Testimony before the U.S.-China Economic and Security Review Commission
Hearing on China's Nuclear Forces

June 10, 2021

Phillip C. Saunders
Director, Center for the Study of Chinese Military Affairs
Institute of National Strategic Studies, National Defense University

The views expressed are those of the author and do not necessarily represent those of the National Defense University, the Department of Defense, or the U.S. government.

Introduction

The People's Republic of China (PRC) is in the midst of an ambitious strategic modernization that will transform its nuclear arsenal from a limited ground-based nuclear force intended to provide an assured second strike after a nuclear attack into a much larger, technologically advanced, and diverse nuclear triad that will provide PRC leaders with new strategic options. China also fields an increasing number of dual-capable medium and intermediate-range ballistic missiles whose status within a future regional crisis or conflict may be unclear, potentially casting a nuclear shadow over U.S. and allied military operations. In addition to more accurate and more survivable delivery systems, this modernization includes improvements to the People's Liberation Army (PLA) nuclear command, control, and communications (NC3) and strategic intelligence, surveillance, and reconnaissance (ISR) systems that will provide PRC leaders with greater situational awareness in a crisis or conflict. These systems will also support development of ballistic missile defenses (BMD) and enable possible shifts in PRC nuclear doctrine and nuclear policy such as a shift to a "launch on warning" posture or a policy that envisions "nuclear warfighting" rather than just deterrence of an adversary first strike.[1]

This testimony reviews what is known about the PRC NC3 system and how that system may adapt to new naval and air force nuclear capabilities, considers how new technologies and operational practices may pose challenges for NC3 and supporting strategic ISR systems, reviews the issue of conventional-nuclear entanglement, assesses evolving PRC ballistic missile defense (BMD) capabilities, and considers the policy issues these raise for the United States.

Nuclear Command, Control, and Communications (NC3)

Decisions about nuclear weapons use are existential questions for the PRC. They will almost certainly be made by senior Chinese Communist Party (CCP) civilian leaders at the Politburo or Politburo Standing Committee level. The CCP's longstanding insistence that "the party must control the gun" continues, as does its emphasis on the primacy of political objectives over military objectives. Political guidance from civilian leaders has shaped PRC nuclear policy, including the "no first use" policy and the views that the utility of nuclear weapons lies primarily in deterring an adversary nuclear first strike and reducing China's vulnerability to nuclear coercion and that the destructiveness of nuclear weapons means that even a few nuclear weapons delivered on adversary territory are sufficient to deter a nuclear first strike.[2]

This emphasis on CCP control has shaped PLA nuclear force structure and command and control arrangements. CCP leaders tasked the Chinese defense establishment and the PLA to produce a "lean and effective" nuclear deterrent that would deter an adversary first strike without the large force structures and high costs that characterized the U.S.-Soviet nuclear arms race.[3] Consistent with its general approach to controlling the use of military capabilities, the CCP has emphasized "negative control" (ensuring that nuclear weapons are never used without explicit authorization) over "positive control" (ensuring that nuclear weapons will always work when ordered).[4] This manifested in PLA operational practices such as keeping nuclear warheads demated from the ground-based missiles that would deliver them and centralized control over the alert status of PRC nuclear forces.[5] In terms of nuclear doctrine, this meant emphasizing assured retaliation (even if it took days or weeks for surviving PLA nuclear forces to respond to a first strike), rather than timely retaliation that required maintaining nuclear forces on high levels of alert.

This approach was compatible with the primitive technological state of the PLA's small nuclear missile forces from the 1980s to the early 2000s, its underdeveloped NC3 system, and the lack of strategic ISR systems to provide warning that an adversary nuclear attack was underway. Under these conditions, the PRC focused on building nuclear forces that could survive an adversary's first strike and deliver a retaliatory strike. Survivability was to be achieved through a variety of means, including ambiguity about the total number of ICBMs and their locations, extensive use of camouflage, and the use of caves and tunnels to protect ICBMs and warheads from attack. China's second generation of ballistic missiles (DF-21 and DF-31) incorporated solid fuel technology and added mobility, improving survivability by complicating an adversary's task of locating and targeting missiles once they deployed from garrison. As the United States invested in advanced research into ballistic missile defense (BMD) in the 1980s and eventually began to deploy operational missile defenses that might have some capability against Chinese intercontinental ballistic missiles (ICBMs), PLA strategists added the need to penetrate current and future U.S. BMD systems when thinking about how large a nuclear force was necessary to provide assured retaliation. According to PRC academics, these calculations focused on how many warheads would survive an initial adversary strike and the ability of the surviving warheads to penetrate U.S. missile defenses.[6]

While civilian CCP leaders would be the critical actors in deciding whether to authorize a nuclear strike, the Central Military Commission (CMC), headed by CCP General Secretary Xi Jinping, would exercise centralized control in the authorization and execution of any Chinese nuclear operations. The CMC would also support, and possibly influence, civilian decisions by providing intelligence and threat analysis, formulating plans and response options, and providing military advice to civilian leaders who mostly have limited experience with military and nuclear matters. These channels would provide senior PLA officers opportunities to influence PRC nuclear decision-making even if they are not the ultimate deciders.[7]

