U.S. decisionmakers in scenarios where nuclear escalation is possible.

Finding: The PLARF now maintains a portion of its nuclear forces on continuous alert to enhance strategic deterrence.¹⁴² The PLARF has adjusted its nuclear warhead storage and handling practices and training to support regular high alert [高度戒备] status. A review of *Rocket Force News* shows that "combat readiness duty" [战备值班] has become an institutionalized and regular practice within the PLA Rocket Force that is embedded in daily routines, training standards, and evaluative mechanisms.

A high-alert posture increases the risk of accidental, inadvertent, or unauthorized ICBM launches, not least because alerted units likely now have nuclear warheads mated with ICBMs to minimize launch preparation time. The heightened risks of silo-based ICBMs and mobile ICBMs differ. Silo-based ICBMs have lower risks of unauthorized launch since alerted units are under more direct supervision, but are more vulnerable to an adversary strike. Mobile ICBMs are more survivable, but have greater risks of accidents and relatively looser supervision when out of garrison. The general PLA tendency is to share operational responsibilities and training opportunities across the force rather than restrict them to elite units, so most PLARF ICBM units likely perform nuclear alert duty once they are operationally certified. Despite extensive PLARF operational security and camouflage efforts, mobile ICBMs are more likely than silo-based ICBMs to send deliberate or inadvertent signals as more of the force is alerted and deployed out of garrison.

Recommendation: *Commission detailed IC analysis of the operational characteristics of PLARF ICBM brigades to identify which brigades regularly perform nuclear alert and potential differences between patterns of silo-based and mobile ICBMs.* This study suggests that the risks of accidental, inadvertent, or unauthorized ICBM

launches will vary depending on how much of the PLARF force and which types of ICBM brigades are on alert at any given time. PLARF nuclear signaling may also differ based on which types of units are alerted.

Finding: A LOW posture, which requires ICBM units to be ready to launch within minutes, further increases the risk of mistaken or unauthorized ICBM launches by requiring ICBMs to be ready for immediate launch. (Absent the LOW requirement, alerted ICBMs could potentially be kept on a somewhat lower level of readiness that would require more steps before missiles could actually be launched.) A LOW posture also compresses the time available to decide whether an adversary nuclear attack is occurring and how China should respond. This increases risks of mistakenly perceiving an attack to be underway (or misunderstanding its size and intent) and pressures to pre-delegate some decisions about whether and how to retaliate to PLA commanders rather than to civilian leaders.¹⁴³ The precise capabilities and choices China makes about how to structure its LOW posture will determine the strengths and weaknesses of the system and the resulting additional risks. (See Appendix 1 for a table that summarizes risk factors associated with the nine LOW design choices.)

Recommendation: *Commission detailed IC analysis of the Chinese LOW system, with particular focus on understanding the coverage and potential gaps in the PLA launch detection and missile tracking system, determining which elements of PLA ICBM forces are routinely alerted, and understanding exactly how the Chinese nuclear command, control, and communications (NC3) system works in a LOW posture. Analysts should be aware of the potential for change as the PLA builds new command and control systems.*

Finding: Countries accept the heightened risks of accidental, inadvertent, or unauthorized ICBM launches that accompany a LOW posture in order to increase the credibility of their nuclear deterrent, especially in cases where a relatively small nuclear ICBM force might not be able to survive an adversary first strike and retaliate through adversary missile defenses.

China's decision to initiate doctrinal research and to develop the technical capabilities needed for a LOW posture likely predates Xi Jinping's decision circa 2015-2016 to dramatically expand the size of China's ICBM force (to about 600 warheads as of late 2024).¹⁴⁴ The heightened risks of a LOW posture may no longer be necessary given the increased survivability of a larger Chinese ICBM force. This suggests it might be possible to persuade China's leaders to move away from an extremely risky LOW posture toward a somewhat less risky nuclear posture which might involve ICBM units on a lower level of alert and provisions to alert more of the force as needed in crisis situations. Such a decision, while difficult to achieve, would parallel Xi's decision to reduce escalation risks by centralizing control of counter-space and offensive cyber capabilities.¹⁴⁵

Recommendation: *Commission detailed IC analysis of the timing of Chinese decisions to develop LOW enabling capabilities, such as launch-detection satellites, and the decision to expand China's ICBM force to confirm hypothesis that the LOW decision predates the ICBM expansion decision.*

Recommendation: *Seek to persuade Chinese leaders that the heightened risks of a LOW posture are unnecessary through published research, official U.S. statements and speeches, official dialogues with China and other nuclear weapons states (NWS), and unofficial dialogues that include Chinese scholars, analysts, military officers, and policymakers. In some cases, officials and academics from other countries, particularly non-nuclear weapon states and those with better relations with China, may be more effective messengers than U.S. government officials.*

Finding: A LOW posture is optimized for strategic deterrence against ICBM attacks, which allow roughly 30 minutes between launch and impact. The shorter flight time of theater-range missiles or submarine-launched missiles would compress the time available for launch detection, target characterization, and decisions about whether and how to retaliate, further amplifying the risk of a nuclear launch based on

misperception or misunderstanding of U.S. intent. This is especially true for depressed-trajectory or hypersonic missile launches.

If the United States decides to deploy shorter-range nuclear missiles to the Indo-Pacific theater to enhance deterrence, it should be cognizant of how the shorter flight times would stress a Chinese LOW posture and consider measures to reduce the risk such systems pose to Chinese ICBMs. This would likely require a clearer differentiation between strategic deterrence based on ICBMs and theater deterrence based on shorter-range missiles. This distinction between strategic and theater nuclear deterrence does not appear to currently exist in official U.S. or Chinese nuclear doctrine, but is commonly made in academic and policy discussions of extended deterrence and escalation dynamics. Current U.S. debates often involve implicit or explicit assumptions that strategic nuclear deterrence and nuclear deterrence at the theater level constitute separate rungs on an escalation ladder and limited nuclear use against some military targets is possible without escalation to the strategic level.

Recommendation: *Seek and support a more robust public and private dialogue with China that examines differences between nuclear deterrence at the strategic and theater levels and seeks to disentangle the two.* This will be challenging given China's unchanged no-first-use (NFU) doctrine and official view that any use of nuclear weapons cannot be controlled and is likely to escalate into an all-out nuclear war. However, there is evidence that PLA strategists are beginning to envision broader deterrent and coercive applications of theater nuclear systems that may be consistent with nuclear warfighting and require changes to PLARF doctrine and training.¹⁴⁶

If the United States decides to deploy theater nuclear systems in the Indo-Pacific to enhance regional deterrence, it could manage risks by limiting the stress those deployments place on China's LOW doctrine. The U.S. goal should be to limit the scope of a Chinese LOW policy to large-scale nuclear attacks on China's strategic ICBM force. This would likely require U.S. shorter-range nuclear missiles to be solely focused on theater targets and not threaten China's strategic deterrent. The United States could make this posture more credible through a combination of range limits on deployed U.S. systems (so they cannot reach some Chinese ICBM fields), quantity limits on deployed U.S. systems, and declarations that theater systems are not for conventional or nuclear counterforce strikes against Chinese ICBMs.

Regardless, China would be highly suspicious of U.S. motivations and likely to view such deployments as a hostile gesture and respond with measures to turn its theater nuclear force into one trained and postured for potential theater nuclear warfighting.

Finding: The PLARF has made changes to its nuclear warhead storage and handling procedures and its personnel training and certification system to support the continuous nuclear alerts necessary for a LOW posture. Open-source information does not reveal how much of the nuclear force is on nuclear alert or how nuclear alert responsibilities are distributed across silo-based and mobile-ICBM brigades. However, PLA scholars write about the varying strengths and weaknesses of the two different basing modes. PLA authors argue that mobile basing enhances survivability and flexibility, but increases operational challenges and exposes forces to attack. Silo basing provides greater stability, but missiles are more vulnerable to attack. PLA analysts suggest that the optimum posture would include a mix of both types of basing modes, with a possible emphasis on road-mobile missiles to maximize survivability.¹⁴⁷

Recommendation: *Commission detailed IC analysis to determine which elements of PLA ICBM forces are routinely alerted and to seek to detect patterns in the distribution of nuclear alert responsibilities and differences in the alert patterns of mobile and silo-based ICBM brigades.*

Finding: The PLA's pursuit of a nuclear triad that includes PLA Navy (PLAN) Type-094 JIN class SSBNs and PLA Air Force (PLAAF) nuclear-capable bombers will complicate PLA nuclear planning and enhance the survivability of the Chinese nuclear force. The expansion of nuclear weapons to services and units with

limited nuclear experience will likely increase the chances of accidental, inadvertent, or unauthorized use. Technical characteristics of Chinese air and sea-based nuclear weapons and their associated NC3 systems make them poorly suited for a LOW posture, but it is possible the PLAN and PLAAF will argue for such a role if it is seen as a prestigious mission that might bring additional resources.

