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Cover Graphic: 3D Illustration visualizing how the boost glide hypersonic weapon is deployed. Travis Burcham, Defense Media Activity – Air Force.

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CHAPTER 1

Introduction

How might hypersonic weapons influence strategic stability between the United States and its nuclear-armed rivals over the next ten years?[1] An enduring U.S. objective is to limit incentives for adversary nuclear use, especially during crises when tensions are high and signals are unclear. This goal has shaped Washington's approach to nuclear strategy, investments, and arms control for many decades, as policymakers not only have worked to avoid vulnerabilities in the U.S. strategic deterrent that could tempt opponents to attack, but also have pursued capabilities to hold at risk what those opponents are thought to value most. At the same time, emerging military technologies have repeatedly raised fears of instability, from ballistic missiles that could traverse the globe in minutes and miniaturized nuclear warheads that could be placed atop them, to advances in weapons accuracy that made conventional forces even more lethal and active defenses that challenged the core assumptions of Cold War-era nuclear strategy.

Today, states are pursuing an array of supposedly "disruptive" or "game-changing" technologies that could alter how they organize, train, equip, and employ their military forces, including their nuclear forces. For instance, the 2018 *National Defense Strategy* identified this trend as one of the biggest challenges that the Pentagon will face. "The drive to develop new technologies," it cautioned, "is relentless, expanding to more actors with lower barriers

1 Strategic stability has been defined in various ways. Nevertheless, the core concept refers to situations of mutual vulnerability and assured retaliation; that is, situations in which a state is discouraged from employing nuclear weapons due to (1) the expectation that it would retain positive control over sufficient nuclear forces in the aftermath of an attack to inflict an unacceptable level of damage on its opponent, and (2) the anticipation that its opponent could also absorb a first strike and launch a devastating reprisal. See, for example, Thomas C. Schelling, *The Strategy of Conflict* (Cambridge, MA: Harvard University Press, 1960); Robert Jervis, *The Meaning of the Nuclear Revolution: Statecraft and the Prospect of Armageddon* (Ithaca, NY: Cornell University Press, 1990); Charles L. Glaser, *Analyzing Strategic Nuclear Policy* (Princeton, NJ: Princeton University Press, 1991); and Elbridge A. Colby and Michael S. Gerson, eds., *Strategic Stability: Contending Interpretations* (Carlisle, PA: U.S. Army War College Strategic Studies Institute, 2013). For an important debate on the definition and durability of strategic stability, see John D. Steinbruner, "National Security and the Concept of Strategic Stability," *Journal of Conflict Resolution,* Vol. 22, no. 3 (September 1978), pp. 411–428; and Colin S. Gray, "Strategic Stability Reconsidered," *Daedalus*, Vol. 109, no. 4 (Fall 1980), pp. 135–154.

to entry, and moving at accelerating speed."[2] More recently, the 2022 *National Defense Strategy* highlighted the link between emerging technology and the risk of nuclear use. "A wide range of new or fast-evolving technologies and applications," it noted, "are complicating escalation dynamics and creating new challenges for strategic stability."[3] In short, a growing emphasis on technological innovation is fueling concerns that the strategic nuclear balance among the major powers is becoming more fragile and the so-called "second nuclear age" might be even more dangerous than the first.[4]

One class of emerging military capabilities that is frequently cited as a potential catalyst for instability is hypersonic weapons: unpowered projectiles and self-propelled vehicles that can travel at more than five times the speed of sound, follow midcourse trajectories that make detection difficult, and execute complex aerodynamic maneuvers in the terminal phase of their flight, all of which could enable them to reduce defender warning time, penetrate missile defenses, and deliver conventional or nuclear payloads against targets with a high degree of accuracy.[5] Although the underlying technology is not new, each of the major powers is now making a push to develop and field hypersonic weapons. Russia, for example, claims to have both intercontinental and theater systems in production; China has conducted repeated test flights with several different platforms and has deployed one of them already; and the United States is currently engaged in more than half a dozen prototyping and early-stage acquisition efforts.[6] This has led to predictions of a full-scale arms race, one that critics fear might "upend existing norms of deterrence and renew Cold War-era tensions."[7]

2 Secretary of Defense Jim Mattis, *Summary of the National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Advantage* (Washington, DC: Department of Defense, January 2018), p. 3, https://www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf.

3 Secretary of Defense Lloyd Austin, 2022 *National Defense Strategy of the United States of America* (Washington, DC: Department of Defense, 2022), p. 6.

4 The second nuclear age is often treated as synonymous with the post-Cold War era, although there is no widely accepted definition of the term itself or the list of attributes that distinguish it from the first nuclear age. See Colin S. Gray, *The Second Nuclear Age* (Boulder, CO: Lynne Reinner, 1999); Paul Bracken, *The Second Nuclear Age: Strategy, Danger, and the New Power Politics* (New York: Times Books, 2012); and the essays in Toshi Yoshihara and James R. Holmes, eds., *Strategy in the Second Nuclear Age: Power, Ambition, and the Ultimate Weapon* (Washington, DC: Georgetown University Press, 2012). On the unique challenges that the United States might confront, see Evan Braden Montgomery, "Sources of Instability in the Second Nuclear Age: An American Perspective," in Lawrence Rubin and Adam Stulberg, eds., *The End of Strategic Stability? Nuclear Weapons and the Challenge of Regional Rivalries* (Washington, DC: Georgetown University Press, 2018).

5 See, for example, Dean Wilkening, "Hypersonic Weapons and Strategic Stability," *Survival*, Vol. 61, no. 5 (November 2019).

6 Kelley M. Sayler, "Hypersonic Weapons: Background and Issues for Congress," *Congressional Research Service*, July 20, 2022.

7 See, for example, "What are Hypersonic Weapons?" *The Economist*, January 3, 2019; and Michael T. Klare, "An 'Arms Race in Speed': Hypersonic Weapons and the Changing Calculus of Battle," *Arms Control Today* (June 2019). The quote is from R. Jeffrey Smith, "Hypersonic Weapons are Unstoppable. And They're Starting a New Global Arms Race." *New York Times Magazine*, June 19, 2019.

These concerns have played a significant role in debates over the utility, cost, and risks of hypersonic weapons. But are they merited or misplaced? Specifically, under what conditions might these weapons increase the danger of nuclear use? Are particular escalation pathways more plausible than others? Should the United States adjust its policies as hypersonic weapons play a more prominent role in major power conventional and nuclear arsenals? If so, what changes should it make? This report addresses each of these questions. In brief, we argue that in one increasingly important case—the intensifying competition between the United States and China—hypersonic weapons are unlikely to influence strategic stability in the ways that many analysts fear they might.[8] Nevertheless, they could contribute to instability in a way that most observers do not yet expect.

To assess the role of hypersonic weapons in this case, it is necessary not only to identify key drivers of nuclear escalation, but also to understand the broader set of changes that are taking place in the bilateral conventional and nuclear balance. Doing so indicates that hypersonic weapons are not uniformly a danger to stability. Moreover, hypersonic weapons are unlikely to drive nuclear escalation in the prospective crisis and conflict situations that receive the most attention from analysts, and that seem associated with the greatest risk of nuclear use.

There is, for example, a well-established line of argument that conventionally armed hypersonic weapons will significantly enhance U.S. force projection capabilities, which could, in turn, pose a serious threat to China's nuclear deterrent. Given the small size of Beijing's strategic arsenal, at least currently and compared to those of Russia and the United States, as well as the widespread belief that its conventional and nuclear capabilities are somewhat entangled, an increased ability to conduct accurate, unwarned, standoff strikes against key military targets could accidentally or unintentionally degrade China's capacity for assured retaliation. As a result, Beijing could find itself in a "use or lose" situation during a conventional conflict, which might lower the bar for nuclear employment.

Alternatively, there is a less common but more controversial view that conventionally armed hypersonic weapons would significantly enhance Chinese force projection capabilities and, by doing so, push the United States to rely on nuclear weapons to defeat a military assault. Due to the significant and growing vulnerabilities of Washington's conventional force posture in the Western Pacific, adding hypersonic weapons to China's already formidable set of anti-access / area denial (A2/AD) capabilities could enable Beijing to overcome American defenses and make a conventional military campaign untenable. Washington could, therefore, find itself in a position not unlike the one it confronted during the Cold War, when it

8 We focus narrowly on the Sino-U.S. competition for a number of reasons, which we explain in greater detail below. In brief, however, several factors stand out: the often-heard argument that China is a leader, if not the leader, in hypersonic weapons technology; the significant changes that are taking place in both the conventional and nuclear balance between China and the United States, which are already raising concerns about the likelihood of conventional war and the prospect of nuclear escalation; and China's status as the "pacing threat" that is central to U.S. defense modernization and planning, especially at a time when Russia has suffered considerable losses in its conflict with Ukraine.

relied on theater and battlefield nuclear weapons to offset the Warsaw Pact's conventional military strength.

Finally, an emerging line of argument suggests that nuclear-armed hypersonic weapons are part of a broader transformation of Chinese nuclear forces and strategy, one that could put U.S. nuclear forces at much greater risk. To date, Beijing's emphasis on assured retaliation, commitment to a "lean and effective" arsenal, and stated no-first-use policy have kept any concerns about its nuclear capabilities in the background. Those concerns are now moving to the foreground, however, as are fears that China might even have its eye on a first-strike counterforce option. With a growing stockpile of warheads, an expanding arsenal of missiles, new capabilities that are designed to deliver nuclear payloads over intercontinental distances and evade American early warning systems, and the ability to equip those new delivery systems with hypersonic weapons that travel along unpredictable paths, some American officials are starting to suggest that China could inflict significant damage on the U.S. nuclear arsenal.

We maintain that none of these escalation pathways is especially plausible for a number of reasons, most importantly the wide-ranging implications of China's ongoing nuclear buildup, which most existing assessments fail to completely flesh out. Notably, a larger and more diverse Chinese strategic nuclear arsenal could have three important implications for escalation dynamics.

First and foremost, it could make Beijing resilient enough that it is no longer highly vulnerable to a counterforce strike. A truly survivable retaliatory force should, therefore, dampen concerns about inadvertent escalation and lower the likelihood that adding hypersonic weapons to Washington's set of conventional strike options would be destabilizing. Second, as inadvertent escalation fears decline, the United States should also have a freer hand to fight a conventional war, if doing so became necessary. In other words, Washington would not need to forgo striking targets that, in the recent past, would have amplified nuclear escalation concerns, which should reduce pressures for a nuclear defense. Third, although changes in China's strategic arsenal are significant, they do not appear sufficient both to disarm and decapitate U.S. nuclear forces, even when hypersonic weapons are added to the equation. That should temper fears in Washington of a first strike, even as Beijing appears determined to add these weapons to its set of global nuclear strike options.

There is, however, another way in which hypersonic weapons could make nuclear escalation more likely: by contributing to the growing number and type of *theater* nuclear capabilities that China possesses, which include intermediate- and medium-range ballistic missiles. Although China's strategic nuclear modernization has received considerable attention, the most serious risk to stability might stem from its growing ability to conduct limited nuclear strikes against regional targets. With an asymmetric advantage over the United States in theater nuclear forces, which could quickly obtain as China fields a variety of dual-use theater missile systems, Beijing might rely on nuclear threats to deter or undermine U.S. military intervention in a high-stakes regional contingency, for instance over the future of

Taiwan. Doing so would set both major powers on the path to further escalation, depending on how Washington opted to respond.