The PRC is developing a nuclear triad that includes ground-based missiles, a nuclear submarine (SSBN) force, and an air component that involves nuclear air-launched ballistic missiles and a future long-range bomber.[8] Much more information is available about NC3 arrangements for the ground-based missiles controlled by the PLA Rocket Force (PLARF), so I will begin by describing those NC3 arrangements and then consider what is known (and unknown) about NC3 arrangements for naval and air nuclear forces.[9]

The PLARF operates an automated command system that is reportedly interoperable with the automated systems used by other PLA services, and which includes support for the mobile missile force. Fiona Cunningham writes that, "CMC orders to alert or use nuclear weapons are likely transmitted to the CMC Joint Operations Command Center [in the Western Hills outside Beijing], then to the Rocket Force Headquarters, then to missile bases and down the chain of command to launch companies. Alternatively, orders may be transmitted directly from the Rocket Force Headquarters to missile brigades, battalions or launch companies, making use of the skip-echelon function of the automated command system."[10] According to the *Science of Second Artillery Campaigns*, the PLARF operates a variety of redundant systems to transmit orders to operational units, including radio, relay, cable, fiber-optic, and satellite means. The Rocket Force also operates basic, reserve, and rear command posts to provide redundancy; the latter two are only staffed at higher alert levels.[11]

The 2015-2016 PLA reforms gave the five newly established theater commands operational control over PLARF conventional missile units in their areas of responsibility. New communication links between the theater commands and PLARF bases and brigades appear to supplement existing command and control links between PLARF headquarters and operational units. Chinese press reports suggest that these new communication links initially did not provide full integration between PLARF C2 systems and those of the theater commands, but such integration would logically be an eventual goal.[12]

Much less is known about NC3 arrangements for the PLA navy's nuclear submarine force, which currently consists of six *Jin* class Type 094 SSBNs, each of which can carry 12 JL-2 nuclear missiles. China is also developing a follow-on Type 096 SSBN, which will carry a longer-range missile and may be deployed by 2030.[13] China's SSBN force is based at Longpo Naval Base on Hainan Island. The complex includes a large underground facility which is probably capable of housing several submarines and loading them with missiles.[14] The PLA Navy operates China's SSBNs and would presumably receive alert and launch orders from the CMC and convey those orders to SSBNs on patrol. Communications with SSBNs on patrol are a significant operational challenge, especially if submarines are deployed into deep ocean. The PLA has built a super low frequency (SLF) transmitter capable of communicating with submarines at frequencies of 30–300 hertz, and has also conducted research on extremely low frequency and satellite communications, which would facility communications with SSBNs submerged to 100 meter depths or below.[15] The effectiveness of these naval NC3 systems in an operational environment is unknown. Some analysts assess that the potential unreliability of these communications systems in a crisis or conflict might lead China to pre-delegate launch authority to SSBN commanders and political commissars, although such a decision would be inconsistent with the CCP's emphasis on negative control and insistence on controlling key military decisions.[16]

The PLA Air Force (PLAAF) has designated the air-refuellable H-6N as a nuclear capable bomber that will likely carry air-launched ballistic missiles derived from the DF-21. It is also reportedly developing a new long-range strategic stealth bomber that would likely also be nuclear capable.[17] Because these systems are not yet operational, there is no definitive open source information on likely NC3 procedures. PLAAF headquarters will likely maintain operation control of these nuclear assets, as they do with other strategic assets such as conventional bombers, some special mission aircraft, transports, and the Airborne Corps.[18] As with the ground-based and sea-based legs of China's deterrent, the CMC would likely issue deployment, alert, and attack orders for air force nuclear systems.

China's development of a nuclear triad and the increasing number of mobile medium-range, intermediate-range, and intercontinental ground-based missiles makes China's nuclear deterrent more survivable, but also poses new challenges for nuclear command and control. First, the navy and air force will need to develop their own operational doctrine, personnel reliability systems, and nuclear warhead handling facilities to support their nuclear operations. Second, SSBNs will likely not be able to follow the PLARF practice of keeping nuclear warheads and missiles demated when they deploy on patrol. China expressed an interest in acquiring permissive action link (PAL) technology that would guard against unauthorized nuclear launches from the United States and Russia, but it is not clear whether currently deployed nuclear systems incorporate such safeguards.[19] Third, the increasing proportion of China's ground-based nuclear force that is mobile (and which would be deployed from garrison in a crisis or conflict) will create new challenges for NC3 systems. Fourth, the deployment of increasing numbers of DF-26 MRBMs, a dual-capable missile capable of hot-swapping between nuclear and conventional warheads, creates challenges in terms of whether brigades equipped with this missile respond to PLARF orders (for nuclear missions) or theater command orders (for conventional missiles).[20] Finally, the growing size, diversity, and complexity of China's nuclear deterrent increases the risk of accidents and the challenge of ensuring effective negative controls that prevent unauthorized use.