Recommendation: *Use commissioned research and dialogues to highlight the historical costs and challenges of maintaining the high readiness necessary for a LOW posture in the air and naval legs of the triad, and encourage Russia and other NWS to share their experiences with the PLA.*

Finding: The PLARF shift to a LOW posture that includes alerted ICBMs raises its baseline level of readiness and compresses the bandwidth for nuclear signaling, since the peacetime PLA will already have a portion of the force ready to fire on short notice. China's larger ICBM force and higher baseline readiness reduces the urgency of flushing mobile ICBMs from garrison early in a crisis to ensure survivability and allows the PLARF to be more deliberate with its nuclear signaling decisions.¹⁴⁸ In addition to the nuclear signaling measures discussed in the literature, the PLARF appears to have adopted a progressive alert system that will mobilize a larger percentage of the ICBM force at higher alert levels.¹⁴⁹ To the extent that the PLARF relies more on silo-based ICBMs rather than mobile ICBMs for strategic deterrence, signals of heightened alert status may be harder to detect. Deployment of mobile ICBMs from garrison and SSBNs to sea would be key indicators of higher alert.

Recommendation: *Task IC to be sensitive to potential shifts in Chinese nuclear signaling patterns given changes in the composition and readiness of the PLARF ICBM force.* There may be value in revisiting intelligence indicators and how red teams portray Chinese nuclear forces in simulations and wargames.

DTRA may want to commission research to re-examine Chinese writings on escalation and nuclear-signaling once they begin to reflect the new reality of a larger Chinese strategic deterrent.

Finding: There is significant nuclear-conventional entanglement in aspects of a nuclear force postured for LOW, in addition to the recognized risks of dual-capable missiles such as the DF-26.¹⁵⁰ The United States and Soviet Union eventually accepted that early warning satellites and dedicated NC3 systems contributed to crisis stability at the strategic nuclear level and that both sides were better off if the other side's systems worked reliably.¹⁵¹ Such stability is best achieved by dedicated early warning satellites and NC3 focused solely on nuclear deterrence and mutual agreement that such systems should be off limits to attack by anti-satellite weapons, offensive cyberattacks, or electronic jamming. This will be challenging given the inherent dual-use characteristics of early warning satellites and radars and some aspects of NC3, which have high value for ballistic missile defense and conventional warfighting and evidence that Chinese analysts see value in using early warning systems for conventional missions. This implies that agreements not to attack these aspects of an adversary's early warning and NC3 systems will require accepting that these systems may be available to support their BMD systems and conventional warfighting capabilities.

Recommendation: *Urge policymakers to examine the extent to which next-generation U.S. early warning and NC3 systems could be dedicated solely to strategic deterrence missions to facilitate possible arms control agreements restricting attacks on these systems.* This will require a classified assessment of the contributions Chinese systems would make to PLA BMD systems and conventional warfighting.

Finding: A critical aspect of NC3 in a LOW nuclear posture is the "last mile" that loops civilian decisionmakers into urgent decisions about whether and how to retaliate for a nuclear attack that is underway. The precise details of how China makes decisions about nuclear use and communicates them to operational units are not known at the open-source level. Our research found no evidence that a PLA officer with the Chinese equivalent of a nuclear football routinely accompanies Xi Jinping on domestic and international travel. A nuclear football might not be necessary because PLA nuclear missiles are not believed to include permissive action links that require inputting centrally-held codes to allow for launch. China may

develop some other system for making and communicating launch decisions. In any case, Xi Jinping's inclusion in LOW response decisions is critical, because he may be the only one with the authority to decide not to execute a pre-planned nuclear response to an accidental or limited nuclear attack.

Expert discussions suggested that an interim solution might be transmitting nuclear messages using the CCP "red phone" secure communications system that already connects senior party officials.¹⁵² Xi Jinping likely has a dedicated civilian communications team that provides constant access to this system, and it may be easy for the Zhongnanhai Telecommunications Directorate to connect PLA nuclear communications lines to the CCP secure red phone system. Such a connection would probably not provide a common operating picture of the military situation. It likely would have the technical ability to support conference calls with senior military officials and possibly with other members of the Politburo Standing Committee. It is possible that efforts to build a new PLA command center in Beijing (known as Beijing military city) may include upgraded NC3.

Recommendation: *Encourage China to conduct simulation exercises that exercise its NC3 arrangements within the LOW response window. Consider POTUS-level discussions with Xi Jinping about the challenges of nuclear decision-making in a crisis.*

Finding: A LOW posture implies making advance decisions about what alerted missiles would target. China has signed at least three agreements not to target other countries with nuclear weapons: a bilateral NFU and non-targeting agreement with Russia in 1994, a bilateral non-targeting agreement with the United States in 1998, and a P-5 non-targeting agreement signed in May 2000.¹⁵³ The U.S.-China agreement was a "non-targeting" agreement because the United States would not give a NFU pledge and because China claimed it did not target the United States with nuclear weapons. At that time, China kept its missiles and warheads separated, so China did not need to make changes in its practices to implement the agreement.¹⁵⁴ Discussion of how China is implementing the 1998 and 2000 non-targeting agreements now that its ICBM force is regularly on nuclear alert and that it has adopted a LOW doctrine could be a useful starting point for crisis stability discussions with China. (According to the organizer of a U.S.-China nuclear track two dialogue, U.S. participants raised this agreement in a June 2025 dialogue and Chinese non-governmental participants responded that they believed the agreement was now void because of changes in U.S.-China bilateral relations.)¹⁵⁵

Recommendation: *State Department and OSD should consider whether China's adherence to its non-targeting commitments would be a good talking point for U.S.-China official dialogues. The U.S. government could also consider whether this point is best raised by other countries or in track two or academic settings.*

APPENDIX 1: LOW DESIGN CHOICES, ASSOCIATED RISKS, AND MITIGATION OPTIONS

Design Decision	Significance	Decisions Increasing Risk	Mitigation Option
<i>EW Systems</i>			
Does system detect both nuclear and conventional launches?	Low	Detecting both increases entanglement and misperception risks	Dedicated nuclear EW systems; agreement not to target EW satellites and radars
Does system incorporate dual phenomenology?	Medium	Single phenomenology increases risk of false positives	China-Russia or TL dialogue on Cold War experience; BL/ML launch notification agreements
What organizations control systems and how is intel shared?	Low	Information loss crossing org. boundaries increases misperception	China-Russia or TL dialogue on Cold War experience and “near misses”
<i>Alerted Forces</i>			
What portion and type of forces are put on alert?	High	Large portion on alert; reliance on mobile missiles	Track 1 or 2 meetings on signaling and crisis behavior; U.S. unilateral transparency on nuclear signaling?
Required changes to organizational structure, processes?	Low	New procedures and coord. across org. boundaries increases inadvertent launch risks	Track 1 or 2 meetings emphasizing best practices of technical and personnel controls; dialogue on past experiences
Does a progressive alert system operate in a crisis?	Medium	Inflexible procedures; overlap between signs of alert and launch prep	Crisis communications mechanisms; launch notification agreements; talks on signaling and crisis behavior
<i>Nuclear C3</i>			
Is launch authority delegated to lower command echelons?	High	Extensive delegation; low control raises risk of unintentional launch	Encourage PRC to conduct pol-mil simulation exercises; U.S.-China track 2 nuclear simulation exercise
Which types of response strikes are pre-prepared?	Medium	Rigid response procedures increase risk of undesired actions	Non-targeting agreement
How is “last mile” of nuclear C3 configured?	High	Unreliable NC3 to top leader limits decision time and info and might eliminate ability to decide NOT to retaliate	Bilateral agreement to not target NC3 systems; PRC pol-mil simulation exercises

The table identifies, for each of the nine design decisions discussed above, the significance of each design decision for U.S.-China nuclear relations, decisions or features related to that design decision which could increase risks of nuclear escalation in a U.S.-China context, and options for mitigating those risks. When determine whether each design decision presents high, medium, or low significance for U.S.-China nuclear relations. High significance decisions are those which are most likely to increase the risks of unauthorized, accidental, or inadvertent nuclear launches. Medium significance decisions are those which are likely to indirectly increase the risks of nuclear use by, for instance, increasing the likelihood of misperception or bureaucratic error. Low significance decisions are those which may impact the internal functioning of China’s LOW posture but in ways which are not likely to influence the risks of nuclear use. Three design

decisions are of high significance: 1) what portion and type of nuclear forces are placed on alert; 2) whether or not China institutes a progressive alert system and implements those alerts in a crisis; and 3) whether launch authority is delegated to lower echelons of command.