The remainder of this report is divided into five chapters. Chapter two reviews the current state of major power hypersonic weapons programs to summarize who is investing in what, and why. Chapter three focuses on escalation dynamics to identify some of the key threats that could raise the risk of nuclear use, including disarming and decapitating threats, and the escalation pathways they highlight. Chapter four takes a deeper look at several specific pathways that have received significant attention from both analysts and policymakers, and then explains why the escalation risks associated with each are not as great as they might seem. Chapter five outlines an alternative escalation pathway that will likely pose an increasing threat to strategic stability as China expands and diversifies its nuclear arsenal. Finally, the conclusion summarizes the report's key findings and policy implications.

CHAPTER 2

Arms and Adversaries

What are hypersonic weapons, and which states are trying to field them? In a strict sense, many states already possess hypersonic capabilities, insofar as the terminal velocities of ballistic missiles exceed Mach 5, which is the lower bound of the hypersonic speed regime. Nevertheless, the term "hypersonic weapons" generally refers to a pair of emerging military capabilities: hypersonic glide vehicles (HGVs) and hypersonic cruise missiles (HCMs). Both have the potential to improve how states project force, which is why Russia, China, and the United States have all made them high-priority areas for defense modernization.[9]

HGVs and HCMs have several similar attributes, although they reach their targets in very different ways. HGVs, for instance, are lofted into the upper atmosphere by rocket boosters launched from aircraft, naval platforms, or ground-based units, then separate, descend, and glide unpowered toward their targets. HCMs, by contrast, are accelerated to hypersonic speeds and then powered throughout their flight by advanced air-breathing engines. Both types of hypersonic weapons (HSWs) have attributes that make them difficult to detect, track, and intercept—and therefore make them attractive to attackers as well as dangerous for defenders. HGVs, for example, travel at lower altitudes and along different trajectories than ballistic missiles, but still fly higher and faster than aircraft, reducing their visibility to ground-based radar and their vulnerability to midcourse missile defenses and long-range air defenses. Their maneuverability and velocity could also allow them to circumvent terminal defenses, achieve high levels of accuracy, and close with relocatable targets before they change positions. Likewise, HCMs combine the main virtues of cruise missiles—namely, the ability to fly low and vary their flight paths to avoid defenses—with greatly enhanced speed.[10]

9 Joseph Trevithick, "Here's How Hypersonic Weapons Could Completely Change the Face of Warfare," *The Drive*, June 6, 2017, https://www.thedrive.com/the-war-zone/11177/heres-how-hypersonic-weapons-could-completely-change-the-face-of-warfare; Kris Osborn, "China's New Hypersonic Missile is a Real Game-Changer," *The National Interest*, December 31, 2021, https://nationalinterest.org/blog/reboot/chinas-new-hypersonic-missile-real-game-changer-198756.

10 National Academies of Science, Engineering, and Medicine, *A Threat to America's Global Vigilance, Reach, and Power—High Speed, Maneuvering Weapons* (Washington, DC: The National Academies Press, 2016).

Each of the major powers is developing a variety of hypersonic weapons. They are, however, emphasizing different types of systems, embracing different rationales, and experiencing different levels of success. Notably, a key difference across the major powers is whether they are pursuing hypersonic weapons to improve their strategic nuclear forces, theater nuclear options, conventional strike capabilities, or a combination of these objectives.[11]

Russia

Russia currently has several programs underway, which it claims to have started more than a decade ago in response to U.S. investments in national and theater missile defense systems.[12] Specifically, Moscow has already fielded an air-launched ballistic missile, the Kinzhal, which is a variant of its Iskander ground-launched missile and is reportedly designed to travel at speeds up to Mach 10, reach targets up to 1200 miles away, maneuver throughout its flight, and deliver both conventional and nuclear payloads. Although the Kinzhal does not appear to be equipped with an HGV, it is often described as a hypersonic weapon, and has been employed by Russia on several occasions during its invasion of Ukraine.[13] In addition, Moscow is reportedly fielding a nuclear-armed HGV, the Avangard, which can travel at speeds up to Mach 20. Avangard is already being placed on modified versions of Russia's SS-19 ICBMs. It is also due to arm some of its new SS-X-29 Sarmat ICBMs—a missile with enormous range and payload that recently conducted a successful test flight.[14] Finally, Moscow is also working on a ship- and submarine-launched HCM, the *Tsirkon*, which has an advertised speed of Mach 9, a range of 600 miles, and the capability to strike targets on land and at sea.[15]

China

Like Russia, China is also pursuing multiple hypersonic weapons programs. These programs are consistent with its rapidly modernizing conventional military capabilities, as well as

11 The development of HSWs extends beyond Russia, China, and the United States, however, with states such as France, India, and Japan all pursuing programs of their own. Richard H. Speier, George Nacouzi, Carrie A. Lee, and Richard M. Moore, *Hypersonic Missile Nonproliferation: Hindering the Spread of a New Class of Weapons* (Santa Monica, CA: RAND, 2017). In addition, North Korea also claims to have conducted a successful test of a hypersonic glide vehicle in early 2022. Josh Smith, "N. Korea Launches Second Hypersonic Missile in Fiery Test," *Reuters*, January 6, 2022.

12 Many of the details regarding these systems have been announced by President Putin in recent public speeches. See Vladimir Putin, "Presidential Address to the Federal Assembly," March 1, 2018, http://en.kremlin.ru/events/president/news/56957; and Vladimir Putin, "Presidential Address to the Federal Assembly," February 20, 2019, http://en.kremlin.ru/events/president/news/59863.

13 "Russia Says it Has Deployed Khinzal Hypersonic Missile Three Times in Ukraine," *Reuters*, August 21, 2022.

14 Hans M. Kristensen and Matt Korda, "Russian Nuclear Weapons, 2022," *Bulletin of the Atomic Scientists* 78, no. 2 (2022), pp. 105–106; and Miko Vranic, "Russia's Sarmat Super-Heavy ICBM Undergoes First Full Test Flight," *Janes*, April 21, 2022.

15 Guy Faulconbridge, "Putin Deploys New Zircon Hypersonic Cruise Missiles to Atlantic," *Reuters*, January 4, 2023, https://www.reuters.com/world/europe/putin-sends-off-frigate-armed-with-new-hypersonic-cruise-missile-2023-01-04/.

its efforts to field a larger and more sophisticated nuclear arsenal. For instance, Beijing is already in the process of deploying the DF-17 medium-range ballistic missile (MRBM), which carries the DF-ZF HGV—a highly maneuverable weapon with a 1200-mile range that has featured prominently in recent military parades and exercise, and which might be capable of carrying nuclear as well as conventional payloads.[16] There are also suspicions among some China-watchers that the People's Liberation Army (PLA) could use existing systems—including theater missile systems like the DF-21 and DF-26 along with ICBMs like the DF-31 and DF-41—as delivery vehicles for conventionally-armed as well as nuclear-armed HGVs. Indeed, in July 2021, China resurrected and updated a Cold War-era capability by pairing an ICBM rocket with an HGV to test a Fractional Orbital Bombardment System (FOBS)—what one senior U.S. official described as "a technological achievement with serious implications for strategic stability."[17] This weapon system is launched into low earth orbit and can circle the globe until de-orbiting on a path to its target, creating enormous challenges for early warning.[18] Lastly, China has also conducted a successful test of its *Starry Sky 2* "wave rider" prototype, which uses its own propulsion system to fly at hypersonic speeds.[19]

The United States

As for the United States, its current emphasis on hypersonic weapons is a legacy of earlier efforts to develop conventional prompt global strike (CPGS) capabilities for engaging high-value, time-sensitive targets across the globe in a matter of hours or minutes—a requirement that could not be achieved with forward-deployed ground, air, or naval assets, unless they happened to be operating in close proximity to a potential target that did not relocate before U.S. personnel, platforms, or weapons could arrive. In the early 2000s, U.S. CPGS options included modifying a small number of Minuteman III ICBMs or Trident II D5 submarine-launched ballistic missiles (SLBMs) to carry conventional rather than nuclear payloads. These approaches encountered significant opposition, however, especially in Congress, due to fears that the launch of a modified nuclear delivery vehicle could be misinterpreted as a nuclear strike, either by the state whose territory was being targeted or a state whose territory would be overflown as it travels toward its target. Moreover, proposed pre-launch and post-launch methods of differentiating CPGS systems from nuclear delivery vehicles—such

16 Hans M. Kristensen and Matt Korda, "Chinese Nuclear Weapons, 2021," *Bulletin of the Atomic Scientists*, Vol. 77, no. 6 (2021), pp. 318, 328. Lora Saalman, "China's Calculus on Hypersonic Glide," SIPRI, August 15, 2017. For a skeptical take on China's progress toward developing HGVs, see James M. Acton, "China's Advanced Weapons," Testimony before the U.S.-China Economic and Security Review Commission, February 23, 2017, pp. 5-6.

17 Statement of Charles A. Richard, Commander, United States Strategic Command, Before the Senate Armed Services Committee," March 8, 2022, pg. 6 (emphasis omitted), https://www.armed-services.senate.gov/download/richard-statement-03/08/2022.

18 Timothy Wright, "Is China Gliding Towards a FOBS Capability," *IISS*, October 22, 2021; and Theresa Hitchens, "It's a FOBS, Space Force's Saltzman Confirms Amid Chinese Weapons Test Confusion," *Breaking Defense*, November 29, 2021.

19 "China Claims Successful Test of Hypersonic Waverider," *Jane's Defence Weekly* (August 10, 2018).

as alternative basing locations, altered flight trajectories, and advance warning to nuclear-armed states—failed to sway skeptics.[20]

Although these options are no longer on the table, the United States is still pursuing more than a half-dozen hypersonic weapons programs across the Department of Defense, all of which are focused on delivering conventional payloads with the high speed and low signature to hold at risk time-sensitive targets inside heavily defended airspace.[21] These programs include a variety of ground-, air-, and sea-launched HGVs, as well as more experimental air-breathing systems.[22] For example, among its many current modernization efforts, the Army has placed a high priority on the Long-Range Hypersonic Weapon, a land-based, extended-range precision-fires system to support its new Multi-Domain Operations concept.[23] Leveraging many of the same components, the Navy's Conventional Prompt Strike program is designed to produce a similar weapon that can be carried aboard submarines and surface platforms.[24] For its part, the Air Force is pursuing an HGV that can be released from long-range aircraft and then propelled by a booster before separating and gliding to its target, as well as an HCM that would be powered by an advanced scramjet engine throughout its flight.[25] In addition, the Defense Advanced Research Projects Agency (DARPA) has several other programs that mainly serve as technology "pathfinders" and demonstrators.[26]

In sum, despite their promise, hypersonic weapons are hardly ubiquitous. Yet many analysts and planners still envision a period in the near future when these capabilities are far more widespread, at least among the major powers. That, in turn, raises questions about how they could influence strategic stability between nuclear-armed states. Gaining insights into that issue, especially for capabilities that are still in their infancy, requires falling back on theory, examining relevant history, and devising analytic frameworks to make informed guesses about the plausible consequences of larger hypersonic weapons arsenals.

20 Amy F. Woolf, "Conventional Prompt Global Strike and Long-Range Ballistic Missiles: Background and Issues," *Congressional Research Service*, January 8, 2019.