Intelligence, Surveillance, and Reconnaissance

The 2015-2016 PLA reforms established a new organization, the PLA Strategic Support Force (PLASSF), which took over responsibility for a range of cyber, space, electronic warfare, and political warfare functions that had previously been scattered throughout the PLA. The PLASSF operates a number of space-based strategic ISR systems and cyber collection capabilities that support PLARF operations.[21] These include electro-optical and synthetic-aperture radar imagery satellites, electronic intelligence (ELINT) satellites to detect electronic signatures, and communications satellites to support PLA operations.[22] Given its ISR responsibilities, the PLASSF likely also operates the PLA's four ground-based large phased-array radar systems, which can potentially be used to track incoming strategic missiles.[23] The PLASSF likely provides information derived from its ISR systems directly to the CMC and PLARF headquarters. It has also established five regional support bases to provide information directly to each of the five theater commands.[24]

In the 2015 Defense White Paper, the PLA discussed its intent to "improve strategic early warning," which would likely involve deployment of a satellite-based system to detect ballistic missile launches.[25] At the time, a RAND study assessed that development of such a system might take a decade.[26] Some analysts suspect that satellite launches in 2015 and 2017 might be part of such a system, but definitive evidence is not available in open sources.[27] In October 2019, Russia announced its intention to help China develop an early warning system that may include space-based sensors.[28] A satellite-based early warning system would be essential to provide cuing to long-range radars and interceptors if China intends to develop a ballistic missile defense system capable of intercepting incoming ICBMs and SLBMs. It would also be essential if China decides to move toward a "launch-on-warning" doctrine where alerted PLA forces would launch a counter-attack before incoming ICBMs and SLBMs from an adversary first strike landed on Chinese territory.

The PLA navy, air force, and army operate early warning radars, radars associated with surface-to-air missile systems, airborne intelligence collection systems, and unmanned reconnaissance systems that provide ISR support. The air force and navy also operate earning warning systems, such as the KJ-500 aircraft and Yuan Wang space support ships, that extend China's coverage beyond the range of its ground-based radar.[29] According to Shinji Yamaguchi, the 2015-2016 PLA reforms appear to have given the theater commands responsibility for integrating intelligence collected within their area of responsibility. The theater command JOCC intelligence center likely operates some intelligence collection operations directly and integrates information collected and processed by intelligence centers under the theater service component headquarters.[30] Presumably this information is also forwarded to the CMC JOCC for national level use.

Conventional-Nuclear Entanglement[31]

Entanglement refers to a range of circumstances in which the operations of nuclear forces may overlap with those of conventional forces. U.S. scholars have expressed concerns about the degree of entanglement in the PLARF and the potential for this to generate escalatory pressures for possible nuclear use in a conventional conflict.[32] Entanglement may occur across three dimensions: *geographic*, *operational*, and *technological*.[33]

Geographic entanglement refers to a state positioning its conventional and nuclear forces within the same geographic spaces. This can be done in peacetime when conventional and nuclear forces are garrisoned together or in crisis or conflict if conventional and nuclear forces are operating in the same areas.

Operational entanglement refers to a condition in which conventional and nuclear forces are operated by or rely on the same military institutions or practices. Conventional and nuclear forces may be operated by the same personnel, subordinated to overlapping command and control structures, employed with the same operational doctrine, share the same supporting maintenance and logistics infrastructure, or assigned against similar targets and mission sets.

Technological entanglement occurs when the delivery systems of conventional and nuclear forces are identical or indistinguishable. Dual-use weapons systems (such as the DF-26 MRBM) increase a state's technological entanglement as do conventional and nuclear variants of weapon systems (such as the conventional and nuclear variants of the DF-21 MRBM) that exhibit the same detection signatures to adversary ISR assets.

Conventional-nuclear entanglement can introduce escalation risks into a crisis or a conflict in at least three ways: *heightened vulnerability*, *target ambiguity*, and *warhead ambiguity*.[34]

Heightened vulnerability is the risk that attempts to attack a state's conventional capabilities might also erode its nuclear capabilities. If significant enough, these strikes could pose a "use it or lose it" dilemma and create incentives to launch. Even if well short of eliminating the target state's second-strike capability, heightened vulnerability could increase its concerns about the survivability of its nuclear deterrent in the face of a potential adversary first strike.

Target ambiguity refers to a misperception of intentions. An entangled state may be unable to determine whether an adversary's strikes are aimed at its conventional or its nuclear assets. This is particularly true for shared infrastructure and supporting components. If a state believes its adversary might be targeting its nuclear capabilities or its ability to command them, this can heighten pressures to alert forces to increase their survivability (which could potentially be misinterpreted as preparations for launch) or to use them before they are lost.

Warhead ambiguity is the risk of misidentifying an incoming conventional strike as a nuclear one.[35] This escalation pathway results from the targeted state misperceiving an entangled state's conventional missile attack as a nuclear strike. This is especially likely if dual-use delivery systems are being used for a conventional attack. If one side in a conflict misperceives a conventional strike—or preparations for one—as nuclear, this may provide incentives to target the entangled state's nuclear arsenal in an attempt at damage limitation or to utilize one's own nuclear arsenal in the mistaken belief that the nuclear threshold is about to be or has already been crossed. Warhead ambiguity is especially dangerous if a country has a "launch on warning" doctrine.