APPENDIX 2: METHODS FOR INFLUENCING CHINESE THINKING ABOUT LAUNCH ON WARNING

This study highlights the importance of Chinese thinking about the utility of nuclear weapons and about strategic stability as critical factors in Chinese decisions about nuclear force structure and nuclear doctrine. It suggests there may be a disjuncture between the new reality of a larger and more survivable Chinese nuclear deterrent and the need to run the heightened risks of a LOW posture to compensate for a small and vulnerable nuclear deterrence. It advocates efforts to influence Chinese thinking through a variety of means.

China's reluctance to engage in frank discussions about its nuclear capabilities has inhibited U.S.-China official dialogues on nuclear issues in the past, and the current state of U.S.-China bilateral relations poses new obstacles. Although some issues can only be addressed through official negotiations, other issues can be usefully discussed in other forums. Moreover, Chinese suspicions about U.S. intentions and motives means that views and experiences shared by Russia or other nuclear weapons states may be regarded as more credible and have more impact on Chinese interlocutors.

U.S. government policy statements and speeches provide authoritative statements of U.S. policy. Chinese interlocutors pay close attention to formal policy statements, but are likely to receive them suspiciously and interpret them through their own preconceptions about U.S. motives.

U.S.-China official dialogues provide opportunities for direct and confidential discussions. It has proven difficult to persuade the Chinese government to engage in such discussions, and in the few times they have occurred, it has been difficult to move beyond scripted talking points.

U.S.-China unofficial (track two) dialogues involve a mix of scholars and officials participating in their personal capacity. A number of unofficial U.S.-China dialogues have been organized to discuss strategic stability and nuclear issues; these have involved current and former government officials, active duty and retired military officers, analysts at government and private research institutes, and academics. It has become more difficult to organize such dialogues in recent years due to concerns of participants on both sides about their personal safety and risk of being detained by security authorities.

Academic conferences are more focused on presenting historical, theoretical, and policy research, often in multilateral forums. The academic nature of such conferences can allow freer discussions, but they have less potential for policy impact.

Sponsored research published openly can potentially influence Chinese academic and policy debates. Chinese analysts follow foreign publications of policy interest; some are translated and summarized for Chinese government officials and cited in research by Chinese academics and research institute analysts.

Official and unofficial *China-Russia dialogues* already occur on a range of strategic issues, and provide a channel through which Russia might share its experience with nuclear deterrence and issues associated with LOW. In some cases, Russian advice and opinions may shape Chinese thinking in undesirable directions.

Trilateral U.S.-China-Russia dialogues on strategic and nuclear issues have sometimes occurred. These offer a chance for the United States and Russia to share their longer experience with nuclear operations and LOW, and for U.S. participants to push back against unhelpful Russian views.

The P-5 (five permanent members of the United Nations Security Council) have held official dialogues and negotiations on strategic stability and nuclear issues; the different mix of participants can potentially spark different discussions.

The United Kingdom and France are both nuclear weapons states that have decided to maintain relatively small nuclear deterrents. They have less competitive relationships with China and could potentially engage in nuclear and strategic discussions in a less adversarial manner.

The matrix below considers which methods for seeking to influence Chinese thinking about launch on warning are best suited for which issues.

Issue	USG policy	U.S.-China official	U.S.-China track two	Academic conferences	Sponsored research	China-Russia	TL	P5	UK/France
Early Warning challenges		X	X	X	X	X			
Challenges of maintaining an alerted nuclear force		X	X	X	X	X	X	X	X
LOW necessity and risks		X	X	X	X		X		X
Balancing survivability and stability		X	X	X	X		X	X	
Strategic-theater distinction	X	X	X		X		X	X	X
Can nuclear Early Warning and NC3 be segregated?		X	X		X	X	X		
Challenges of nuclear decision-making under LOW		X	X	X	X	X	X		
Nontargeting and LOW		X	X				X	X	X

ACKNOWLEDGEMENTS

Lilly Min-Chen Lee and LtCol Gary Sampson, USMC (ret.) provided valuable research assistance for this study. Participants in the project workshop provided invaluable feedback, and in some cases Chinese sources, that greatly improved the study. Raina Nelson proofread the study twice and provided substantive comments on several points. Thanks to Gerald Brown (Department of State) and to Justin Anderson, Christopher Andrews, and Kathleen Ellis of the INSS Center for the Study of Weapons of Mass Destruction for helpful conversations and comments on the findings.

Thanks to Don Wenzlick and Jonathan Bukowski at DTRA for advice and support throughout the project. Diane Fabrizio, Greg Simpson, and Kathy Spagnoli at Tufts University provided valuable assistance in the application and contract management process. Cathy Reese, Lauren Edson, and Darien Shedrick at NDU/INSS planned and executed logistics arrangements for the project workshop.

REFERENCES

-
- ¹ *Annual Report to Congress: The Military Power of the People's Republic of China 2023* (Washington, DC: Office of the Secretary of Defense, 2023), p. 112.
- ² See, for example, Vipin Narang, "What Does It Take to Deter? Regional Power Nuclear Postures and International Conflict," *Journal of Conflict Resolution*, Vol. 57, No. 3 (2013), pp. 478-508; and Mark S. Bell and Julia Macdonald, "How to Think About Nuclear Crises," *Texas National Security Review*, Vol. 2, No. 2 (2019), pp. 40-64.
- ³ Christopher Lawrence, "The Balance of Nuclear Humility: Techno-optimism, Complexity, and the Perils of Nuclear Primacy," working paper, version 4, spring 2025.
- ⁴ These sources included China's Defense White Papers; Chinese military reporting; academic writings from strategists affiliated with the Academy of Military Science, National Defense University, National University of Defense Technology, prominent civilian institutions, and other government-affiliated research centers such as the Chinese Academy of Social Sciences and the Chinese Institute for Contemporary International Relations; official statements from senior Chinese government personnel; and open-source data on China's nuclear and missile forces and related capabilities derived from sources such as patent filings and commercial satellite imagery.
- ⁵ Bruce G. Blair, *The Logic of Accidental Nuclear War* (Washington, D.C.: Brookings Institution Press, 1993), p. 186; and L. Wainstein et al., "The Evolution of U.S. Strategic Command and Control and Warning, 1945-1972, Study S-467, Institute for Defense Analyses, June 1975, Top Secret, declassified excerpts, <https://nsarchive2.gwu.edu/NSAEBB/NSAEBB43/doc17.pdf>, p. 345; and Anthony M. Barrett, "False Alarms, True Dangers? Current and Future Risks of Inadvertent U.S.-Russian Nuclear War," RAND Corporation, PE-191-TSF (2016), p. 2; and Bruce G. Blair, *The Logic of Accidental Nuclear War* (Washington, D.C.: Brookings Institution Press, 1993), p. 186.
- ⁶ James Acton, "Escalation through Entanglement: How the Vulnerability of Command-and-Control Systems Raises the Risks of an Inadvertent Nuclear War," *International Security*, Vol. 43, No. 1 (Summer 2018), pp. 56-99; and David C. Logan, "Are They Reading Schelling in Beijing: The Dimensions, Drivers, and Risks of Nuclear-Conventional Entanglement in China," *Journal of Strategic Studies*, Vol. 46, No. 1 (2023), pp. 5-55.
- ⁷ Acton, "Escalation through Entanglement," pp. 56-99.
- ⁸ Bruce Blair argues that the United States may have been more flexible in implementing its dual phenomenology requirements, though he does not provide specifics. According to Blair, "Unlike the United States, which tolerated greater warning ambiguity in its rapid reaction posture, the Soviet Union maintained a strict requirement for dual phenomenology." See Blair, *The Logic of Accidental Nuclear War*, p. 215.