21 Bruce M. Sugden, "Speed Kills: Analyzing the Deployment of Conventional Ballistic Missiles," *International Security*, Vol. 34, no. 1 (Summer 2009); Richard P. Hallion and Curtis M. Bedke, with Marc V. Schanz, *Hypersonic Weapons and US National Security: A 21st Century Breakthrough* (Washington, DC: The Mitchell Institute for Aerospace Studies, January 2016); and Robert Haffa and Anand Datla, *Hypersonic Weapons: Appraising the "Third Offset"* (Washington, DC: American Enterprise Institute, April 2017).

22 For a summary of U.S. programs, see Sayler, "Hypersonic Weapons," pp. 4–8. In addition, the United States and Australia are set to collaborate on the development of HSWs through the AUKUS pact. Aamer Madhani, "Australia, UK, US Alliance to Develop Hypersonic Missiles," *AP News*, April 6, 2022.

23 Andrew Feickert, "The U.S. Army's Long-Range Hypersonic Weapon (LRHW)," *Congressional Research Service*, May 23, 2022.

24 Mallory Shelbourne, "Hypersonic Weapons on Track to Deploy on Attack Submarines in 2028," *USNI News*, November 19, 2021.

25 John A. Tirpak, "Hypersonic ARRW Flies Successfully for Second Time, Completing Booster Tests," *Air Force Magazine*, July 13, 2022; and Valerie Insinna, "Air Force to Name Newest Hypersonic Weapon Maker by September," *Breaking Defense*, May 20, 2022.

26 DARPA's HSWs programs include the Hypersonic Air-breathing Weapon Concept in partnership with the Air Force; the Tactical Boost Glide system, also in partnership with the Air Force; and the ground-based Operational Fires program.

CHAPTER 3

Sources of Instability

As hypersonic weapons have become an increasingly central component of major power defense modernization plans, as well as a growing area of defense investment for many states, they also have become the subject of fierce debates over their technological viability, their operational utility, and perhaps most important, their escalatory implications. "Development of hypersonics is moving so quickly," one author notes, "that it threatens to outpace any real discussion about the potential perils of such weapons, including how they may disrupt efforts to avoid accidental conflict, especially during crises."[27] But what exactly about hypersonic weapons generates so much concern, and is that concern warranted? Are they, as one U.S. senator put it, "strategic game-changers with the dangerous potential to fundamentally undermine strategic stability as we know it?"[28] And what is the best framework for assessing whether, how, and under what conditions hypersonic weapons could have such enormous effects?

Thinking about Emerging Technology and Strategic Stability

Explicitly or implicitly, most assessments of the nexus between emerging technology and strategic stability adopt either a capability-based approach or a scenario-based approach. The former typically begins by focusing on certain characteristics of new weapons systems and then works forward to determine how those weapons could lead to situations in which nuclear use becomes more likely. For instance, strategists often argue that attributes such as the range, speed, accuracy, and yield of weapons can influence escalation dynamics, whether by reducing the amount of warning time that decision makers receive when an attack is underway, making existing targets more vulnerable to attack, putting at risk new targets that were previously considered safe, or simply increasing the aggregate amount of damage that can be inflicted on a rival, its territory, and its population.

27 Smith, "Hypersonic Missiles are Unstoppable. And They're Starting a New Global Arms Race."

28 Senator Angus King, quoted in "Biden Concerned Over Chinese Hypersonic Missiles," *Reuters*, October 20, 2021.

The latter, by contrast, tends to start by identifying hypothetical situations that appear conducive to nuclear use and then works backward to determine how specific weapons systems might create these conditions. Strategists have long observed that certain structural conditions can increase the likelihood of escalation, regardless of the particular technological, organizational, or procedural factors that bring them about, because they can fuel reciprocal fears of surprise attack, create windows of opportunity and vulnerability, or put a premium on nuclear weapons as a military equalizer. For instance, a pair of nuclear-armed states that each possesses exposed retaliatory forces might confront strong pressures to conduct preemptive strikes. Alternatively, a state with a significant advantage in strategic forces might be tempted to launch a preventive attack that eliminates an opponent's nuclear arsenal, while a state at a disadvantage might choose to employ its nuclear weapons if it anticipates or begins to experience the loss of its strategic deterrent. Finally, conventional military asymmetries could lead the weaker side in a conflict to rely on the early use of nuclear weapons to compensate for its battlefield inferiority, or to escalate in the latter stages of a war to shock its opponent and stave off defeat.

Both types of approaches often struggle to establish a clear link between plausible contingencies and actual capabilities, however. Instead, reflecting their starting positions, they often stress capability attributes without clearly showing how they could lead to nuclear use, or highlight worrisome scenarios without fully accounting for the role of emerging technologies in bringing them about.

When it comes to hypersonic weapons, for example, analysts and officials have highlighted several capability-centric challenges to strategic stability, including payload ambiguity, target ambiguity, and low signature. First, the dual-use character of many hypersonic weapons could cause states to conclude incorrectly that they are the victims of an impending nuclear strike and retaliate accordingly. Second, given the range and maneuverability of many hypersonic weapons, states might not be able to predict what locations are being targeted, which could lead to worst-case assumptions about the consequences of an attack. Third, due to the speed, altitude, and trajectory of hypersonic weapons, states might receive minimal warning of inbound weapons until shortly before impact, and therefore would face added pressure to respond quickly before key assets are degraded or destroyed, despite possessing limited information.[29] Describing China's recent test of an HGV-tipped FOBS, one U.S. official captured many of these concerns when he noted that the new weapon would contribute to "decreased warning timelines, difficulties in attribution and an increased threat to our traditional space and missile defenses and forces."[30]

29 See, for example, James M. Acton, *Silver Bullet? Asking the Right Questions about Conventional Prompt Global Strike* (Washington, DC: Carnegie Endowment for International Peace, 2013), pp. 1–4; Heather Williams, "Hypersonics Disrupt Global Strategic Stability," *Janes Intelligence Review,* February 6, 2017; "The Speed of War: Faster Weapons; Faster Organisations," *Strategic Survey 2018* (London, UK: International Institute for Strategic Studies, 2018), pp. 23–32; and Steve Simon, "Hypersonic Missiles are Game Changer," *New York Times*, January 2, 2020.

30 Admiral Charles Richard, quoted in Joe Gould and Courtney Albon, "Russia and China's Space Weapon Plans Spur High-Level Pentagon Meeting," *Defense News*, August 30, 2022.

Payload ambiguity, target ambiguity, and low signature are undoubtedly worrisome in the abstract, but it is unclear what situations would raise these concerns to such a level that nuclear escalation could be the result. After all, each of the major powers already fields a variety of dual-use strike capabilities that could contribute to confusion about the character of an attack, regardless of whether those capabilities carry a hypersonic weapon; states with survivable arsenals and resilient command-and-control architectures can opt to wait and confirm the target or targets of an attack before retaliating, rather than embrace a launch on warning posture; and although limited warning time could perhaps trigger some type of nuclear paroxysm as a state lashes out against its attacker, it could also lead to decision paralysis, as leaders wrestle with the weightiest imaginable choice without much time or information.[31]

Ultimately, a rational leadership facing uncertainty over what types of weapons are inbound and against what targets, or one that is confronting a smaller than anticipated window of time to decide on a response, is only likely to authorize a nuclear reprisal if it believed that its capability to retaliate was in jeopardy, that limiting the potential damage from follow-on strikes was necessary, or both. In other words, payload ambiguity, target ambiguity, and low signature do not offer convincing explanations for escalation, at least not on their own.

Scenario-based approaches, by contrast, seem to offer a better starting point for understanding escalation dynamics, although they also have their limitations, which can include providing too few details to establish a convincing link between technology and instability. Put differently, they may highlight potential pathways to escalation, such as use-or-lose pressures, without examining the extent to which emerging technologies actually make these pathways more likely, which requires accounting for which targets matter and why, how vulnerable they are, how new capabilities might be employed against them, and what countermeasures are available, among other factors.

Nuclear Escalation Drivers

To leverage the virtues and address the limits of both approaches—and to better understand whether, how, and under what conditions hypersonic weapons might contribute to strategic instability—this report relies on the simple but critical distinction between *disarming threats* and *decapitating threats*.[32] Understanding both types of threats, the different forms they can take, and the relationship between them can aid in identifying and assessing the escalation scenarios of greatest concern.

31 Moreover, the problem of limited warning time eventually could be mitigated by new, space-based detection and tracking capabilities that address the limitation of existing ground- and space-based sensors. Tom Karako and Masao Dahlgren, *Complex Air Defense: Countering the Hypersonic Missile Threat* (Washington, DC: Center for Strategic and International Studies, 2022); and Kelly M. Sayler, *Hypersonic Missile Defense: Issues for Congress*, CRS Report no. IF11623 (Washington, DC: Congressional Research Service, 2022), updated October 3, 2022.

32 Evan Braden Montgomery, "Posturing for Great Power Competition: Identifying Coercion Problems in U.S. Nuclear Policy," *Journal of Strategic Studies*, 45, Issue 6/7 (2022).

Disarming threats can come in two general forms. The first and most obvious entails attacking (via conventional weapons, nuclear weapons, or both) a state's operational nuclear forces and delivery systems. The aim, quite simply, is to leave the targeted state without sufficient weapons left for effective retaliation.[33] That, in turn, can raise the risk of nuclear use—not only if the targeting state would need to employ nuclear weapons in pursuit of a disarming strike, but also if this threat increases incentives for nuclear preemption on the part of the targeted state, or if a disarming attack fails and provokes a nuclear reprisal by the targeted state. Not surprisingly, emerging technologies and new military capabilities can enable disarming threats and raise the specter of each subsequent escalation pathway.

During the 1970s, for example, some American policymakers and strategists began to fear a looming "window of vulnerability," during which the likelihood of a Soviet nuclear first strike would be far higher than it had ever been.[34] This fear was due mainly to Moscow's development of heavy ICBMs with sufficient throw weight to carry a large number of high-yield warheads, along with the advent of Multiple Independently-Targetable Reentry Vehicle (MIRV) technology, which allowed the Soviets to multiply the number of targets they could hold at risk with a single ICBM. The result was a heightened concern that the Soviet Union might eventually conclude that it could inflict a major blow against the U.S. nuclear arsenal—including land-based ICBMs, bomber bases, and ballistic missile submarines (SSBNs) in port—by using a relatively small portion of its own ICBM force. In theory, Moscow would still have sufficient weapons left to absorb an American retaliation and launch a counter-reprisal, leaving Washington partially disarmed and on the horns of a dilemma.[35]

The second type of disarming threat is directed against a state's non-nuclear forces, which could leave it without the ability to mount an offensive or defensive conventional campaign. That, in turn, could lead it to fall back on nuclear threats or even nuclear use to keep those non-nuclear forces intact.

33 This does not mean eliminating all of the targeted state's nuclear weapons, however much the targeting state might aspire to do so, but rather destroying so many of the targeted state's weapons that it cannot conduct a damage-limiting retaliation, and therefore would remain highly vulnerable to follow-on strikes—making any use of its surviving nuclear forces a suicidal act. On the U.S. ability to conduct disarming counterforce attacks, see Keir A. Lieber and Daryl G. Press, 'The New Era of Counterforce: Technological Change and the Future of Nuclear Deterrence', *International Security* 41/4 (Spring 2017).

34 Concerns about the Soviet threat to U.S. land-based ICBMs was most associated with the writings of Paul Nitze. See Paul Nitze, "Deterring our Deterrent," *Foreign Policy*, no. 25 (Winter 1976/77).