A recent study found that conventional-nuclear entanglement and resulting escalation risks varied across the PLARF's silo-based ICBMs, mobile ICBMs, and theater ICBMs.[36]

Silo-based ICBMs have the lowest entanglement risks but high escalation risks. Silo-based ICBMs are stationary, mitigating any potential geographic entanglement with China's conventional missile forces. Most of China's silo-based ICBMs are assigned to missile bases which do not command a significant number of conventional missile units. However, to the extent that all Rocket Force units may rely on the same strategic (headquarters to base-level) or operational (base to brigade-level) command and control infrastructure, these units may have some operational entanglement with conventional forces. The basing arrangement, operational practices, and technical features of silo-based ICBMs clearly distinguish them from China's conventionally-armed mobile SRBMs, MRBMs, and IRBMs. However, the escalation risks of inadvertently striking these forces are very high considering their importance to China's strategic nuclear deterrent (ICBMs hold the U.S. homeland at risk) and the fact that several of the silo-based ICBMs carry MIRVs.

Mobile ICBMs have moderate entanglement risks and high escalation risks. Due to their mobility, mobile ICBMs are more likely to be geographically entangled with conventional forces. Mobile ICBMs are assigned to more bases, including bases that have brigades with conventional and dual-use missiles, increasing operational entanglement. The operational practices and technical features of mobile ICBMs, however, should still largely distinguish them from conventional systems. The escalation risks of inadvertently striking mobile ICBMs are high. China likely highly prioritizes mobile ICBMs; conventional strikes against these forces might be seen as the start of a disarming first strike, before an adversary targets the more visible and vulnerable silo-based ICBMs.

Regional nuclear forces exhibit high entanglement risks but low escalation risks. These forces are mobile and shorter-range, increasing risks of geographic entanglement with conventional systems. They are operated by several missile bases, including the Rocket Force's key conventionally-oriented Base 61 located opposite Taiwan, potentially introducing operational entanglement through overlapping command and control. Some systems, such as the DF-21, have both nuclear and conventional variants; these and true dual-use systems like the DF-26 are more likely to share operational practices and technical features, complicating U.S. efforts at identification and discrimination. Dual-use systems may also share a common logistics and maintenance infrastructure, especially if conventional and nuclear missiles are deployed in a single brigade. However, because China does not depend heavily on these forces for its strategic deterrent, the escalation risks of inadvertently striking a regional nuclear unit are relatively low.

Overall, current conventional-nuclear entanglement in China's land-based missile forces is moderate but less extensive than previous academic analyses have suggested. The extent to which entanglement generates pressures for nuclear use will depend in part on how Chinese leaders value the relative contributions of ICBMs and more entangled theater nuclear forces to its deterrent and on China's perception of the minimum threshold for a survivable nuclear force in the face of a potential U.S. first strike. U.S. strikes which inadvertently destroy a handful of Chinese ICBMs or severely degrade PLARF strategic command and control systems could significantly heighten Chinese threat perceptions and create "use or lose" pressures that encourage nuclear use. At the same time, a larger and more diversified nuclear deterrent, including China's nascent SSBN fleet and future strategic nuclear bomber, could mitigate some of the nuclear escalation pressures experienced by the PLA, though similar risks of conventional-nuclear entanglement may also be present in these other services.

Ongoing trends may increase entanglement in the PLARF in the future. Solid-fueled road-mobile missiles make up an increasing proportion of China's ground-based deterrent, including some with off-road capabilities able to fire without requiring pre-surveyed launch sites. As China retires some of its older silo-based ICBMs and replaces them with mobile ICBMs such as the DF-41 and DF-31AG, the increasing mobility of the ICBM force may increase geographic entanglement.[37]

Trends in command and control may also alter operational entanglement. As discussed earlier, giving the theater commands operational control over conventional missile units will create new command and control arrangements. However, these units are likely to also retain existing (and potentially entangled) command and control channels to PLARF headquarters and bases, since the PLARF will retain administrative control over all missile forces.[38] Recent PLA texts also emphasize the importance of integrating command and control of both conventional and nuclear forces, suggesting that operational entanglement could increase in the future.[39]

New weapons systems may increase technological entanglement. Currently, the relatively clear distinctions between China's ICBMs and its regional nuclear forces help to limit technological entanglement risks at the strategic level. However, if China develops and deploys conventional- and nuclear-armed hypersonic glide vehicles on ICBMs and theater missiles, warhead ambiguity risks could extend beyond the theater to the strategic level. Similarly, the continued growth of dual-use DF-26 forces may further blur the lines between nuclear and conventional systems, especially if DF-26 brigades train for both conventional and nuclear missions. Mixed brigades would significantly increase geographic, operational, and technological entanglement among theater missile forces.