- ⁹ Paul Bracken, "Instabilities in the Control of Nuclear Forces," in Anatolii Andreevich Gromyko and Martin E. Hellman, eds., *Breakthrough: Emerging New Thinking* (New York, N.Y.: Walker and Company, 1988), pp. 21-30, p. 5; and Linn I. Sennott, "Overlapping False Alarms: Reason for Concern?" in Gromyko and Hellman, eds., *Breakthrough*, pp. 39-44.
- ¹⁰ Bruce G. Blair and John D. Steinbruner, *The Effects of Warning on Strategic Stability* (Washington, D.C.: The Brookings Institution Press, 1991).
- ¹¹ John A. Gentry and Joseph S. Gordon, *Strategic Warning Intelligence: History, Challenges, and Prospects* (Washington, D.C.: Georgetown University Press, 2019), pp. 224-227.
- ¹² *Ibid.*
- ¹³ Hans M. Kristensen, "Alert Status of Nuclear Weapons," Briefing to Short Course on Nuclear Weapon and Related Security Issues, American Physical Society's Forum on Physics/Society, GWU Elliott School, 21 April 2017, https://web.archive.org/web/20250204164946/https://uploads.fas.org/2014/05/Brief2017_GWU_2s.pdf.
- ¹⁴ Blair, *The Logic of Accidental Nuclear War*, pp. 168-218; and Pavel Podvig, "Reducing the Risk of an Accidental Launch," *Science and Global Security*, Vol. 14, Nos. 2-3 (2006), pp. 75-115.
- ¹⁵ Memorandum from Seymour Weiss, State Department Policy Planning Council, to Undersecretary of State John Irwin and Deputy Secretary of State for Political Affairs U. A. Johnson, "Luncheon Conversation October 2 with Paul Nitze on SALT," 7 October 1970, Top Secret/Nodis/Sensitive, RG 59, Policy Planning Council Miscellaneous Records, 1959-72, box 299, SALT 1970 October 1-13; also published in DNSA, Nuclear History II, 1969-1976, <https://nsarchive.gwu.edu/document/19342-national-security-archive-doc-14-memorandum>; and Meeting of the General Advisory Committee on Arms Control and Disarmament [GAC], Thursday, January 21, 1971, "ICBM Survivability," Top Secret, excised copy, excerpt, <https://nsarchive.gwu.edu/document/19343-national-security-archive-doc-15-meeting>.
- ¹⁶ Keir A. Lieber and Daryl G. Press, "The New Era of Counterforce: Technological Change and the Future of Nuclear Deterrence," *International Security*, Vol. 41, No. 4 (Spring 2017), pp. 9-49; Hans M. Kristensen, Matthew McKinzie, and Theodore A. Postol, "How U.S. Nuclear Force Modernization Is Undermining Strategic Stability: The Burst-Height Compensating Super-Fuze," *Bulletin of the Atomic Scientists*, March 1, 2017, <https://thebulletin.org/2017/03/how-us-nuclear-force-modernization-is-undermining-strategic-stability-the-burst-height-compensating-super-fuze/>
- ¹⁶ Wu Riqiang, "Living with Uncertainty: Modeling China's Nuclear Survivability," *International Security*, Vol. 44, No. 4 (Spring 2020), pp. 84-118. However, for a compelling discussion and critique of the "standard linear model" approach adopted by the preceding studies, see Christopher Lawrence, "The Balance of Nuclear Humility: Techno-Optimism, Complexity, and the Perils of Nuclear Primacy," Spring 2025, working paper.
- ¹⁷ *ICBM Basing Options: A Summary of Major Studies to Define a Survivable Basing Concept for ICBMs*, Office of the Deputy Under Secretary of Defense for Research and Engineering, December 1980.
- ¹⁸ For a review of Rocket Force personnel management practices, see David C. Logan, "Rocket Force Personnel in the Age of Xi Jinping," in *The People in the PLA 2.0*, ed. Roy Kamphausen (Carlisle, PA: U.S. Army War College Press, 2021), pp. 41-96.
- ¹⁹ Tami Davis Biddle, "Coercion Theory: A Basic Introduction for Practitioners," *Texas National Security Review*, Vol. 3, No. 2 (2020), pp. 94-109; and Reid Pauly, "Damned If They Do, Damned If They Don't: The Assurance Dilemma in International Coercion," *International Security*, Vol. 49, No. 1 (2024), pp. 91-132.
- ²⁰ Richard Ned Lebow, *Nuclear Crisis Management* (Ithaca, N.Y.: Cornell University Press, 1987), pp. 102-153.
- ²¹ *Ibid.*, pp. 31-103.
- ²² Jeffrey G. Lewis and Bruno Tertrais, *The Finger on the Button: The Authority to Use Nuclear Weapons in Nuclear-Armed States* (Monterey, CA: Middlebury Institute of International Studies at Monterey, 2019).
- ²³ U.S. planning for delegation of launch authority began in the mid-1950s during the Eisenhower administration amid concerns that the U.S. president might be unavailable or incapacitated. Daniel Ellsberg, *The Doomsday Machine: Confessions of a Nuclear War Planner* (New York, N.Y.: Bloomsbury, 2017), p. 298. On fears of decapitation generally,

see Peter D. Feaver, "Command and Control in Emerging Nuclear Nations," *International Security*, Vol. 17, No. 3 (1992-1993), pp. 160-187.

- ²⁴ Cable from Commander-in-Chief Strategic Air Command Holloway to JCS Chairman and Air Force Chief of Staff Ryan, "Visit of Dr. Henry Kissinger to HQ SAC," 10 March 1970, Secret; Note by the Secretaries to the Joint Chiefs of Staff on Review of JCS NSTL and SIOP-62, JCS 2056/206, 26 January 1961, Top Secret, Excised copy with more details released on appeal; and Scott D. Sagan, "SIOP-62: The Nuclear War Plan Briefing to President Kennedy," *International Security*, Vol. 12, No. 1 (1987), p. 37-39.
- ²⁵ William Burr, "Presidents and the 'Nuclear Football,'" *Arms Control Today*, Vol. 55, No. 3 (2025).
- ²⁶ Feaver, "Command and Control in Emerging Nuclear Nations," pp. 164-168.
- ²⁷ *Ibid.*
- ²⁸ Alex Wellerstein, "NC3 Decision Making: Individual Versus Group Process", NAPSNet Special Reports, August 8, 2019, <https://nautilus.org/napsnet/napsnet-special-reports/nc3-decision-making-individual-versus-group-process/>.
- ²⁹ 寿晓松 [Shou Xiaosong], 战略学 [Science of Military Strategy], (Beijing, 军事科学出版社 [Academy of Military Science Press], 2013), pp. 148-150. Also see 肖天亮 [Xiao Tianliang], 战略学 [Science of Military Strategy], (Beijing, 国防大学出版社 [National Defense University Press], 2020), pp. 217-219. For discussion in English, see Marcus Clay and Roderick Lee, "Unmasking the Devil in the Chinese Details: A Study Note on the Science of Military Strategy 2020," China Aerospace Studies Institute, January 24, 2022, pp. 3, 14.
- ³⁰ Zhao Lei, "Xi's Thought Guides Reform of Armed Forces," *China Daily*, September 21, 2022, <https://www.chinadaily.com.cn/a/202209/21/WS632a7bcba310fd2b29e78e73.html>.
- ³¹ *Military and Security Developments Involving the People's Republic of China, 2024* (Washington, D.C.: Office of the Secretary of Defense, 2024), p. 99.
- ³² *Military and Security Developments Involving the People's Republic of China, 2021* (Washington, D.C.: Office of the Secretary of Defense, 2021), p. 94; and *Military and Security Developments Involving the People's Republic of China, 2024* (Washington, D.C.: Office of the Secretary of Defense, 2024), p. 110.
- ³³ Henk H.F. Smid, "An Analysis of Chinese Remote Sensing Satellites," *Space Review*, September 26, 2022; Phillip S. Clark, "China's Shiyen Weixing Satellite Programme," *Space Chronicle*, Vol. 71, No. 1 (2018), pp. 23, 28; Peter Wood, Alex Stone, and Thomas Corbett, *Chinese Nuclear Command, Control, and Communications* (Montgomery, AL: China Aerospace Studies Institute, 2024), p. 58; and "Tongxin Jishu Shiyen 12," NASA Space Science Data Coordinated Archive, <https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=2024-246A>.
- ³⁴ J. Michael Dahm, "China C4ISR and Counter-Intervention," Testimony before the U.S.-China Economic and Security Review Commission, March 21, 2024, p. 41; Gunter D. Krebs, "TJS 2, 5, 6, 13 (Huoyan-1 ?)," Gunter's Space Page, https://space.skyrocket.de/doc_sdat/tjs-2.htm; and James Acton, Twitter post, March 28, 2023, 9:35 a.m., https://x.com/james_acton32/status/1640709182935506944.
- ³⁵ "TJS-2," N2YO, <https://www.n2yo.com/satellite/?s=41911>; "TJS-5," N2YO, <https://www.n2yo.com/satellite/?s=44978>; "TJS-6," N2YO, <https://www.n2yo.com/satellite/?s=47613>; "TJS-7," N2YO, <https://www.n2yo.com/satellite/?s=49115>; and James Acton, Twitter post, March 28, 2023, 9:37 a.m., https://x.com/james_acton32/status/1640709609315868672.
- ³⁶ James Acton, Twitter post, March 28, 2023, 9:51 a.m., https://x.com/james_acton32/status/1640713339780354051.
- ³⁷ 周尚辉, 曾德贤, 胡晶晶 吴曙光, and 赵彤 [Zhou Shanghui, Zeng Dexian, Hu Jingjing, Wu Shuguang, and Zhao Tong], "弹道导弹目标识别方法研究 [Research on Ballistic Missile Target Recognition Method]," 中国设备工程 [China Plant Engineering], No. 5 (2022), p. 222.
- ³⁸ Hans M. Kristensen, "China's Strategic Systems and Programs," in James M. Smith and Paul J. Bolt, eds., *China's Strategic Arsenal: Worldview, Doctrine, and Systems* (Washington, D.C.: Georgetown University Press, 2021), p. 115.
- ³⁹ For an earlier, slightly dated list, see Brian Weeden and Victoria Samson, *Global Counterspace Capabilities: An Open Source Assessment* (Broomfield, CO: Open World Foundation, 2022), p. 15-28.