35 Robert R. Soule, *Background Paper: Counterforce Issues for the U.S. Strategic Nuclear Forces* (Washington, DC: Congressional Budget Office, January 1978), http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/67xx/doc6714/78-cbo-012.pdf. Although U.S. ICBMs were indeed becoming more vulnerable in the late 1970s and 1980s, this scenario exaggerated the likelihood and effectiveness of a Soviet first-strike. Among other factors, it rested on worst-case assumptions about Soviet capabilities, especially missile accuracy, and it generally ignored the fact that a large portion of U.S. nuclear warheads were assigned to the submarine and bomber legs of the triad (by comparison, the Soviet triad was heavily weighted toward ICBMs). General Accounting Office, *The U.S. Nuclear Triad* (Washington, DC: June 10, 1993), p. 6.

Consider, for instance, the Soviet response to changes in U.S. and NATO conventional military capabilities and doctrine during the final phase of the Cold War. Beginning in the 1970s, U.S. military planners devised a new approach to mounting a conventional defense against the Warsaw Pact in response to several operational and political problems: improvements in Soviet air and armored forces, which seemed to be eroding NATO's qualitative military advantages; the increased firepower of modern weapons, which were expected to make initial military engagements much shorter and Washington's goal of reinforcing its front-line allies even harder; and the reticence of Western European NATO members to fight a defense-in-depth across their own territory, which would result in enormous destruction. This new approach, AirLand Battle, called for deep strikes against second-echelon enemy forces, which would undercut the Pact's quantitative military advantage and undermine its ability to overrun NATO forward defenses. It also influenced NATO's decision to adopt a similar operational concept that became known as Follow-on Forces Attack.[36] As for the Soviets, they were highly fearful of emerging technologies that would enable NATO to "look deep" and "shoot deep," and highly circumscribed in their ability to adapt their own forces in response. Consequently, they often described these new warfighting approaches "as having the potential to lower rather than raise the nuclear threshold by bordering on the capabilities of theater nuclear weapons."[37]

Decapitating threats, by contrast, include attacks on personnel and infrastructure that aim to blind a target, disrupt its decision-making process, or sever its communications links so that it cannot make, transmit, or execute a timely nuclear employment decision.[38] Notably, new and advanced weapons can fuel decapitation fears, for instance if they raise the prospect of rapid and effective attacks against command-and-control (C2) targets that would prevent a coordinated reprisal, or perhaps any reprisal at all. In other words, the ability to threaten C2 targets could make "splendid first strikes" appear more attainable, while the anticipated disruption or destruction of these targets could generate pressure to escalate quickly while launch orders can still be issued and shared reliably.

36 John J. Romjue, "The Evolution of the AirLand Battle Concept," *Air University Review*, May–June 1984; Douglas W. Skinner, "AirLand Battle Doctrine," Professional Paper 463 (Arlington, VA: Center for Naval Analyses, September 1988); and Barry C. Watts, *Six Decades of Guided Munitions and Battle Networks: Progress and Prospects* (Washington, DC: Center for Strategic and Budgetary Assessments, 2017), 28–31.

37 Office of Technology Assessment, *New Technology for NATO: Implementing Follow-On Forces Attack* (June 1987), p. 103.

38 A narrow interpretation of decapitation suggests that a handful of strikes would be sufficient to prevent a nuclear reprisal. If the United States were the target of decapitation, however, the scope of the assault would need to be larger, although how large would depend on the attacker's objectives: whether it aimed to delay retaliation or permanently undermine the U.S. deterrent. John D. Steinbruner, 'Nuclear Decapitation', *Foreign Policy* 45 (Winter 1981/82), 18; and Ashton B. Carter, "Assessing Command System Vulnerability", in Ashton B. Carter, John D. Steinbruner, and Charles A. Zraket, eds., *Managing Nuclear Operations* (Washington, DC: The Brookings Institution Press, 1987), p. 572.

During the later stages of the Cold War, "both superpowers perceived themselves as increasingly vulnerable to a decapitating nuclear strike."[39] In the early-to-mid 1980s, for example, Washington's deployment of Pershing II intermediate-range ballistic missiles (IRBMs) to Europe generated some of these very concerns in Moscow. The Pershing II was a direct response to the Soviet SS-20 IRBM, which posed a decoupling risk to NATO by enhancing Moscow's ability to conduct nuclear strikes on European alliance members, as well as Washington's cancellation of the neutron bomb, which deprived those members of a countervailing capability they had anticipated. Given the speed, range, and accuracy of the nuclear-armed Pershing II, Soviet leaders began to fear the possibility of a "paralyzing" U.S. strike against C2 facilities that would jeopardize all of their land-based strategic forces by delaying a launch and leaving them vulnerable to follow-on attacks by U.S. ICBMs and SLBMs.[40] In this case, a decapitating threat ultimately contributed to cooperation rather than conflict, insofar as it heightened incentives for the Soviet Union to reach an arms control agreement with the United States banning ground-launched, intermediate-range conventional and nuclear missiles. As Mikhail Gorbachev would write in his memoirs, though, that agreement became necessary to remove "a pistol held to our head."[41]

China, the United States, and Strategic Stability

Understanding the significance of disarming versus decapitating threats, the different forms they might take, and the escalation pathways they can create is a useful baseline for understanding the relationship between emerging technologies and strategic stability. In the past, however, assessing the implications of emerging technologies for strategic stability meant focusing first and foremost on the capabilities of the United States and the Soviet Union (and later Russia), as well as the military balance between them. Of course, the contemporary U.S.–Russian rivalry remains critically important, especially because these two adversaries possess the world's largest nuclear arsenals and account for the vast majority of global nuclear weapons stockpiles.[42] Nevertheless, there are reasons to suspect that hypersonic weapons could have their most significant effects on the competition between the United States and China—reasons that are rooted in the shifting conventional and nuclear balance between Washington and Beijing.

39 Nate Jones, ed., *Able Archer 83: The Secret History of the NATO Exercise That Almost Triggered Nuclear War* (New York: The New Press, 2016), p. 11.

40 Raymond Garthoff, *Détente and Confrontation: American-Soviet Relations from Nixon to Reagan*, (Washington, DC: The Brookings Institution Press, 1994), 312–327; and Taylor Downing, *1983: Reagan, Andropov, and a World on the Brink* (New York: Hachette, 2018), p. 78. This fear was magnified by the belief that the next generation of American land-based and sea-based ICBMs would have the yield and accuracy necessary to conduct effective counterforce attacks against Soviet silo-based ICBMs. Michael McGwire, *Military Objectives in Soviet Foreign Policy* (Washington, DC: The Brookings Institute Press, 1987), p. 260.

41 Mikhail Gorbachev, *Memoirs* (New York: Doubleday, 1996), p. 444.

42 On the size and shape of U.S. and Russian nuclear weapons inventories, see Evan B. Montgomery, Jacob Cohn, and Adam Lemon, *Assessing the Arsenals: Past, Present, and Future Capabilities* (Washington, DC: Center for Strategic and Budgetary Assessments, 2019).

After spending many decades in a position of inferiority, China's modernization efforts along both dimensions of military power have so altered its position relative to the United States that Washington now considers Beijing the "pacing threat" that most influences its defense plans and investments.[43] And although many of China's new military capabilities have provoked serious concerns, hypersonic weapons are at or near the very top of the list. In fact, U.S. officials have noted repeatedly that China appears to be in the lead when it comes to developing and demonstrating hypersonic weapons,[44] spurring intensified efforts by the United States to procure hypersonic weapons of its own, as well as improved countermeasures to defend against hypersonic threats.[45] It is not surprising, then, that analysts have already identified a variety of disarming and decapitating threats that could materialize if hypersonic weapons feature more prominently in both states' military toolkits, all of which could set them down a path to nuclear use. The following chapter explores these paths.

43 Dan Lamothe, "In Japan, Top Biden Administration Officials Attempt to Set the Tone on China," *Washington Post*, March 15, 2021; and Jim Garamone, "Official Talks DoD Role in Chinese Pacing Threat, Integrated Deterrence," *DoD News*, June 2, 2021, https://www.defense.gov/Explore/News/Article/Article/2641068/official-talks-dod-policy-role-in-chinese-pacing-threat-integrated-deterrence/.

44 Oriana Pawlyk, "US Losing its Advantage in Race for Hypersonic Technology: Selva," *Military.com*, January 31, 2018; Stew Magnuson, "National Hypersonics Initiative Gets Green Light," *National Defense*, March 20, 2018; John Grady, "Work: U.S. at Risk of Losing Military Technology Edge to China in Two Years," *USNI News*, June 21, 2018; David Lague, "China Leads U.S. on Potent Super-Fast Missiles," *Reuters*, April 25, 2019; and David Ignatius, "America Led in Hypersonic Technology. Then Other Countries Sped Past." *The Washington Post*, February 3, 2022.

45 Terri Moon Cronk, "Defense Official Says Hypersonic Weapons are Vital to Modernization Strategy, Battlefield Dominance," *DoD News*, May 3, 2021; and Courtney Albon and Joe Gould, "Top Pentagon Officials Met with Industry Execs About Hypersonics. What Comes Next?" *Defense News*, February 4, 2022.

CHAPTER 4

Assessing Escalation Pathways

How might hypersonic weapons heighten the prospect of nuclear use between China and the United States? To date, there are three main escalation paths that have received the most attention. First, the employment of conventionally armed hypersonic weapons by the United States against China could pose a disarming threat to the latter's strategic nuclear forces, raising the risk that Chinese leaders would opt for nuclear use before their arsenal was severely degraded. Second, the employment of conventionally armed hypersonic weapons by China against the United States could pose a disarming threat to the latter's conventional forces, raising the risk that U.S. leaders would opt for nuclear use to defend its remaining forces, protect its allies, and defeat a Chinese assault. And third, the possession of nuclear-armed hypersonic weapons by China could pose a decapitating threat to the United States, insofar as these weapons could be used to conduct unwarned strikes against C2 targets that undermine the responsiveness of U.S. strategic forces and leave them vulnerable to follow-on attacks.

This chapter reviews these threats. In brief, we argue that none of them create a very plausible pathway to nuclear escalation. Although this sanguine conclusion rests on a variety of factors, one common thread that runs through our assessment of each threat is the role of China's growing strategic nuclear arsenal. Simply put, the changing size and shape of that arsenal should leave Beijing less vulnerable to conventional counterforce attacks; it should enable Washington to fight a more effective conventional defense; but it should not be sufficient to conduct a credible first strike, unless the United States reduces the size of its arsenal as China continues to build up its strategic forces.

Inadvertent Escalation

Perhaps the most prevalent escalation concern surrounding hypersonic weapons is that by adding these capabilities to its conventional strike portfolio, the United States could inflict significant damage on China's strategic nuclear deterrent during a conflict, whether deliberately or by design. Fearing the loss of that deterrent and the safety it provides, Chinese leaders could then choose to employ some of the weapons that remain, if not in a spasmodic

break from their no-first-use pledge, then in a limited fashion to shock Washington and raise the risk of additional nuclear use.[46]

This scenario represents the latest evolution of longstanding concerns about the survivability of Beijing's strategic arsenal. In comparison to the American and Russian nuclear arsenals, which each include approximately 1,550 operationally deployed strategic warheads as counted by the New START Treaty, China's inventory of nuclear forces remains small and is often characterized by analysts as a "minimum deterrent," despite being unconstrained by any treaty. According to recent estimates, Beijing has approximately 350 deliverable warheads, principally associated with ICBMs and SLBMs.[47] Given this disparity in size, as well as other qualitative factors such as warning time and readiness levels, some analysts have long argued that Chinese nuclear forces—when arrayed against U.S. nuclear forces, conventional precision strike capabilities, and missile defenses—are at risk of suffering from a splendid first strike, or something dangerously close to it.[48] That, in turn, could put Chinese leaders in a "use them or lose them" situation during a crisis.