Ballistic Missile Defenses[40]

China's interest in ballistic missile defense (BMD) systems dates back to the Mao era, with an initial research program running from shortly after the PRC's first nuclear test in 1964 until it was cancelled in 1983.[41] Chinese researchers continued to explore the potential impact of the United States' Strategic Defense Initiative (SDI) on China's nuclear deterrent.[42] Despite formal opposition to BMD deployments, which PRC officials regarded as a threat to the viability of China's nuclear deterrent, PRC scientists continued research to understand the underlying technologies and to keep pace with the United States and the Soviet Union.[43] The CMC appropriated funds for a 10-year development plan for a missile defense system in the mid-1990s, including early warning capabilities, a "Patriot-like" surface-to-air missile (SAM) with limited BMD capabilities, and eventual development of longer-range interceptors that provide theater missile defense capabilities.[44] China's BMD research and development efforts have roughly followed this plan of action.

This section briefly outlines China's BMD systems, identifies their respective targets and distribution among the PLA services, and speculates on future deployments. The PRC currently fields numerous Russian-built and indigenous long-range SAM systems that, when combined with advanced interceptors and supporting ISR infrastructure, offer a limited capability against tactical and medium-range ballistic missiles. The Chinese have shown progress on BMD operations, successfully executing a land-based midcourse missile intercept test as recently as February 2021.[45] With further improvements, particularly in space-based launch detection systems, China may eventually be able to target longer-range systems as part of an integrated BMD system.

A comprehensive BMD system typically involves an integrated, "layered" architecture, with each layer targeting the flight profile of a specific category of missile. The most developed aspect of the PRC's BMD system builds upon the radars and SAMs in its existing Integrated Air Defense System (IADS). The OSD 2020 annual report on the Chinese military notes: "The PLAAF possesses one of the largest forces of advanced long-range SAM systems in the world."[46] In addition to fielding advanced Russian SAMs, including the S-300 and S-400, the PRC currently produces its own indigenous long-range SAMs based on modified Russian designs. According to media reports, the HQ-9 has a range of 300 kilometers and a speed of over Mach 4.[47] In the event of a conflict, this system may be able to intercept the U.S. Tomahawk and other cruise missiles. The 2020 OSD report states the Chinese HQ-9 "likely has a limited capability to provide point defense against tactical ballistic missiles."[48] China has also developed the HHQ-9, a shipborne version of the HQ-9.[49] If successfully integrated with the land-based IADS, destroyers fitted with the HHQ-9 could potentially act as a first line of defense, extending the reach of the IADS offshore.[50]

The HQ-19 is the latest iteration of the HQ-9 system and has completed tests that demonstrate a capability against 3,000 km-range ballistic missiles.[51] Chinese media reports claim the HQ-19 can target missiles in the midcourse and terminal phase of their trajectory with a range of 1,000-3,000 km.[52] The HQ-19 is roughly analogous to the US Terminal High Altitude Area Defense (THAAD) system. China is also pursuing a number of ASAT weapons that have BMD capabilities. A China Aerospace Studies Institute report concludes: "studies on the PRC's BMD program strongly suggest that the PLA might use a BMD program as a cover for ASAT programs given the poor press associated with ASAT tests."[53] China's February 2021 test of a midcourse interceptor could be an extension of completed research on the DN-2 or SC-19 ASAT systems, both of which can engage targets in space. Frequent testing and media reports suggest that the PLA has some capability to engage both short-range and medium-range ballistic missiles, although intercepts of longer-range missiles may be constrained by the speed of the interceptors and by limited PRC launch detection capabilities.

U.S. experience suggests the technical challenges to constructing an effective national missile defense system are significant and that developing and deploying a system capable of reliably intercepting ICBMs is very expensive.[54] Security analysts should continue to monitor Chinese progress toward deployment of a launch-detection system and efforts to develop, test, and deploy systems and technologies with BMD and ASAT capabilities. They should also monitor possible Chinese development and procurement of advanced SAM systems, such as the new Russian-built S-500, which can reportedly target IRBMs, satellites, and hypersonic weapons, and also has a limited capacity against ICBMs.[55] China is also developing a series of indigenous laser weapons that it claims can target IRBMs.[56] Progress in these areas could indicate a shift from technology development and deployment of limited BMD capabilities toward the development of a more ambitious and comprehensive system.

Implications

The expansion and modernization of China's nuclear forces, improvements in NC3 and strategic ISR systems, and the development of complementary conventional strategic capabilities such as accurate conventional ballistic missiles, anti-ship ballistic missiles, hypersonic weapons, counter-space capabilities, and offensive cyber capabilities will give CCP and PLA leaders new options in the event of a crisis or conflict.[57] A full analysis is beyond the scope of this testimony, but it is worth pointing out a few implications tied specifically to the PLA's emerging NC3, strategic ISR, and BMD capabilities.[58]

One important implication is the potential for a shift in China's nuclear policy and nuclear doctrine toward a nuclear war-fighting capability or a launch-on-warning posture. PLA theorists have repeatedly raised the possibility of a shift away from "no first use" toward a more flexible nuclear doctrine that might contemplate nuclear warfighting, only to have CCP leaders end the debate and reaffirm existing policy.[59] However, as Chris Twomey points out, the technological constraints that prevented such a shift have eroded as the PLA has developed more accurate and more survivable missiles, improved NC3 systems, and strategic ISR that would provide better awareness on a nuclear battlefield.[60] The lack of an operational space-based launch detection system is the principal constraint, and the PLA appears to be taking steps to develop and deploy such a system. A PRC shift away from "assured retaliation" toward a more flexible nuclear doctrine would be a significant change with major implications for the dynamics of a U.S.-China crisis or conflict.