- ⁴⁰ *Military and Security Developments Involving the People's Republic of China, 2024* (Washington, D.C.: Office of the Secretary of Defense, 2024), p. 110.
- ⁴¹ Kristin Huang, "Chinese Radar 'Is Watching Missile Threats from Korean Peninsula and Japan,'" *South China Morning Post*, May 2, 2022, <https://www.scmp.com/news/china/military/article/3296786/chinas-aerospace-force-reveals-long-range-radar-message-xi-jinping>.
- ⁴² Andrew Tate, "China Integrates Long-Range Surveillance Capabilities," *IHS Janes*, 2017.
- ⁴³ Tate, "China Integrates Long-Range Surveillance Capabilities"; Mike Yeo, "New Chinese Radar Looks toward Japan, Satellite Image Shows," *Defense News*, 18 April 2022, <https://www.defensenews.com/global/asia-pacific/2022/04/18/new-chinese-radar-looks-towards-japan-satellite-image-shows/>; and James Acton, Twitter post, March 28, 2023, 9:58 a.m., https://x.com/james_acton32/status/1640715093901193227.
- ⁴⁴ 郭小川, 陈桂明, 申军岭, 常雷雷, and 刘鑫昌 [Guo Xiaochuan, Chen Guiming, Shen Junling, Chang Leilei, and Liu Xinchang], 导弹预警反击作战体系构建与效能评估研究 [Construction of Missile Early Warning and Counter Attack System and Effectiveness Evaluation], 装备学院学报 [Journal of Equipment Academy], Vol. 27, No. 6 (2016), pp. 75-81; 孙志鹏, 陈桂明, and 高卫刚 [Sun Zhipeng, Chen Guiming, and Gao Weigang], "基于证据推理的预警反击作战体系保障能力评估方法 [Support Capability Evaluation Method for Early-Warning Counter-attack System of Systems Based on Evidential Reasoning]," 兵工学报 [Acta Armamentarii], Vol. 40, No. 9 (2019), pp. 1928-1934.
- ⁴⁵ *China's Military Strategy* (Beijing: State Information Council, 2015); *China's National Defense in the New Era* (Beijing: State Information Council, 2019); and Xiao, *Science of Military Strategy*, pp. 383, 388.
- ⁴⁶ 曹繁 and 黄万军 [Cao Fan and Huang Wanjun], "‘执着’让他一路奔跑 [‘Perseverance’ Keeps Him Running All the Way]," 火箭兵报 [Rocket Force News], November 9, 2011, p. 3.
- ⁴⁷ 曹繁 and 王军涛 [Cao Fan and Wang Juntao], "始终冲锋在‘打赢’前沿 [Always at the Forefront of ‘Winning’]," 火箭兵报 [Rocket Force News], December 14, 2011, p. 3.
- ⁴⁸ Hans M. Kristensen, Matt Korda, Eliana Johns and Mackenzie Knight, "Chinese Nuclear Weapons, 2025," *Bulletin of the Atomic Scientists*, Vol. 81, No. 2 (2025), p. 136.
- ⁴⁹ *Military and Security Developments Involving the People's Republic of China, 2024* (Washington, D.C.: Office of the Secretary of Defense, 2024), p. 56.
- ⁵⁰ 李忠 and 张帆 [Li Zhong and Zhang Fan], "雪域战场演兵忙：某旅冬训场营营对抗演练目击记 [Snowy Battlefield Military Exercises Are Busy: Account of a Brigade's Winter Training Camp Confrontation Exercise]," 火箭兵报 [Rocket Force News], January 7, 2017.
- ⁵¹ *Ibid.*
- ⁵² 陆正辉, 刘小博, and 岳小林 [Lu Zhenghui, Liu Xiaobo, Yue Xiaolin], "导弹成功发射，人员却“全体阵亡”，究竟算不算胜利？ [The Missile Was Successfully Launched, But All the Personnel Were “Killed.” Is This Considered a Victory?]," 解放军报 [PLA Daily], December 7, 2021, http://www.81.cn/hjj/2021-12/07/content_10113210.htm.
- ⁵³ 杨承军 [Yang Chengjun], "核战略专家杨承军：不宜在网络上炒作涉核问题 [Nuclear Strategy Expert Yang Chengjun: It Is Not Appropriate to Hype Nuclear-Related Issues on the Internet]," 祖国 [Motherland], May 13, 2020.
- ⁵⁴ *Military and Security Developments Involving the People's Republic of China, 2024* (Washington, D.C.: Office of the Secretary of Defense, 2024), p. 106.
- ⁵⁵ "热学探悟励斗志凝心聚力创佳绩 [Enthusiastic Study and Exploration Encourages Fighting Spirit and Unites Efforts to Achieve Outstanding Results]" 火箭兵报 [Rocket Force News], October 19, 2022 and "实战牵引求突破创新思路谋打赢 [Actual Combat Leads to Breakthroughs and Innovative Ideas to Win]" 火箭兵报 [Rocket Force News], November 26, 2022.
- ⁵⁶ Fiona S. Cunningham, "Nuclear Command, Control, and Communications Systems of the People's Republic of China," NAPSNet Special Reports, July 18, 2019, <https://nautilus.org/napsnet/napsnet-special-reports/nuclear-command-control-and-communications-systems-of-the-peoples-republic-of-china/>.

- ⁵⁷ Lyle J. Morris and Rakesh Sood, *Understanding China's Perceptions and Strategy Toward Nuclear Weapons: A Case Study Approach*, HDTRA1-23-P-0033, Defense Threat Reduction Agency, September 2024.
- ⁵⁸ Wood, Stone, and Corbett, *Chinese Nuclear Command, Control, and Communications*, pp. 59-70.
- ⁵⁹ 郭阳, 张洪亮, and 田亮 [Guo Yang, Zhang Hongliang, and Tian Liang], “张春洋:思战研战的‘驭剑先锋’ [Zhang Chunyang: A ‘Pioneer in Wielding the Sword’ Who Thinks about War and Studies War],” 火箭兵报 [*Rocket Force News*], July 7, 2018, p. 2. The brigade in question was Unit 96751 under Base 65. At the time, the brigade was equipped with the nuclear-armed DF-21A medium-range ballistic missile (MRBM). In 2019, it converted to the nuclear-armed DF-41 road-mobile ICBM. See Ma Xiu, *PLA Rocket Force Organization* (Montgomery, AL: China Aerospace Studies Institute, 2022), p. 142.
- ⁶⁰ 于际训 [Yu Jixun], ed., 第二炮兵战役学 [*The Science of Second Artillery Campaigns*] (Beijing: 解放军出版社 [PLA Press], 2004), p. 349.
- ⁶¹ 夏文亮 and 孙晨 [Xia Wenliang and Sun Chen], “曾洪贵:一路驰骋向战场 [Zeng Honggui: Galloping All the Way to the Battlefield],” 火箭兵报 [*Rocket Force News*], July 28, 2018, p. 3.
- ⁶² Yu, ed., *The Science of Second Artillery Campaigns*, p. 168.
- ⁶³ Wood, Stone, and Corbett, *Chinese Nuclear Command, Control, and Communications*, pp. 14-19, 59-60, 67-69.
- ⁶⁴ 王宏强 [Wang Hongqiang], ed., 战略预警系统 [*Strategic Early Warning System*], (Beijing: 国防科技大学出版社 [National University of Defense Technology Press], 2024), p. 2.
- ⁶⁵ *Ibid.*, pp. 2-3.
- ⁶⁶ *Ibid.*, p. 3.
- ⁶⁷ 曲卫, 李云涛, and 杨君 [Qu Wei, Li Yuntao, and Yang Jun], 导弹预警系统概论 [*Introduction to Missile Early Warning System*], (Beijing: 国防工业出版社 [National Defense Industry Press], 2023), p. 91. The authors are researchers at Space Engineering University (航天工程大学), Beijing Institute of Tracking and Telecommunications Technology (北京跟踪与通信技术研究所), Beijing Aerospace Control Center (北京航天飞行控制中心), and China Satellite Maritime Survey and Control Department (中国卫星海上测控部).
- ⁶⁸ 汪明敏 [Wang Mingmin], “预警概念界定问题研究 [A Study on the Definition of the Concept of Warning],” 情报杂志 [*Journal of Intelligence*], Vol. 41, No. 1 (2022), p. 16.
- ⁶⁹ Qu, Li, and Yang, *Introduction to Missile Early Warning System*, p. 80.
- ⁷⁰ 郑建成, 谭贤四, 曲智国, 何文琳, and 李志淮 [Zheng Jiancheng, Tan Xiansi, Qu Zhiguo, He Wenlin, and Li Zhihui], “高超声速/常规巡航导弹预警探测特征比较 [Comparison of Early Warning Detection Characteristics Between Hypersonic Cruise Missile and Cruise Missile],” 现代防御技术 [*Modern Defence Technology*], Vol. 50, No. 4 (2022), pp. 116-123.
- ⁷¹ On nuclear command and control, see Feaver, “Command and Control in Emerging Nuclear Nations.” On China's past practices of nuclear command and control, see M. Taylor Fravel and Evan S. Medeiros, “China's Search for Assured Retaliation: The Evolution of Chinese Nuclear Strategy and Force Structure,” *International Security*, Vol. 35, No. 2 (2010), pp. 48-87.
- ⁷² Fiona S. Cunningham and M. Taylor Fravel, “Dangerous Confidence? Chinese Views on Nuclear Escalation,” *International Security*, Vol. 44, No. 2 (2019), pp. 61-109. For some more recent evidence that Chinese scholars have a greater appreciation for the risks of escalation, see David C. Logan, “Chinese Views of Strategic Stability: Implications for U.S.-China Relations,” *International Security*, Vol. 49, No. 2 (2024), pp. 77, 87-89.
- ⁷³ Lora Saalman, “Fear of False Negatives: AI and China's Nuclear Posture,” *Bulletin of the Atomic Scientists*, 24 April 2018, <https://thebulletin.org/2018/04/fear-of-false-negatives-ai-and-chinas-nuclear-posture/>.
- ⁷⁴ Qu, Li, and Yang, *Introduction to Missile Early Warning System*; and Wang, ed., *Strategic Early Warning System*.
- ⁷⁵ 王铁, 王浩, and 张伟 [Wang Tie, Wang Hao, and Zhang Wei], “信息工匠: 王学宁 [Information Craftsman: Wang Xuening],” 火箭兵报 [*Rocket Force News*], January 13, 2017, p. 2.
- ⁷⁶ Analysis of articles conducted in April 2025.