Even if the likelihood that the United States would conduct a preventive attack on China's nuclear forces is extraordinarily low, concerns about its arsenal vulnerability remain. The main fear now, though, is the prospect of inadvertent escalation during a conventional war—a fear that the introduction of HSWs only magnifies.[49]

Given recent shifts in the conventional military balance, a conflict between China and the United States appears more likely than it was in the past, when Washington had an enormous advantage and the outcome of a clash seemed easy to predict.[50] For decades, analysts have warned that the United States was bound to see an erosion of its post-Cold War

46 There is also the related possibility that HSWs could enable the United States to pose a disarming threat against China's conventional forces; that is, they could inflict so much damage on those forces that Beijing would resort to nuclear weapons to avoid defeat, even if its strategic arsenal were left intact. Although it is impossible to predict how a conventional war would play out, recent changes in the military balance suggest that Washington would be operating from a disadvantageous position, making it unlikely that the addition of HSWs to its conventional strike portfolio would so reverse this equation that it would suddenly be positioned for a rapid victory. For a discussion of this escalation pathway, see Caitlin Talmadge, "Too Much of a Good Thing? Conventional Military Effectiveness and the Dangers of Nuclear Escalation," in Dan Reiter, ed., *The Sword's Other Edge: Trade-Offs in the Pursuit of Military Effectiveness* (New York: Cambridge University Press, 2017).

47 Hans M. Kristensen and Matt Korda, "Chinese Nuclear Weapons, 2021," *Bulletin of the Atomic Scientists* 77, no. 6 (2021).

48 Keir A. Lieber and Daryl G. Press, "The End of MAD? The Nuclear Dimension of U.S. Primacy," *International Security* 30, no. 4 (Spring 2006).

49 On Chinese concerns that HSWs could put parts of their nuclear arsenal risk, see Tong Zhao, "Conventional Challenges to Strategic Stability: Chinese Perceptions of Hypersonic Technology and the Security Dilemma," in *The End of Strategic Stability?*

50 Evan Braden Montgomery, "Contested Primacy in the Western Pacific: China's Rise and the Future of U.S. Power Projection," *International Security* 38, no. 4 (Spring 2014).

military primacy.[51] China, moreover, has been at the center of these concerns.[52] Driven in part by Washington's demonstrations of military strength during the 1990s, Beijing began to design more advanced missile capabilities and refine counter-intervention concepts previously developed by Soviet military planners.[53] These capabilities and concepts are intended to exploit vulnerabilities in the contemporary American way of warfare, such as the need to conduct uninterrupted, high-tempo combat operations from large and vulnerable theater air bases.[54] As a result, there is now a consensus that Washington's ability to project power has eroded, although assessments differ as to just how much.[55]

What is clear, however, is that the United States is counting on hypersonic weapons to mitigate some of its power projection deficiencies. One of the biggest operational problems that it would confront in a future fight with China is holding at risk hardened, relocatable, and mobile targets in cluttered and contested environments. This includes, for instance, long-range air-defense systems, as well as surface-to-surface, anti-ship, and anti-satellite missile launchers.[56] Given their unique features, hypersonic weapons could play an important role in solving this operational problem, especially in comparison to legacy alternatives that are too slow, too vulnerable, or both.[57] Yet this could also improve Washington's ability to threaten targets that comprise, support, or are co-located with its nuclear arsenal. For instance, even if HSWs were only used to target Chinese conventional A2/AD systems, Beijing relies upon similar systems—namely, mobile transporter-erector-launchers—for the most survivable element of its strategic deterrent. Under these conditions, Chinese leaders might feel intense pressure to employ nuclear weapons, either to use them before they are lost or to signal their resolve.[58]

51 Barry D. Watts, *The Maturing Revolution in Military Affairs* (Washington, DC: Center for Strategic and Budgetary Assessments, 2011).

52 For assessments of China's military strategy and capabilities, see Roger Cliff, *China's Military Power: Assessing Current and Future Capabilities* (New York: Cambridge University Press, 2015); Eric Heginbotham et al., *The U.S.–China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996–2017* (Santa Monica, CA: RAND Corporation, 2015); and Toshi Yoshihara and James R. Holmes, *Red Star over the Pacific: China's Rise and the Challenge to U.S. Maritime Strategy*, 2nd ed. (Annapolis, MD: Naval Institute Press, 2018).

53 Dean Cheng, "Chinese Lessons from the Gulf Wars," in Andrew Scobell, David Lai, and Roy Kamphausen, eds., *Chinese Lessons from Other Peoples' Wars* (Carlisle, PA: Strategic Studies Institute, 2011).

54 John Stillion and David Orletsky, *Airbase Vulnerability to Conventional Cruise-Missile and Ballistic Missile Attacks* (Santa Monica, CA: RAND, 1999); Owen R. Coté, Jr., *Assuring Access and Projecting Power: The Navy in the New Security Environment*, MIT Security Studies Conference Report (April 2001); and Christopher J. Bowie, *The Anti-Access Threat and Theater Air Bases* (Washington, D.C., Center for Strategic and Budgetary Assessments, 2002).

55 Eric Edelman and Gary Roughead, Co-Chairs, *Providing for the Common Defense: The Assessment and Recommendations of the National Defense Strategy Commission* (Washington, DC: United States Institute of Peace Press, 2018).

56 Ibid., p. 24.

57 Eric Edelman, Chris Bassler, Toshi Yoshihara, and Tyler Hacker, *Rings of Fire: A Conventional Missile Strategy for a Post-INF Treaty World* (Washington, DC: Center for Strategic and Budgetary Assessments, 2022).

58 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); and Josh Rovner, "Two Kinds of Catastrophe: Nuclear Escalation and Protracted War in Asia," *Journal of Strategic Studies* 40, no. 5 (2017).

Indeed, a sizable body of Chinese writings published over the past decade identifies U.S. conventional long-range precision-strike capabilities as a major threat to China's nuclear deterrent.[59] Chinese analysts express concerns that such capabilities would give the United States the means to attack "time sensitive targets, deeply buried or fixed targets, and high-value targets" across global distances.[60] They also believe that the prospective introduction of American hypersonic weapons would enhance U.S. global strike posture. They further worry that the operational characteristics of HSWs, especially speed and flight profile, would pose significant challenges to China's air and missile defenses and thereby undermine the survivability of its nuclear arsenal.[61] Writing about the American conventional hypersonic threat to Russia, one analyst from the Chinese National University of Defense Technology contends that the mass production of hypersonic missiles, such as the X-51 Waverider, would position the United States to hold at risk Russian nuclear command and control centers, ICBM silo fields, mobile nuclear missile launchers, in-port strategic ballistic missile submarines, and heavy bombers as well as nuclear weapons and related facilities at airbases.[62] The threat of such a disarming attack would apply with equal force to China. As the Pentagon's most recent China military power report explained, "Beijing fears that advances in U.S. and allied hypersonic capabilities may credibly threaten China's relatively small arsenal of land-based weapons."[63]

Although Chinese concerns should not be dismissed out of hand, this type of disarming threat that has animated discourse on the mainland rests on assumptions about China's nuclear arsenal that seem increasingly outdated. With a much larger and more survivable inventory of strategic forces, the prospect that Beijing would be backed into a corner and confronted with a "use or lose" dilemma during a conventional fight would dim. Indeed, this trend is already underway, as China is engaged in a significant quantitative and qualitative nuclear buildup—an unsurprising development for a rising power looking to leave areas of military disadvantage in the past.

59 See Thomas G. Mahnken, et. al., *Understanding Strategic Interaction in the Second Nuclear Age* (Washington, D.C., Center for Strategic and Budgetary Assessments, 2019), pp. 72–75. In recent years, Chinese analysts have paid close attention to hypersonic weapons around the world. For example, the June 2022 issue of *Modern Ships* published a special series on six translated articles detailing hypersonic developments in the United States, Russia, and countries across the Indo-Pacific. See 承影 [Cheng Ying], "美国将如何用兵祺推演应对高超音速武器挑战? [How Will the United States Use Wargames to Deal with the Hypersonic Weapon Challenge?]," 现代舰船 [*Modern Ships*], no. 6, 2022, pp. 63–76. The article is a translation of Bruce M. Sugden, "Analyzing the Potential Disruptive Effects of Hypersonic Missiles on Strategy and Joint Warfighting," *Joint Forces Quarterly*, no. 104 (December 2021), pp. 6–21.

60 李新春 王中伟 [Li Xingchun and Wang Zhongwei], "美国全球快速打击武器概述 [Survey of U.S. Rapid Global Strike Weapons Development]," 科技风 [Technology Trends], October 2019, p. 17.

61 梁熠 于洪敏 蔡业泉 邢继娟 胡磊 [Liang Yi, Yu Hongmin, Cai Yequan, Xing Jijuan, and Hu Lei], 美军快速全球打击装备发展分析 [Analysis of U.S. Prompt Global Strike Developments], 装备学院学报 [Journal of Equipment Academy] 25, no. 5 (October 2014), p. 61.

62 陈曦 [Chen Xi], "美俄战术核武器困境生成原因 [The Causes of the U.S.-Russian Tactical Nuclear Weapons Dilemma]," 战略决策研究 [*Journal of Strategy and Decision Making*], no. 1 (2021), p. 60.

63 Office of the Secretary of Defense, *Military and Security Developments Involving the People's Republic of China 2022* (Washington, DC: Department of Defense, 2022), p. 159.

According to the Department of Defense, "Over the next decade, the PRC aims to modernize, diversify, and expand its nuclear forces."[64] In recent years, for example, China has strengthened its strategic forces by fielding a new, road-mobile, ICBM capable of carrying MIRVs; planning follow-on nuclear-powered ballistic submarines and submarine-launched ballistic missiles; and developing a nuclear-capable air-launched ballistic missile. Alongside an improved inventory of strategic delivery systems, Beijing is building fast breeder reactors and reprocessing facilities for the production and separation of plutonium, which would enable it to increase its warhead numbers, perhaps substantially. Although past predictions of Chinese arsenal growth have proven to be wide of the mark, the Department of Defense currently projects that Beijing is on track to have 1500 warheads by 2035.[65] These estimates appear to be driven not only by its plutonium production capacity, but also by recent revelations that it has constructed several new ICBM silo fields with several hundred silos in total. Under these conditions, concerns about China's nuclear escalation in the face of disarming threats to its strategic arsenal are likely to decline—although Beijing could still claim during a conflict that its arsenal remained vulnerable in the hope of encouraging Washington to exercise restraint.

Countering Conventional Advantages

Another prospective path to escalation also stems from changes in the conventional military balance. According to this argument, which is rarely discussed openly, China's modernization efforts not only heighten the risk of a regional war, but also raise a serious possibility that the United States could lose such a war—especially if Beijing enhances its conventional force projection capabilities with HSWs that could keep it ahead of any improvements to Washington's military posture.[66] Determined to counter this disarming threat and avoid that outcome, Washington could take a page from its Cold War playbook and lean on nuclear weapons to even the odds.