Although a number of analysts and some U.S. officials see a PLA shift toward a "launch on warning" posture and doctrine as likely, I am somewhat skeptical. The CCP has always insisted on tight political control over strategic military capabilities and on making military decisions with important political consequences itself. Given the heightened risks of escalation or accidental nuclear conflict and some degree of civilian distrust of the military, CCP leaders are unlikely to pre-delegate launch authority to the CMC or even to the sole authority of the CCP General Secretary. Despite concerns of some Chinese analysts, the risks of the U.S. launching a disarming nuclear first strike is extremely low and does not warrant the risks inherent in such a shift. There would be considerable value in dialogue to discuss such issues, perhaps even in a trilateral U.S.-China-Russia format that could incorporate lessons learned from Cold War crises and incidents.

A third implication is that conventional-nuclear entanglement is present in the current PLARF posture and may be increasing with changes in the PRC nuclear force structure. This would increase escalation risks in a U.S.-China conflict, especially if the United States conducts strikes into mainland China against PLARF units firing at U.S. bases, ports, and aircraft carriers. The PLA has choices about the degree of future entanglement and could take steps to reduce the extent of nuclear entanglement and to improve crisis management mechanisms. The United States should also improve its ability to differentiate between PLA conventional and nuclear systems and think through its declaratory policy and crisis messaging in advance. Conventional-nuclear entanglement has been discussed in past U.S.-China "Track 1.5" nuclear dialogues, and should also be discussed at the official level.

A final point is to note the interactive nature of U.S.-China strategic competition, and the implications for the nuclear domain. PRC conventional missiles, U.S. missile defenses, and the U.S. and Chinese nuclear arsenals have previously been relatively loosely coupled so that changes in one area did not necessarily prompt major changes in the others. This is no longer the case, as strategic developments appear to be becoming more interdependent and the system is becoming more tightly coupled. This suggests increased—and more complex—strategic competition is likely in the future, and that developments in one side's nuclear and non-nuclear forces (including missiles and missile defenses) may increasingly affect the other side's nuclear force structure and posture.[61]

Recommendations

- Congress and the U.S.-China Economic and Security Review Commission should hold regular hearings and continue to fund academic and open-source research on China's strategic modernization (broadly defined to include nuclear modernization, missile defenses, hypersonic weapons, and other capabilities), and especially on the potential for strategic competition to change the nature of the U.S.-China relationship and the dynamics of strategic force modernization in both countries.

- Congress and the U.S.-China Economic and Security Review Commission should encourage the administration to conduct and support U.S.-China strategic dialogues at both the official and unofficial levels, including exploration of crisis management mechanisms. Dialogue is critical to understanding the other side's perspectives and conveying strategic messages in a private setting. The PRC side has historically been reluctant to engage on these issues at an official level, but the U.S. government has sometimes created obstacles as well.

---

[1] Christopher P. Twomey, "China's Nuclear Doctrine and Deterrence Concept," in James M. Smith and Paul J. Bolt, eds., *China's Strategic Arsenal: Worldview, Doctrine, and Systems* (Washington, DC: Georgetown University Press, 2021), 45-62.

[2] M. Taylor Fravel and Evan Medeiros, "China's Search for Assured Retaliation: The Evolution of Chinese Nuclear Strategy and Force Structure," *International Security* 35, no. 2 (Fall 2010), 48–87; Fiona S. Cunningham and M. Taylor Fravel, "Assuring Assured Retaliation: China's Nuclear Strategy and U.S.-China Strategic Stability," *International Security* 40, no. 2 (Fall 2015), 7-50.

[3] Fravel and Medeiros.

[4] Peter D. Feaver, "Command and Control in Emerging Nuclear Nations." *International Security*, 17, no. 3 (Winter 1992/1993), 160–187 and Fionna Cunningham, "Nuclear Command, Control, and Communications Systems of the People's Republic of China," Tech4GS Special Reports, July 18, 2019, 8-9.

[5] Mark A. Stokes, *China's Nuclear Warhead and Handling System* (Arlington, VA: Project 2049, 2010).

[6] For example, see Wu Riqiang, "Living with Uncertainty: Modeling China's Nuclear Survivability," *International Security* 44, no. 4 (Spring 2020), 84-118.

[7] See Phillip C. Saunders and Andrew Scobell, "Introduction: PLA Influence on Chinese National Security Policymaking," in Phillip C. Saunders and Andrew Scobell, eds., *PLA Influence on China's National Security Policymaking* (Stanford, CA: Stanford University Press, 2015), 1-30.