- ⁷⁷ Saalman, "Fear of False Negatives."
- ⁷⁸ 张东冬 [Zhang Dongdong], "人工智能军事化与全球战略稳定 [The Militarization of Artificial Intelligence and Global Strategic Stability]," 国际展望 [Global Review], No. 5 (2022), p. 150.
- ⁷⁹ *Ibid.*, pp. 151-152.
- ⁸⁰ 张煌 and 杜雁芸 [Zhang Huang and Du Yanyun], "军事智能化与人工智能威慑的生成路径 [Military Intelligence and the Generation Path of Artificial Intelligence Deterrence]," 外交评论 [Foreign Affairs Review], No. 1 (2025), pp. 99, 101, 111; and 陈曦, 葛腾飞, and 宋道青 [Chen Fei, Ge Tengfei, and Song Daoqing], "智能化情报手段对大国战略稳定的影响评估 [An Assessment of the Impact of Intelligent Intelligence Means on the Strategic Stability of Great Powers]," 情报杂志 [Journal of Intelligence], Vol. 40, No. 6 (2021), pp. 15-16.
- ⁸¹ Chen, Ge, and Song, "An Assessment of the Impact of Intelligent Intelligence Means on the Strategic Stability of Great Powers," p. 16.
- ⁸² Jarrett Renshaw and Trevor Hunnicutt, "Biden, Xi Agree that Humans, Not AI, Should Control Nuclear Arms," *Reuters*, November 16, 2024, <https://www.reuters.com/world/biden-xi-agreed-that-humans-not-ai-should-control-nuclear-weapons-white-house-2024-11-16/>.
- ⁸³ John Costello and Joe McReynolds, *China's Strategic Support Force: A Force for a New Era*, China Strategic Perspectives No. 13 (Washington, D.C.: National Defense University Press, 2018), pp. 22-23.
- ⁸⁴ Decker Eveleth, *PLA Aerospace Force Base 37: An Open-Source Case Study in Integrating Geospatial Data* (Montgomery, AL: China Aerospace Studies Institute, 2024), p. 14; and Kristin Burke, "The PLA's New Base for Space Situational Awareness—Opportunities and Challenges for the U.S.," China Aerospace Studies Institute, September 2023; and Mark Stokes, Gabriel Alvarado, Emily Weinstein, and Ian Easton, "China's Space and Counterspace Capabilities and Activities," Testimony before the U.S.-China Economic and Security Review Commission, March 30, 2020, pp. 35-36.
- ⁸⁵ *Military and Security Developments Involving the People's Republic of China, 2024* (Washington, D.C.: Office of the Secretary of Defense, 2024), p. 69.
- ⁸⁶ Eveleth, *PLA Aerospace Force Base 37*, p. 10.
- ⁸⁷ *Military and Security Developments Involving the People's Republic of China, 2024* (Washington, D.C.: Office of the Secretary of Defense, 2024), p. 59.
- ⁸⁸ *Military and Security Developments Involving the People's Republic of China, 2024* (Washington, D.C.: Office of the Secretary of Defense, 2024), p. 87.
- ⁸⁹ 王学梅, 陶金, 姚凡凡, and 马也 [Wang Xuemei, Tao Jinyao Fanfan, and Ma Ye], "伴随卫星干扰中继卫星通信链路策略研究 [Study on Strategies of Jamming Tracking and Data Relay Satellite Communication Link with Accompanying Satellites]," 无线电工程 [Radio Engineering], No. 12 (2020); Zhou, Zeng, Hu, Wu, and Zhao, "Research on Ballistic Missile Target Recognition Method," pp. 219-222; 常春贺, 武高卫, 于兴伟, and 姚旭 [Chang Chunhe, Wu Gaowei, Yu Xingwei, and Yao Xu], "大型相控阵雷达天线阵面备件优化配置研究 [Research on Optimization Model for Spare Parts of Large-Scale Phased Array Radar Antenna]," 雷达科学与技术 [Radar Science and Technology], No. 3 (2017); and 许江来 and 韩磊 [Xu Jianglai and Han Lei], "测控设备自跟踪状态稳定性分析及对策 [Analysis and Improvement of Self-tracking State Stability of TT&C Equipment]," [Radio Engineering], No. 7 (2021), pp. 580-584.
- ⁹⁰ Eveleth, *PLA Aerospace Force Base 37*, p. 9; and Kristin Burke, *PLA Counterspace Command and Control* (Montgomery, AL: China Aerospace Studies Institute, 2023), pp. 68-69.
- ⁹¹ 槐荫区淄博路以东、德州路以南、青岛路以北、东营路以西 [East of Zibo Road, South of Dezhou Road, North of Qingdao Road, and West of Dongying Road in Huaiyin District], 标找找 [Biao Zhaozhao], <https://web.archive.org/web/20240213221931/https://www.biaozhaozhao.com/land/c980772103e86d45ab212d9521155f5c>; and Chang, Wu, Yu, and Yao, "Research on Optimization Model for Spare Parts of Large-Scale Phased Array Radar Antenna." For discussion in English of this evidence, see Eveleth, *PLA Aerospace Force Base 37*, pp. 14-15.
- ⁹² Eveleth, *PLA Aerospace Force Base 37*, p. 16.