Specifically, there is a growing fear among many defense analysts that China eventually might be willing and able to launch a "knock-out blow" against forward-operating U.S. forces across the Western Pacific, particularly in the context of a military move against Taiwan.[67] In such a contingency, air bases, exposed aircraft, ships in port, and critical information networks could suffer significant damage from the outset, as could surface ships afloat and aircraft that get off the ground if they venture too deep into the PLA's weapons engagement zone. Of course, Washington is taking steps to mitigate these dangers by devising ways to ride out attacks, fight through air raids and missile salvos, disperse forces to a larger number

64 Ibid., p. 94.

65 Ibid., p. 94.

66 Edelman and Roughead, *Providing for the Common Defense*, p. 14.

67 See, for example, Thomas Shugart, *First Strike: China's Missile Threat to U.S. Bases in Asia* (Washington, DC: Center for a New American Security, 2017).

of operating locations, and develop the means to disaggregate its forces into smaller and less vulnerable packages that still manage to be combat effective. Nevertheless, hypersonic weapons could bolster Beijing's already-formidable A2/AD systems. As the Department of Defense notes, for example, the DF-17 appears "designed to strike foreign military bases and fleets in the Western Pacific."[68] This could worsen the operational dilemmas that Washington would confront in a regional conflict and perhaps make the conventional defense of frontline allies and partners prohibitively difficult.

One potential response under these conditions would be to rely on nuclear weapons to offset Chinese conventional military advantages.[69] During the Cold War, for example, the United States adopted this approach to compensate for the Warsaw Pact's quantitative advantages in personnel and materiel, which led to persistent questions regarding whether NATO could mount an effective conventional defense against an invasion of Western Europe. Indeed, at least one senior U.S. defense official has publicly drawn a direct connection between China's development of conventionally armed HSWs and the possibility of a U.S. nuclear offset: "When the Chinese can deploy [a] tactical or regional hypersonic system, they hold at risk our carrier battle groups. They hold our entire surface fleet at risk. They hold at risk our forward-deployed forces and land-based forces." Consequently, "Without our ability to defend and without at least an equal response capability on the offensive side, then what we have done is we have allowed a situation to exist where our deployed forces are held at risk and we cannot do the same for them," he continued. "And so our only response is either to let them have their way or to go nuclear."[70]

Although there is a certain logic to this line of argument, it suffers from several problems, not least of which are the political barriers to embracing such a radical change in defense strategy. For instance, the United States no longer has the kind of "warfighting" arsenal that would allow it to embrace a non-strategic nuclear backstop. During the Cold War, for example, Washington developed and fielded a wide array of non-strategic nuclear weapons: gravity bombs, depth bombs, artillery rounds, torpedoes, surface-to-air missiles, cruise missiles that could be launched from a variety of platforms, and both short- and intermediate-range ballistic missiles. Many of these weapons were also kept outside the United States, including the deployment of tactical nuclear weapons in South Korea and Taiwan. In addition, aircraft carriers, surface combatants, and attack submarines all carried or were capable of being equipped with non-strategic nuclear weapons.[71]

68 Office of the Secretary of Defense, *Military and Security Developments Involving the People's Republic of China 2022*, p. 83.

69 Elbridge Colby, "Asia Goes Nuclear," *The National Interest* (January/February 2015).

70 Then-Undersecretary of Defense for Research and Engineering Michael Griffin, quoted in Aaron Mehta, "Hypersonics 'Highest Technical Priority' for Pentagon R&D Head," *Defense News*, March 6, 2018.

71 Robert S. Norris and William M. Arkin, "Where They Were," *Bulletin of the Atomic Scientists* (November/December 1999). The number of forward deployed U.S. nuclear weapons in Europe peaked during the early 1970s at more than 7,000 warheads, many of them located in Germany, while the number of weapons in Asia peaked during the late 1960s at more than 3,000 warheads, most of which were located in Okinawa and South Korea.

Today, by contrast, the United States has a very limited number of non-strategic nuclear weapons in its nuclear arsenal. This includes approximately 200 B61 gravity bombs, a subset of which remain forward deployed in Europe, where they can be mated with dual-capable U.S. and host nation strike aircraft.[72] In addition, the 2018 Nuclear Posture Review (NPR) called for the United States to field 'supplemental' non-strategic weapons, including a low-yield version of the W76 SLBM warhead, which has already been deployed, and a new, nuclear-armed sea-launched cruise missile (SLCM-N).[73] Yet that NPR explicitly disavowed the notion that supplemental non-strategic nuclear weapons were intended to support nuclear warfighting, while the 2022 NPR opted to cancel the SLCM-N program.[74]

Another reason to be skeptical of the claim that the United States could rely on nuclear weapons to offset Chinese conventional military advantages, one that has not yet received much recognition, is that those advantages might themselves be offset by changes in how Washington fights, at least partially. Those changes, moreover, can be traced back to the implications of China's strategic nuclear buildup.

In general, a consensus is emerging that China's nuclear buildup could magnify its conventional military power by increasing its appetite for war.[75] This view rests on the logic of the stability-instability paradox—the situation in which a low probability of a strategic nuclear exchange due to mutual vulnerability raises the probability of conventional conflict due to a hard ceiling on escalation.[76] Specifically, China might view a larger and more survivable strategic deterrent as an enabler that allows it to conduct a conventional campaign against a nuclear-armed rival without the attendant risk of escalation. In other words, as Caitlin Talmadge has put it, nuclear modernization might make the region "safe" for conventional war from China's perspective. With Washington unable to conduct a counterforce strike to disarm Beijing, and Beijing unconcerned that it would need to use its strategic forces rather than lose them in an attack, the two sides could clash at the conventional level alone—a prospect that would seem to benefit China given its geographic, technical, and operational military advantages.[77]

72 Hans M. Kirstensen and Matt Korda, "United States Nuclear Weapons, 2022," *Bulletin of the Atomic Scientists* 78, no. 3 (2022).

73 Amy F. Woolf, 'A Low-Yield, Submarine-Launched Nuclear Warhead: Overview of the Expert Debate', *Congressional Research Service*, January 10, 2020; and John Rood, 'Statement on the Fielding of the W76-2 Low-Yield Submarine Launched Ballistic Missile Warhead', February 4, 2020, https://www.defense.gov/Newsroom/Releases/Release/Article/2073532/statement-on-the-fielding-of-the-w76-2-low-yield-submarine-launched-ballistic-m/.

74 Department of Defense, *Nuclear Posture Review* (Washington, DC: Department of Defense, 2018), p. 54; and Department of Defense, *2022 Nuclear Posture Review* (Washington, DC: Department of Defense, 2022), p. 20.

75 Gerald C. Brown, "Understanding the Risks and Realities of China's Nuclear Forces," *Arms Control Today* (June 2021), https://www.armscontrol.org/act/2021-06/features/understanding-risks-realities-chinas-nuclear-forces.

76 Glenn Snyder, 'The Balance of Power and the Balance of Terror', in Paul Seadbury, ed., *Balance of Power* (San Francisco: Chandler Publishing, 1965).

77 Caitlin Talmadge, "China and Nuclear Weapons," *The Brookings Institution* (September 2019), p. 7, https://www.brookings.edu/wp-content/uploads/2019/09/FP_20190930_china_nuclear_weapons_talmadge-1.pdf.

This emerging consensus is incomplete, however, because the stability-instability paradox cuts in two directions. Although China might be more willing to start a conventional conflict under conditions of mutual vulnerability, the United States might be less restrained in how it fights that conflict.[78]

To date, most discussions of a potential war between these two nuclear-armed rivals assume that U.S. political leaders would place sharp restrictions on defense planners when it comes to the conduct of a campaign. Fearful of backing China into a corner and provoking the type of inadvertent escalation scenario described above, the United States could forgo striking certain targets such as missile bases or command and control nodes on the mainland or submarines at sea to avoid degrading Beijing's strategic deterrent. As its strategic deterrent becomes more secure, though, the United States might be less inhibited when it comes to targeting dual-use capabilities, co-located forces, or undersea platforms that can be difficult to distinguish as conventionally- or nuclear-armed when tensions are high.[79] Of course, this does not address the many challenges that U.S. forces would face if they confronted the PLA. But it could enhance deterrence and warfighting by enabling Washington to embrace operational concepts and tactics that might have been eschewed when escalation concerns loomed larger. That, in turn, could reduce any pressures to view non-strategic nuclear weapons as a necessary equalizer.

Strategic First Strike

To date, few observers have expressed serious worries about Beijing's nuclear modernization program. Although China has made slow and steady improvements to its strategic deterrent, those improvements have not made it a nuclear peer of the United States and Russia, nor have they erased concerns that its arsenal could even be vulnerable to a first strike. That situation is starting to change, however. As noted above, however, the size and composition of its arsenal are both changing, while the conditions under which it might resort to nuclear threats and nuclear use may be changing as well.

Not surprisingly, these steps have generated considerable debate over the drivers of China's nuclear modernization, the extent of Beijing's ambitions, and the potential consequences of its actions. For instance, some observers view China's recent steps as relatively modest, motivated mainly by survivability concerns, and most likely to elevate risks by introducing miscalculation rather than emboldening aggression. Alternatively, others see Beijing's buildup as far more significant, driven in part by a more offensive rationale, and likely to

78 Evan Braden Montgomery and Toshi Yoshihara, "The Real Challenge of China's Nuclear Modernization," *The Washington Quarterly* 45, no. 4 (Winter 2023).

79 Washington has become more willing to deploy, and allies more willing to host, land-based conventional theater strike systems that could be used to hold high-value targets at risk. See, for example, Eric Edelman, Chris Bassler, Toshi Yoshihara, and Tyler Hacker, *Rings of Fire: A Conventional Missile Strategy for a Post-INF Treaty World* (Washington, DC: Center for Strategic and Budgetary Assessments, 2022).

unlock new coercive options.[80] Many U.S. officials appear to subscribe to the latter view, however, and have characterized China's actions as part of a "nuclear breakout strategy" that includes a "first strike capability."[81] But does China's growing inventory of weapons and more diverse array of delivery systems put the U.S. strategic deterrent at risk?

In general, a true first strike capability would require the ability to decapitate an opponent and then disarm that opponent. Without the ability to eliminate or substantially erode an opponent's nuclear arsenal, even the most successful decapitation attack would only postpone rather than prevent a nuclear reprisal—especially against a nation like the United States that has well-developed continuity-of-government and continuity-of-operations procedures. Put another way, disarming an adversary might not be possible without decapitating it first, but decapitating an adversary without disarming it might only postpone rather than prevent a nuclear retaliation.[82]

In the case of China, systems like an HGV-tipped FOBS raise the specter of decapitation because they can avoid early detection, circumvent defenses, and strike accurately. Meanwhile, a large number of silo-based ICBMs, especially ICBMs armed with MIRVs, puts the U.S.'s own land-based silos at much greater risk, in addition to threatening any strategic bomber forces that have not yet departed from their bases. As then-Vice Chairman of the Joint Chiefs of Staff John Hyten remarked about Beijing's nuclear forces, "They look like a first-use weapon. That's what those weapons look like to me."[83]

Yet the suspicion that China is or could eventually be close to achieving a first-strike capability, although suddenly more worrisome, remains improbable, even its HGV-tipped FOBS does indeed present a true decapitation threat. The reason, quite simply, is that Beijing would need an *even larger* arsenal to pose a legitimate disarming threat—one that could not only eliminate U.S. land-based ICBMs and bombers, but also have sufficient weapons in reserve to deter U.S. retaliation with its sea-based strategic nuclear forces, not to mention deterring other nuclear powers like India and Russia. As one Chinese skeptic observes, "Hypersonic nuclear weapons cannot prevent retaliatory strikes from nuclear great powers *unless they can completely destroy the opponent's second-strike capability in the first*

80 See, for example, David Logan, "The Dangerous Myths about China's Nuclear Weapons," *War on the Rocks*, September 18, 2020, https://warontherocks.com/2020/09/the-dangerous-myths-about-chinas-nuclear-weapons/; and Austin Long, "Myths or Moving Targets? Continuity and Change in China's Nuclear Forces," *War on the Rocks*, December 4, 2020, https://warontherocks.com/2020/12/myths-or-moving-targets-continuity-and-change-in-chinas-nuclear-forces/.