[8] Hans M. Kristensen, "China's Strategic Systems and Programs," in *China's Strategic Arsenal*, 93-124.

[9] The PLA's ground-based missiles were originally operated by the Second Artillery Corps, which was renamed the PLA Rocket Force in military reforms at the end of 2015. For clarity, this testimony uses PLA Rocket Force.

[10] Cunningham, 4-5, 9.

[11] Yu Xijun, ed., *Di'er pao bing zhanyi xue* [*The Science of Second Artillery Campaigns*] (Beijing: Jiefangjun chubanshe, 2004), cited in Cunningham and Fravel, 44-45.

[12] See David Logan, "Making Sense of China's Missile Forces," in Phillip C. Saunders, Arthur S. Ding, Andrew Scobell, Andrew N.D. Yang, and Joel Wuthnow, eds., *Chairman Xi Remakes the PLA: Assessing Chinese Military Reforms* (Washington, DC: National Defense University Press, 2019), 410-412. Also see Roderick Lee, "Integrating the PLA Rocket Force into Conventional Theater Operations," *China Brief* 20, no. 14 (August 14, 2020), 24-31, https://jamestown.org/program/integrating-the-pla-rocket-force-into-conventional-theater-operations/

[13] *Military and Security Developments Involving the People's Republic of China 2020* (Washington, DC: Office of the Secretary of Defense, 2020), 45 and Kristensen, 108-110.

[14] Kristensen, 108-110.

[15] Tong Zhao, *Tides of Change: Nuclear Ballistic Missile Submarines and Strategic Stability* (Washington, D.C.: Carnegie Endowment for International Peace, 2018), 37.

[16] Tong Zhao, 81-82.

[17] *Military and Security Developments Involving the People's Republic of China 2020*, 51 and Kristensen, 110-112.

[18] See China Aerospace Studies Institute, *PLA Aerospace Power: A Primer on Trends in China's Military Air, Space, and Missile Forces*, 2nd edition (Montgomery, AL: China Aerospace Studies Institute, 2019).

[19] See Steve Coll, "The Man Inside China's Bomb Labs," *The Washington Post*, May 16, 2001 and Cunningham, 8-9.

[20] Kristensen, 102-105, 112-115.

[21] John Costello and Joe McReynolds, "China's Strategic Support Force: A Force for a New Era," in *Chairman Xi Remakes the PLA*, 437-515.

[22] *Military and Security Developments Involving the People's Republic of China 2020*, 60-65.

[23] Kristensen, 115-116.

[24] John Chen, Joe McReynolds, and Kieran Green, "The PLA Strategic Support Force: A "Joint" Force for Information Operations," in Joel Wuthnow, Arthur S. Ding, Phillip C. Saunders, Andrew Scobell, and Andrew N.D. Yang, eds., *The PLA Beyond Borders: Chinese Military Operations in Regional and Global Context* (Washington, DC: NDU Press, 2021), 151-182.

[25] *China's Military Strategy* (Beijing: State Council Information Office of the People's Republic of China, May 2015).

[26] Eric Heginbotham, et al, *The U.S.-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power*, 1996–2017 (Arlington, VA: RAND, 2015), 143.

[27] Kristensen, 116.

[28] Dmitry Stefanovich, "Russia to Help China Develop an Early Warning System," *The Diplomat*, October 25, 2019, https://thediplomat.com/2019/10/russia-to-help-china-develop-an-early-warning-system/ and Military and Security Developments Involving the People's Republic of China, 2020, 89.

[29] "Military and Security Developments Involving the People's Republic of China, 2020," 75.

[30] Shinji Yamaguchi, "Chinese Intelligence, Surveillance, and Reconnaissance Operations in the Near Seas," in *The PLA Beyond Borders*, 127-150.

[31] This section draws upon previous joint research by David C. Logan and the author.

[32] See Thomas J. Christensen, "The Meaning of the Nuclear Evolution: China's Strategic Modernization and U.S.-China Security Relations," Journal of Strategic Studies 35, no. 4 (2012), 447-487 and Caitlin Talmadge, "Would China Go Nuclear? Assessing the Risk of Chinese Nuclear Escalation in a Conventional War with the United States," *International Security* 41, no. 4 (Spring 2017), 50–92.

[33] This framework is adopted from David C. Logan, "Are They Reading Schelling in Beijing? The Dimensions, Drivers, and Risks of Nuclear-Conventional Entanglement in China," *Journal of Strategic Studies*, 2020, DOI: 10.1080/01402390.2020.1844671.

[34] These distinctions are drawn from the terminology of experts exploring similar risks in the U.S.'s conventional prompt global strike program. See M. Elaine Bunn and Vincent A. Manzo, "Conventional Prompt Global Strike: Strategic Asset or Unusable Liability?" *INSS Strategic Forum*, No. 263 (February 2011); and James Acton, *Silver Bullet? Asking the Right Questions About Conventional Prompt Global Strike* (Washington DC: Carnegie Endowment for International Peace, 2013).