- ⁹³ Eveleth, *PLA Aerospace Force Base* 37, p. 20.
- ⁹⁴ Yu, ed., *The Science of Second Artillery Campaigns*, pp. 282-296; and 曹正荣, 吴润波, and 孙建军 [Cao Zhengrong, Wu Runbo, and Sun Jianjun], 信息化联合作战 [Informationized Joint Operations] (Beijing: 解放军出版社 [PLA Press], 2008), p. 260.
- ⁹⁵ Jeffrey G. Lewis, *The Minimum Means of Reprisal: China's Search for Security in the Nuclear Age* (Cambridge, MA: The MIT Press, 2007).
- ⁹⁶ Logan, "Rocket Force Personnel in the Age of Xi Jinping," pp. 74-84.
- ⁹⁷ Jack Lau, "China's Stealth Fighter Jets Now Seeing Duty in All 5 Theatre Commands," *South China Morning Post*, September 28, 2022. Though initial introduction focused on the Eastern Theater Command. See Eli Tirk, "Status of 41st Aviation Brigade Transition to the J-20 (Montgomery, AL: China Aerospace Studies Institute, 2024), pp. 1-3.
- ⁹⁸ Kenneth Allen, "The PLA's Military Diplomacy in Advance of the 20th Party Congress (Part Two)," *China Brief*, Vol. 22, No. 18 (2022).
- ⁹⁹ Joel Wuthnow, *Gray Dragons: Assessing China's Senior Military Leadership*, China Strategic Perspectives No. 16 (Washington, D.C.: National Defense University Press, 2022), p. 1.
- ¹⁰⁰ 代海峰, 毕义明, 张欧亚, and 黄远征 [Dai Haifeng, Bi Yiming, Zhang Ouya, and Huang Yuanzheng], "美俄陆基核力量多元形态发展探析 [An Analysis of the Development of Multiple Forms of U.S. and Russian Land-Based Nuclear Forces]," 飞航导弹 [Aerodynamic Missile Journal], No. 10 (2018), p. 50.
- ¹⁰¹ 杨明映, 朱昱, 强江峰, and 王彬虎 [Yang Mingying, Zhu Yu, Qiang Jiangfeng, and Wang Binhu], "导弹主要发射平台、技术特点及未来趋势 [Main Missile Launch Platforms, Technical Features and Future Trends]," 飞航导弹 [Aerodynamic Missile Journal], No. 6 (2020), p. 36.
- ¹⁰² *Ibid.*
- ¹⁰³ *Ibid.*, pp. 39-40.
- ¹⁰⁴ Dai, Bi, Zhang, and Huang, "An Analysis of the Development of Multiple Forms of U.S. and Russian Land-Based Nuclear Forces," p. 50.
- ¹⁰⁵ 目光 [Mu Guang], 导弹作战概论 [Basic Theory and Method of Missile Operation] (Beijing: 北京理工大学出版社 [Beijing Institute of Technology Press], 2020), p. 133; and 邓飙, 刘云飞, 唐圣金, 郭杨, and 陈渐伟 [Deng Biao, Liu Yunfei, Tang Shengjin, Guo Yang, and Chen Jianwei], 俄罗斯发射井盖的发展历程 [The Development History of Russian Launch Silo Covers], 飞航导弹 [Aerodynamic Missile Journal], No. 2 (2019), p. 73.
- ¹⁰⁶ Xiao, *Science of Military Strategy*, pp. 382-383.
- ¹⁰⁷ 权辉, 谢建, 张力, and 魏小玲 [Quan Hui, Xie Jian, Zhang Li, and Wei Xiaoling], "发射井引射器的工作特性 [Working Characteristic of Silo Ejector]," 航空动力学报 [Journal of Aerospace Power], Vol. 35, No. 4 (2020), pp. 855-866; 权辉, 谢建, 谢政, and 李良, [Quan Hui, Xie Jian, Xie Zheng, and Li Liang], "一种考虑壁面摩擦作用的发射井引射器设计方法 [A Method for Design of Silo Ejector Concerning Wall Friction]," 北京理工大学学报 [Transactions of Beijing Institute of Technology], Vol. 41, No. 2 (2021), pp. 274-285; and 周岸峰, 郭振, 李道奎, 周仕明, and 姜人伟 [Zhou Anfeng, Guo Zhen, Li Daokui, Zhou Shiming, and Jiang Renwei], "发射井内弹—筒系统抗爆减震设计 [Blast Resistant and Shock Absorption Design for Missile-Canister System in Silo]," 国防科技大学学报 [Journal of National University of Defense Technology], Vol. 45, No. 1 (2023), pp. 102-109.
- ¹⁰⁸ 张岩 [Zhang Yan], ed., 战略威慑论 [Theory of Strategic Deterrence], (Beijing: 社会科学文献出版社 [Social Sciences Academic Press], 2018), p. 110; and Mu, *Basic Theory and Method of Missile Operation*, pp. 80, 90.
- ¹⁰⁹ This and the following two paragraphs come from David C. Logan and Phillip C. Saunders, *Discerning the Drivers of China's Nuclear Force Development: Models, Indicators, and Data*, China Strategic Perspectives, No. 18 (Washington, D.C.: National Defense University Press, 2023), pp. 77-78.
- ¹¹⁰ "Nuclear Engineering and Nuclear Technology Major" [核工程与核技术专业], Rocket Force University of Engineering [火箭军工程大学], https://web.archive.org/web/20181209093646mp_/http://www.epgc.net/zsxx/zszy/249355.shtml.

¹¹¹ *Ibid.*

¹¹² “Academic Majors” [学科专业], Air Force Engineering University [空军工程大学], <http://www.afeu.cn/web/afeu/xkzyn/>.

¹¹³ “School of Nuclear Science and Technology” [核科学技术学院], Naval University of Engineering [海军工程大学], <http://www.nue.edu.cn/index.aspx?lanmuid=63&sublanmuid=701>.

¹¹⁴ This preceded the recent PLARF practice of regularly placing some brigades on higher levels of alert. John W. Lewis and Xue Litai, “Making China’s Nuclear War Plan,” *Bulletin of the Atomic Scientists*, Vol. 68, No. 5 (2012), p. 57.

¹¹⁵ Ministry of Foreign Affairs of the People’s Republic of China, “Implementation of the Treaty on the Non-Proliferation of Nuclear Weapons in the People’s Republic of China,” Report Submitted by China to the Preparatory Committee for the 2020 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Third Session, New York. May 10-29, 2019, <https://digitallibrary.un.org/record/3805416?ln=en&v=pdf>, p. 4.

¹¹⁶ Yu, ed., *The Science of Second Artillery Campaigns*, pp. 282-296, 402.

¹¹⁷ Feaver, “Command and Control in Emerging Nuclear Nations.”

¹¹⁸ *Ibid.*

¹¹⁹ *Ibid.*

¹²⁰ Vipin Narang, *Nuclear Strategy in the Modern Era: Regional Powers and International Conflict* (Princeton, N.J.: Princeton University Press, 2014), pp. 139-152.

¹²¹ Logan, “Chinese Views of Strategic Stability,” pp. 78-80.

¹²² 朱锋 and 倪桂桦 [Zhu Feng and Ni Guihua], “拜登政府对华战略竞争的态势与困境 [The Biden Administration’s Strategic Competition Approach with China: Its Character and Looks],” 亚太安全与海洋研究 [Asia-Pacific Security and Maritime Affairs], Vol. 1 (2022), pp. 1-18; and 王文 [Wang Wen], “论新时代的机遇期论新时代的战略机遇期：源起、现状与未来 [On the Strategic Opportunity Period of the New Era: Origin, Current Situation, and Future],” 中国与世界研究 [Journal of the Central Institute of Socialism], No. 4 (2022), pp. 33-42. For discussion in English, see Logan, “Chinese Views of Strategic Stability,” pp. 80-84.

¹²³ For more on the buildup and the possibility that it is driven by a desire to maintain the survivability of the strategic deterrent, see Logan and Saunders, *Discerning the Drivers of China’s Nuclear Force Development*; and Logan, “Chinese Views of Strategic Stability.”

¹²⁴ Wu, “Living with Uncertainty.”

¹²⁵ Daniel C. Mattingly, “How the Party Commands the Gun: The Foreign–Domestic Threat Dilemma in China,” *American Journal of Political Science*, Vol. 68, No. 1 (2024), pp. 227-242.

¹²⁶ Joel Wuthnow, “Can Xi Jinping Control the PLA?” *China Leadership Monitor*, No. 83 (Spring 2025), p. 11; and Joel Wuthnow and Phillip C. Saunders, *China’s Quest for Supremacy* (London, U.K.: Polity Press, 2025), introduction.

¹²⁷ See Phillip C. Saunders and Joel Wuthnow, “Xi Can’t Trust His Own Military,” *New York Times*, May 6, 2025, <https://www.nytimes.com/2025/05/06/opinion/china-taiwan-xi-jinping.html>.

¹²⁸ Yew Lun Tian and Laurie Chen, “Chinese Military Purge Exposes Weakness, Could Widen,” *Reuters*, December 31, 2023, <https://www.reuters.com/world/china/sweeping-chinese-military-purge-exposes-weakness-could-widen-2023-12-30/>.

¹²⁹ Peter Martin and Jennifer Jacobs, “U.S. Intelligence Shows Flawed China Missiles Led Xi to Purge Army,” *Bloomberg*, January 6, 2024, <https://www.bloomberg.com/news/articles/2024-01-06/us-intelligence-shows-flawed-china-missiles-led-xi-jinping-to-purge-military>.

¹³⁰ Elliot Ji, “Rocket-Powered Corruption: Why the Missile Industry Became the Target of Xi’s Purge,” *War On the Rocks*, January 23, 2024, <https://warontherocks.com/2024/01/rocket-powered-corruption-why-the-missile-industry-became-the-target-of-xis-purge/>.