81 See, for example, Richard, "Statement Before the United States Armed Services Committee"; Marcus Weisgerber, "Air Force Secretary Warns of China's Burgeoning Nuclear Arsenal, Reveals B-21 Detail," *Defense One*, September 20, 2021, https://www.defenseone.com/threats/2021/09/air-force-secretary-warns-chinas-burgeoning-nuclear-arsenal-reveals-b-21-detail/185486/; David Martin, "Exclusive: No. 2 in U.S. Military Reveals New Details about China's Hypersonic Weapons Test," *CBS News*, November 16, 2021; https://www.cbsnews.com/news/china-hypersonic-weapons-test-details-united-states-military/.

82 Montgomery, "Posturing for Great Power Competition."

83 Quoted in Chandelis Duster, "Top Military Leader Says China Hypersonic Missile Test 'Went Around the World'," *CNN*, November 18, 2021, https://www.cnn.com/2021/11/17/politics/john-hyten-china-hypersonic-weapons-test.

strike [emphasis added]. From this perspective, hypersonic nuclear weapons are no better than ICBMs or submarine-launched missiles."[84] Importantly, this suggests that while China can alleviate the vulnerability of its relatively small arsenal to a first strike by expanding it, the United States similarly could, if necessary, alleviate its own vulnerability to future first strike threats in the very same way.

This assessment of plausible escalation pathways does require caveats. For instance, major improvements in the conventional capabilities of one side or the other could revive Beijing's fears of arsenal vulnerability or make a nuclear offset to China's military power more tempting to Washington, while an even more rapid Chinese nuclear buildup or an ill-advised American nuclear drawdown could suddenly make first strike threats more credible. Nevertheless, these changes would need to be quite dramatic to warrant dampening the skepticism surrounding these escalation pathways and the role that HSWs play in them, given the current scale and likely implications of China's nuclear modernization.

84 常逸昆 [Chang Yikun], "高超声速技术能否推动核武再升级? [Can Hypersonic Technology Promote the Upgrading of Nuclear Weapons?]," 军事文摘 [*Military Digest*], no. 11, 2020, p.48. The author summarizes and responds to a *Strategic Studies Quarterly* article. See Nathan B. Terry and Paige Price Cone, "Hypersonic Technology: An Evolution in Nuclear Weapons?" *Strategic Studies Quarterly*, 14:2 (Summer 2020), pp. 74–99.

CHAPTER 5

New Theater Nuclear Threats

The disarming and decapitating threats described above, and the escalation pathways they highlight, illustrate several different ways that HSWs might undermine strategic stability. None of these pathways seem especially plausible upon closer examination, although that could change if the conventional military or strategic nuclear balance between China and the United States shifts even further and faster. There is, however, another path to escalation that is starting to emerge but is rarely mentioned, in which Chinese HSWs contribute to a growing risk of nuclear war: an increasingly lopsided theater nuclear balance that encourages and enables Beijing to employ nuclear threats against Washington and its allies to prevent them from intervening in a regional conflict.

Escalation Ladders and Escalation Gaps

For years, the United States has been worried about the imbalance in non-strategic nuclear forces that characterizes its rivalry with Russia. Whereas Moscow maintains a diverse arsenal of approximately 2000 non-strategic nuclear weapons and continues to modernize these forces, Washington has far smaller inventory of non-strategic capabilities.[85] This imbalance has led to concerns about gaps in the so-called escalation ladder that could allow Russia to levy nuclear threats against NATO members during a crisis to undermine alliance cohesion, or even resort to limited nuclear use against NATO members during a conflict to scare the alliance into submission.[86] It also motivated the decision in the 2018 NPR, described above, to begin investing in supplemental non-strategic nuclear weapons.

85 Hans M. Kristensen and Matt Korda, "Russia Nuclear Weapons, 2022," *Bulletin of the Atomic Scientists*, 78, no. 2 (2022). U.S. officials and analysts have also argued that Russia has devised and exercised doctrine to support the employment of nonstrategic nuclear weapons, although this has been a persistent source of debate.

86 See, for example, Montgomery, "Sources of Instability in the Second Nuclear Age," in *The End of Strategic Stability*; and Matthew Kroenig, *A Strategy for Deterring Russian Nuclear De-Escalation Strikes* (Washington, DC: The Atlantic Council, 2018).

Although the theater nuclear imbalance in Europe remains a concern, especially in light of Moscow's repeated nuclear threats following its invasion of Ukraine, there might be a similar imbalance on the horizon in East Asia. In addition to the increase in its strategic nuclear forces, China has also improved its nuclear-capable theater strike capabilities. For instance, it has introduced the dual-use DF-26 IRBM, which is its "first nuclear-capable missile system that can conduct precision strikes, and therefore, is the most likely weapon system to field a lower-yield warhead in the near-term."[87] Meanwhile, as noted above, the DF-17 MRBM carries an HGV and, according to some reports, might also be capable of delivering nuclear weapons.

The growth of China's theater strike systems should come as no surprise; after all, missiles are meant to play a critical role in its approach to conventional warfighting. For instance, the 2013 edition of the authoritative *Science of Military Strategy* describes "non-contact medium- to long-range firepower strikes"—a mission that would employ China's large missile arsenal—as the main form of combat in a major theater conflict against the United States.[88] In an offensive campaign, the PLA envisions using "joint firepower strikes," which employ long-range precision strike weaponry, to cripple the adversary's operational system. According to one doctrinal study, such attacks are designed to "suppress, disrupt, and destroy the enemy's important military, political, and economic targets, weaken the enemy's combat power and war potential, and collapse the enemy's will to resist."[89] A joint firepower strike campaign fits within the framework of "system destruction warfare," the PLA's theory of victory.[90] System destruction refers to kinetic and non-kinetic attacks that target the adversary's entire operational architecture, ranging from sensors to information nodes and networks to command-and-control systems. This theory of victory posits that system destruction would paralyze the enemy's operations, precluding it from effectively employing its frontline combat units.

Yet there is another possible rationale for China to expand its arsenal of theater strike systems that can, or do, carry nuclear weapons: they can be used to strain U.S. extended deterrence commitments and isolate potential targets of aggression like Taiwan.[91] Despite prevailing concerns that China's larger strategic nuclear arsenal could make East Asia "safe" for conventional war by ensuring that a conflict with the United States remains conventional, Beijing might instead conclude that a larger theater nuclear arsenal could make the

87 Office of the Secretary of Defense, *Military and Security Developments Involving the People's Republic of China 2021*, p. 93.

88 寿晓松 主编 [Shou Xiaosong, ed.], 战略学 [*Science of Military Strategy*] (Beijing: Academy of Military Science, 2013), p. 108.

89 李有升 主编 [Li Yousheng, ed.], 联合战役学教程 [*Course Materials on the Science of Joint Campaigns*] (Beijing: Academy of Military Science, 2012), p. 201.

90 See Jeffrey Engstrom, *System Confrontation and System Destruction Warfare: How the Chinese People's Liberation Army Seeks to Wage Modern Warfare* (Washington, D.C.: RAND Corporation, 2018).

91 Montgomery and Yoshihara, "The Real Challenge of China's Nuclear Modernization."

region safe for bilateral war between China and a local state by preventing any U.S. military intervention at all.

Reducing the risk of nuclear escalation and engaging in a force-on-force conventional fight could benefit Beijing, especially given the advantages it would enjoy vis-à-vis Washington as a regional military power fighting a global military power—and particularly as a regional military power that has modernized its conventional military power with that global power foremost in mind.[92] But taking on the United States would still be a tall order, especially if Washington felt that it could fight with a freer hand as escalation to strategic nuclear use becomes less plausible. For Chinese leaders, then, the far better outcome would be to deter U.S. intervention, and only attempt to degrade it if deterrence were to fail. Toward that end, with a larger and more diverse theater nuclear arsenal, Beijing might be tempted to issue threats and engage in brinkmanship at the very start of a crisis—potentially denying Washington critical support by keeping U.S. allies on the sidelines and raising the stakes for American policymakers as they debate what to do.[93]

The Past and Future of Theater Nuclear Options

These types of escalatory activities are likely to be enabled by a shifting theater nuclear balance. China could soon be equipped with multiple theater nuclear options, potentially including the DF-21, the highly accurate DF-26, and the HGV-equipped DF-17. Paired with low-yield warheads, these delivery systems would enable Beijing to credibly make limited nuclear threats against regional targets throughout the Japanese archipelago and as far away as Guam. Indeed, the Department of Defense now concludes that "The PRC probably seeks lower yield nuclear warhead capabilities to provide proportional response options that its high-yield warheads cannot deliver."[94]

Moreover, China's ongoing investments suggest that the emerging asymmetry in the Sino-U.S. theater nuclear balance likely will sharpen in the coming years. Its inventory of nuclear-capable IRBMs and the MRBMs, for example, has increased markedly. According to the Pentagon's 2022 annual report on China's military power, the PLA Rocket Force deployed 250 launchers and more than 250 missiles for its IRBMs and 250 launchers and more than 500 missiles for its MRBMs.[95] The IRBMs may have grown at least eightfold in launchers and missiles since 2018.[96] The number of MRBM launchers and missiles may

92 Montgomery, "Contested Primacy in the Western Pacific."

93 Brian Radzinsky, "Chinese Views of the Changing Nuclear Balance," *War on the Rocks*, October 22, 2021, https://warontherocks.com/2021/10/chinese-views-of-the-changing-nuclear-balance/.

94 Office of the Secretary of Defense, *Military and Security Developments Involving the People's Republic of China* (Washington, D.C.: Department of Defense, 2022), p. 83.

95 Ibid., p. 167.

96 Office of the Secretary of Defense, *Military and Security Developments Involving the People's Republic of China* (Washington, D.C.: Department of Defense, 2018), p. 125.