[35] James Acton, *Is It a Nuke? Pre-Launch Ambiguity and Inadvertent Escalation*, (Washington, D.C.: Carnegie Endowment for International Peace, 2020).

[36] Logan, "Are They Reading Schelling in Beijing?"

[37] Kristensen, 106-108.

[38] Logan, "Making Sense of China's Missile Forces," 415-417.

[39] The 2017 edition of the NDU Science of Military Strategy appears to call for a further integration of conventional and nuclear systems: "The integration of nuclear and conventional strike capability refers to, in the course of constructing a strategic missile force combat capability, organically integrating nuclear counterattack capabilities and conventional strike capabilities, in order that tactical combat units will be under the command of a unified information platform support and command system." See 肖天亮 (Xiao Tianliang), 战略学 (The Science of Military Strategy), 国防大学出版社 (Beijing: National Defense University Press, 2017), 380-381.

[40] INSS research intern Jake Rinaldi conducted research and wrote an initial draft of this section.

[41] Brad Roberts, *China and Ballistic Missile Defense: 1955 to 2002 and Beyond* (Institute for Defense Analyses, September 2003), 7, https://apps.dtic.mil/sti/pdfs/ADA418710.pdf.

[42] Bonnie S. Glaser and Banning N. Garrett, "Chinese Perspectives on the Strategic Defense Initiative," *Problems of Communism* 35, no. 2 (1986), 30.

[43] Roberts, *China and Ballistic Missile Defense*, 13.

[44] Bruce W MacDonald and Charles D Ferguson, *Understanding the Dragon Shield: Likelihood and Implications of Chinese Strategic Ballistic Missile Defense* (Federation of American Scientists, 2015), 11, https://fas.org/wp-content/uploads/2015/09/DragonShieldreport_FINAL.pdf.

[45] "China Successfully Executes Land-Based Midcourse Missile Interception Technology Test [中国成功实施陆基中段反导拦截技术试验]," Xinhua, February 4, 2021, http://www.xinhuanet.com/politics/2021-02/04/c_1127065881.htm.

[46] "Military and Security Developments Involving the People's Republic of China, 2020," Annual Report to Congress (Office of the Secretary of Defense, n.d.), 52.

[47] "China's Most Advanced Air Defense Missile in Service [中国最先进防空导弹服役]," Tou Tiao, accessed May 22, 2021, https://kknews.cc/zh-my/military/yj2zyxj.html.

[48] *Military and Security Developments Involving the People's Republic of China, 2020*, 73.

[49] "Hai Hongqi-9 (HHQ-9) [海红旗-9]," Wuqi Baike, accessed May 22, 2021, http://www.wuqibaike.com/index.php?doc-view-4726.

[50] Thomas R McCabe, "Air and Space Power with Chinese Characteristics: China's Military Revolution," *Air and Space Power Journal*, Spring 2020, 29.

[51] *Military and Security Developments Involving the People's Republic of China, 2020*, 75.

[52] "The HQ-19 Is Combat Ready and Can Intercept Missiles at a Range of 3,000km. Westerners Speculate This Is Not the Most Sophisticated System [HQ-19 战备值班，可拦截 3000 公里导弹，西方推测这还不是最尖端的]," September 27, 2017, 000, https://baijiahao.baidu.com/s?id=1579669076731520221&wfr=spider&for=pc.

[53] McCabe, "Air and Space Power with Chinese Characteristics: China's Military Revolution," 2.

[54] "US Missile Defense Timeline," Explainer (Union of Concerned Scientists, March 29, 2019), https://www.ucsusa.org/resources/us-missile-defense-timeline.

[55] "Russian S-500 'Space Defense System' to Be Deployed This Year," defenseworld.net, July 3, 2020, https://www.defenseworld.net/news/27340/Russian_S_500__Space_Defense_System__to_be_deployed_this_year#.YKp2RGb0k0p.

[56] "What Is the Power of China's Laser Weapons: They Can Burn through Intercontinental Missiles, and They Can Target Satellites. [中国激光武器威力如何：能烧穿洲际导弹还能反卫星]," Sina Military News, February 13, 2019, http://mil.news.sina.com.cn/jssd/2019-02-13/doc-ihqfskcp4741744.shtml.

[57] On the latter point, see Phillip C. Saunders and David C. Logan, "China's Regional Nuclear Capability, Non-Nuclear Strategic Systems, and Integration of Concepts and Operations," in *China's Strategic Arsenal*, 125-157.

[58] For a more comprehensive look, see Smith and Bolt, *China's Strategic Arsenal*.

[59] For an example, see Alastair Iain Johnston, "China's New 'Old Thinking': The Concept of Limited Deterrence," *International Security* 20, no. 3 (Winter 1995/96), 5–42. For an updated assessment, see Twomey, "China's Nuclear Doctrine and Deterrence Concept," 45-62.

[60] Twomey, "China's Nuclear Doctrine and Deterrence Concept," 45-62.

[61] See Phillip C. Saunders, "The Military Factor in U.S.-China Strategic Competition," forthcoming in Evan S. Medeiros, ed., *Managing Competition: Rethinking U.S.-China Relations in the 21st Century*.