- ¹³¹ Bloomberg News, "Xi's New Military Purge Is Broadest Since He Ousted Rival Clique," *Bloomberg*, December 5, 2024, <https://www.bloomberg.com/news/articles/2024-12-06/xi-s-biggest-military-purge-in-years-spotlights-frustration-with-armed-forces>.
- ¹³² Wuthnow, "Can Xi Jinping Control the PLA?" p. 11.
- ¹³³ Joel Wuthnow and Phillip C. Saunders, "More Red but Still Expert: Party-Army Relations Under Xi Jinping," *Journal of Contemporary China* (2024).
- ¹³⁴ Fiona S. Cunningham and M. Taylor Fravel, "Assuring Assured Retaliation: China's Nuclear Posture and U.S.-China Strategic Stability," *International Security*, Vol. 40, No. 2 (Fall 2015), pp. 13-14.
- ¹³⁵ Yang, Zhu, Qiang, and Wang, "Main Missile Launch Platforms, Technical Features and Future Trends," p. 41.
- ¹³⁶ Fiona S. Cunningham, "Nuclear Command, Control, and Communications Systems of the People's Republic of China," NAPSNet Special Reports, July 18, 2019, <https://nautilus.org/napsnet/napsnet-special-reports/nuclear-command-control-and-communications-systems-of-the-peoples-republic-of-china/>.
- ¹³⁷ *Ibid.*
- ¹³⁸ Kenneth W. Allen and Jana Allen, *Building a Strong Informatized Strategic Missile Force: An Overview of the Second Artillery Force with a Focus on Training in 2014* (Washington, D.C.: Jamestown Foundation, 2015), p. 35.
- ¹³⁹ Demetri Sevastopulo, Joe Leahy, Ryan McMorro, Kathrin Hille, and Chris Cook, "China Builds Huge Wartime Military Command Centre in Beijing," *Financial Times*, 30 January 2025, <https://www.ft.com/content/f3763e51-8607-42b9-9ef9-5789d5bf353d>.
- ¹⁴⁰ *Annual Report to Congress: The Military Power of the People's Republic of China 2024* (Washington, DC: Office of the Secretary of Defense, 2024), p. 110.
- ¹⁴¹ Phillip C. Saunders and David C. Logan, "The Implications of the PLA's Nuclear Expansion and Modernization for China's Crisis Behavior" in *China's Military Decision-making in Crisis and Conflict*, ed. Roy D. Kamphausen (Seattle: National Bureau of Asian Research, 2023), pp. 151-174.
- ¹⁴² *Annual Report to Congress: The Military Power of the People's Republic of China 2024* (Washington, DC: Office of the Secretary of Defense, 2024), pp. 101-110.
- ¹⁴³ PLA doctrinal writings speak of the "national command authority" making nuclear decisions; this would include Chinese Communist Party (CCP) General Secretary and Central Military Commission (CMC) Chair Xi Jinping and probably other Politburo Standing Committee and CMC members.
- ¹⁴⁴ There is evidence of specific PLA LOW doctrinal research taskings in 2011. For the 2015-16 date of Xi's decision to expand Chinese nuclear forces, see Brandon J. Babin, "Xi Jinping's Strangelove: The Need for a Deterrence-Based Offset Strategy," in *Modernizing Deterrence: How China Coerces, Compels, and Deters*, ed. Roy Kamphausen (Seattle, WA: National Bureau of Asian Research, 2023), pp. 67-97.
- ¹⁴⁵ Fiona S. Cunningham, "Strategic Substitution: China's Search for Coercive Leverage in the Information Age," *International Security*, Vol. 47, No. 1 (2022), pp. 46-92; Fiona S. Cunningham, *Under the Nuclear Shadow: China's Information-Age Weapons in International Security* (Princeton, N.J.: Princeton University press, 2025); and David C. Gompert and Phillip C. Saunders, *The Paradox of Power: Sino-American Strategic Restraint in an Age of Vulnerability* (Washington, D.C.: National Defense University Press, 2011).
- ¹⁴⁶ For recent research, see Brandon J. Babin, "Xi Jinping's Strangelove: The Need for a Deterrence-Based Offset Strategy," in *Modernizing Deterrence: How China Coerces, Compels, and Deters*, ed. Roy Kamphausen (Seattle, WA: National Bureau of Asian Research, 2023); and Chris Andrews and Justin Anderson, "China's Theater-Range, Dual-Capable Delivery Systems: Integrated Deterrence and Risk Reduction Approaches to Counter a Growing Threat," Strategic Trends Research Initiative, Defense Threat Reduction Agency, August 2024. Iain Johnston has shown that this strand of thinking in the PLA goes back much earlier. Alastair Iain Johnston, "China's New 'Old Thinking': The Concept of Limited Deterrence," *International Security*, Vol. 20, No. 3, (1995), pp. 5-42.

- ¹⁴⁷ Zhang, *Theory of Strategic Deterrence*, p. 110; and Mu, *Basic Theory and Method of Missile Operation*, p. 90.
- ¹⁴⁸ Saunders and Logan, "The Implications of the PLA's Nuclear Expansion and Modernization for China's Crisis Behavior."
- ¹⁴⁹ On nuclear alerts and signaling, see Scott D. Sagan, "Nuclear Alerts and Crisis Management," *International Security*, Vol. 9, No. 4 (Spring 1985); and Richard Ned Lebow, *Nuclear Crisis Management* (Ithaca, N.Y.: Cornell University Press, 1987). On evidence of China's alert system, see Lewis and Xue, "Making China's Nuclear War Plan," p. 57; Ministry of Foreign Affairs of the People's Republic of China, "Implementation of the Treaty on the Non-Proliferation of Nuclear Weapons in the People's Republic of China," Report Submitted by China to the Preparatory Committee for the 2020 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Third Session, New York, May 10-29, 2019, <https://digitallibrary.un.org/record/3805416?ln=en&v=pdf>, p. 4.; Yu, ed., *The Science of Second Artillery Campaigns*, pp. 282-296, 402; and Nathan Beauchamp-Mustafaga, et al, *Deciphering Chinese Deterrence Signaling in the New Era: An Analytic Framework and Seven Case Studies* (Santa Monica, CA: RAND Australia, 2021), p. 33.
- ¹⁵⁰ David C. Logan and Phillip C. Saunders, *Addressing Conventional-Nuclear Entanglement Risks in a U.S.-China Conventional Conflict*, study for the Defense Threat Reduction Agency, August 21, 2020 (FOUO).
- ¹⁵¹ John Lewis Gaddis, "The Evolution of a Reconnaissance Satellite Regime," in *U.S.-Soviet Security Cooperation: Achievements, Failures, Lessons*, eds., Alexander George, et al. (New York: Oxford University Press, 1988), 353-372. Though some scholars argue that some of this dedication may have weakened in recent years. See James M. Acton, "Escalation through Entanglement: How the Vulnerability of Command-and-Control Systems Raises the Risks of an Inadvertent Nuclear War," *International Security*, Vol. 43, No. 1 (2018), pp. 56-99.
- ¹⁵² See Richard McGregor, *The Party: The Secret World of China's Communist Rulers* (New York: Harper, 2012).
- ¹⁵³ Walter Pincus, "U.S., China May Retarget Nuclear Weapons," *The Washington Post*, June 15, 1998, <https://www.washingtonpost.com/archive/politics/1998/06/16/us-china-may-retarget-nuclear-weapons/a05ea961-13f3-4a14-ae61-77529ca2d70c/>; "France, on behalf of Five Nuclear-Weapon States, Tells Review Conference No State Is Targeted by Their Weapons," United Nations, DC/2703, May 1, 2000, <https://press.un.org/en/2000/20000501.dc2703.doc.html>.
- ¹⁵⁴ The United States reportedly changed the default target for its ICBMs and SLBMs to point to the ocean rather than any country.
- ¹⁵⁵ Authors' personal communications with U.S. dialogue organizer, June 2025.

For any questions or comments about the report, please contact the Strategic Trends Office at dtra.belvoir.si.mbx.hdtra1-stri-adm@mail.mil.

STRATEGIC TRENDS RESEARCH INITIATIVE

STRI is a sponsored research program that encompasses studies and strategic dialogues. STRI focuses on delivering operationally relevant, credible, timely, and actionable research for DTRA and the warfighter community and is intended to inform future operations, activities, and investments within DTRA.

CONNECT WITH US



facebook.com/doddtra



[@doddtra](https://twitter.com/doddtra)



www.dtra.mil/About/Mission/Strategic-Integration



[@doddtra](https://twitter.com/doddtra)



youtube.com/user/doddtra