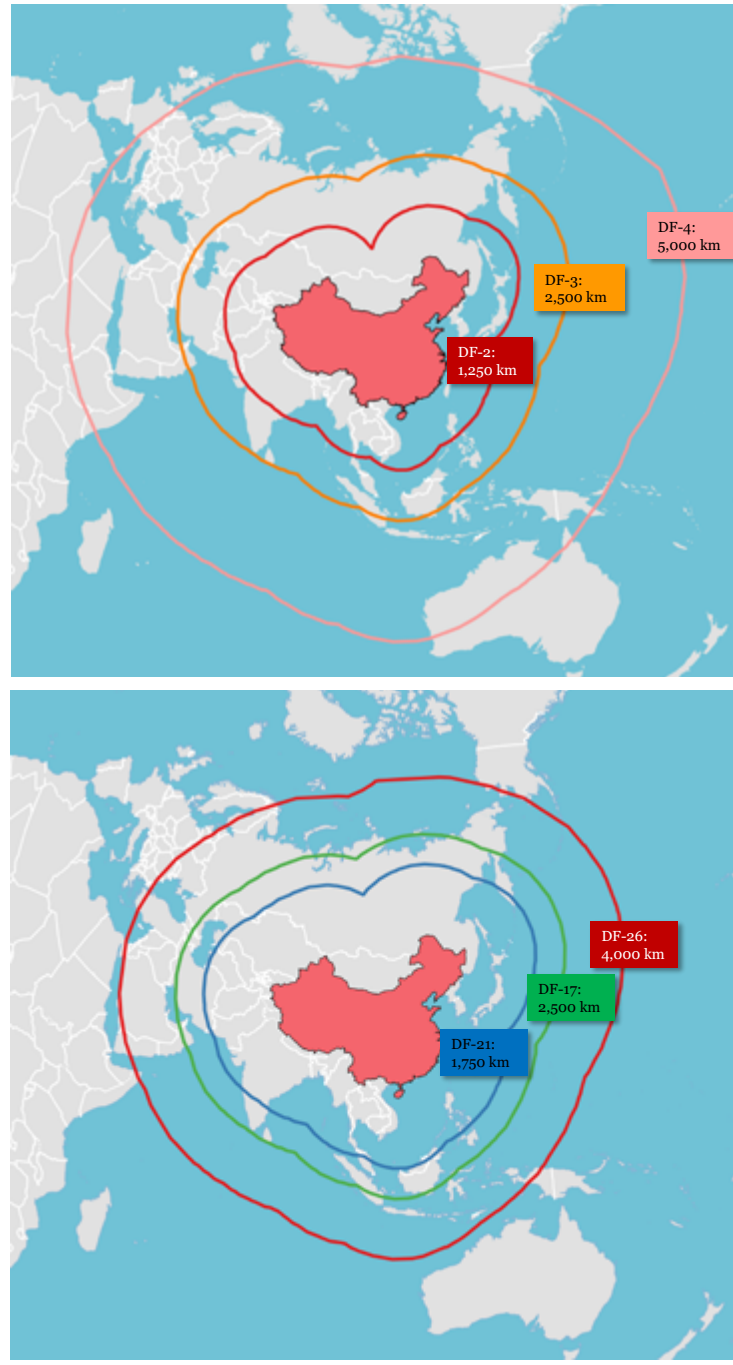
have nearly tripled and quintupled, respectively, since 2010.[97] While it is unclear how many nuclear-armed missiles account for the size of the IRBMs and MRBMs, which can perform nuclear, conventional, and anti-ship missions, the upward trajectories are clear.

Missile forces and HSWs are only one part of the equation, however. In fact, there are several other reasons to suspect that China might embrace theater nuclear threats. First, doing so would draw on decades of accumulated experience and, in some respects, represent a return to Beijing's nuclear roots. Before China possessed the means to hold at risk the continental United States, it relied on theater-range delivery systems to target U.S. military bases in Asia. Beginning in the mid-1960s, China tested and fielded successive nuclear-tipped missiles with progressively longer ranges that corresponded with the specific locations of U.S. forward-deployed forces (see Figure 1). Chinese rocketeers first developed the DF-2 and the DF-3 missiles to reach American bases in Japan and in the Philippines respectively. They subsequently built the DF-4 missiles to threaten Guam.[98]

97 Office of the Secretary of Defense, *Military and Security Developments Involving the People's Republic of China* (Washington, D.C.: Department of Defense, 2010), p. 66.

98 John Wilson Lewis and Xue Litai, *China Builds the Bomb* (Stanford, CA: Stanford University Press, 1988), p. 213.

FIGURE 1: RANGES OF DF-2, DF-3, AND DF-4 AND DF-17, DF-21, AND DF-26, RESPECTIVELY



Source: Graphic created by CSBA using map data courtesy of naturalearthdata.com. Range data complied from Janes, the Missile Defense Advocacy Alliance, and the Center for Strategic and International Studies (CSIS) Missile Defense Project.

Although China's initial theater posture was driven by necessity, it maintained a modest theater nuclear strike capability for the rest of the Cold War and well into its aftermath. The nuclear version of the DF-21, which entered service in the 1990s, was meant to replace its obsolete counterparts. A 2002 study speculated that the rationales for the theater systems were to "decouple the U.S. from its allies in the region, especially Japan and Korea" and "strike U.S. forces and bases in Asia to degrade conventional capability."[99] Its authors also found that China's theater-range forces were located in garrisons that brought them within range of Korea, Vietnam, and India, suggesting theater missions beyond the United States.[100] Recent efforts to diversify and expand the theater arsenal continue this decades-long practice.

Second, Chinese strategists are acutely aware of the role that nuclear threats can play when it comes to driving wedges between the United States, its allies, and its partners.[101] Although their scholarly writings do not reflect official policy, they do hint at how Chinese strategists may perceive the weaknesses of U.S. extended deterrence commitments. One finding they share is that the credibility of extended deterrence is very fragile and that those states protected under the U.S. nuclear umbrella are prone to doubt Washington's commitment.[102] For example, two analysts describe an "extended deterrence dilemma" that has long accompanied U.S. nuclear strategy since the Cold War. The dilemma, according to them, is "whether a state is willing to assume the risk of an all-out nuclear war with its opponent in order to protect its allies from conventional military attacks or limited nuclear strikes. The extended deterrence dilemma is especially acute when the state and its opponent's nuclear forces are evenly matched."[103]

Notably, Chinese commentators have examined the contentious transatlantic debates in the late 1970s about the credibility of U.S. deterrence in Europe following the Soviet Union's deployment of the SS-20 IRBM. They have paid special attention to the danger of decoupling

99 Bates Gill, James C. Mulvenon, and Mark Stokes, "The Chinese Second Artillery Corps," in *The People's Liberation Army as Organization: Reference Volume 1*, James C. Mulvenon and Andrew N.D. Yang, eds. (Santa Monica, CA: RAND Corporation, 2002), p. 557.

100 Ibid, p. 542.

101 Thomas G. Mahnken, Gillian Evans, Toshi Yoshihara, Eric S. Edelman, and Jack Bianchi, *Understanding Strategic Interaction in the Second Nuclear Age* (Washington, D.C.: Center for Strategic and Budgetary Assessments, 2019), pp. 79–81.

102 江天骄 [Jiang Tianjiao], "同盟安全与防扩散—美国延伸威慑的可信度及其确保机制 [Alliance Security and Counterproliferation—The Credibility of U.S. Extended Deterrence and the Mechanisms for Securing It]," 外交评论 [*Foreign Affairs Review*], no. 1 (2020), p. 128; 江天骄 [Jiang Tianjiao], "美国实战威慑核战略: 理论, 历史与现实 [U.S. Nuclear Warfighting Deterrence Strategy: Theory, History, and Reality]," 国际安全研究 [*Journal of International Security Studies*], no. 2 (2021), p. 36; and 王政达 [Wang Zhengda], "核威慑机理: 实力基础, 信号传递和心理博弈 [Nuclear Deterrence Mechanisms: Power Base, Signaling, and Psychological Games]," 国际论坛 [*International Forum*], no. 1 (2022), p. 117.

103 李享 高衡 [Li Xiang and Gao Heng], "大国竞争背景下的美国有限核战争理论再辨析—基本逻辑, 政策辩论与现实影响 [A Reexamination of the U.S. Limited Nuclear War Theory Against the Backdrop of Great Power Competition—Basic Logic, Policy Debate, and Practical Impact]," 当代亚太 [*Journal of Contemporary Asia-Pacific Studies*], no. 5 (2022), p. 110.

that animated Western fears at the time.[104] The risk was that an exclusive nuclear threat against Europe might disincline the United States—whose territory would be spared from the Soviet theater-range missiles—to intervene and retaliate on behalf of its allies across the Atlantic. These lessons, especially if Beijing were to internalize them, could be a clue of what the future holds for Asia.

Third, the legacy of China's nuclear history and the lessons of the past might be amplified by current events, namely the war in Ukraine.[105] One of the most worrisome aspects of that conflict has been Vladimir Putin's willingness to rattle the nuclear saber, both implicitly and explicitly, as a way of deterring outside intervention.[106] Although these actions have not prevented the United States and its allies from providing arms and intelligence to Ukraine, they have induced caution and colored debates over how to respond as U.S. officials avoid steps that could provoke "World War III."[107] One lesson for Chinese leaders, therefore, might be that nuclear threats will induce greater restraint on the part of the United States, particularly when it comes to direct military intervention, and drive a wedge between Washington and frontline allies like Japan that might find themselves in the immediate crosshairs.

Indeed, as war has raged in Ukraine, American, Japanese, and Chinese observers have all argued that the apparent effects of Russia's nuclear threats might convince Beijing to double down on the nuclear card.[108] And there is preliminary evidence that they may be right. Following House Speaker Nancy Pelosi's visit to Taiwan in August 2022, video footage of nuclear-capable missiles being transported on the mainland's city streets circulated on China's social media. According to retired PLA colonel Yue Gang, the images were "aimed at warning the US and its close ally Japan not to intervene in the Taiwan issue, reminding them that Beijing has the most powerful weapon that could give [them] a deadly strike." Yue explicitly attributed the putative nuclear signaling to the Ukraine war,

104 See, for example, 刘芝平 [Liu Zhiping], "冷战时期联邦德国促使北约双重决议萌芽的原因 [The Reasons Behind West Germany's Push for NATO's Dual-Track Decision During the Cold War]," 南华大学学报 [*Journal of University of South China*] 11, no. 4 (August 2010), p. 57 and 员欣依 孙向丽 [Yuan Xinyi and Sun Xiangli], "北约核政策与核态势的回顾及展望 [Retrospect and Prospect of NATO's Nuclear Policy and Nuclear Posture]," 国际安全研究 [*Journal of International Security Studies*], no. 5 (2017), pp. 145–151.

105 Evan Montgomery and Toshi Yoshihara, "Leaderless, Cut Off, and Alone: The Risks to Taiwan in the Wake of Ukraine," *War on the Rocks*, April 5, 2022, https://warontherocks.com/2022/04/leaderless-cut-off-and-alone-the-risks-to-taiwan-in-the-wake-of-ukraine/.

106 Max Fisher, "Putin's Case for War, Annotated," *New York Times*, February 24, 2022; and David E. Sanger and William J. Broad, "Putin Declares a Nuclear Alert, and Biden Seeks De-escalation," *New York Times*, February 27, 2022.

107 Max Fisher, "As Russia Digs In, What's the Risk of Nuclear War? It's Not Zero," *New York Times*, March 16, 2022; and Aaron Blake, "Why Biden and the White House Keep Talking about World War III," *Washington Post*, March 17, 2022.

108 Seth Cropsey, "Going Vertical: Ukraine, Taiwan, and the Nuclear Ploy," *Asia Times*, April 14, 2022; Hiroyuki Akita, "What the Ukraine War Has Taught China About Designs on Taiwan," *Nikkei Asia*, April 16, 2022; Mark Magnier, "Russian Missteps in Ukraine Offer Chinese Lessons in Better Military Strategy, Stronger Troop Morale," *South China Morning Post*, April 21, 2022; and David Sacks, "What Is China Learning From Russia's War in Ukraine?" *Foreign Affairs*, May 16, 2022.

explaining that, "Putin's experience inspired Beijing that it's a workable strategy" to preclude third-party intervention.[109]

If the social media postings were indeed a purposeful element of Beijing's deterrent signaling, they are consistent with Chinese military writings, which indicate that China's armed forces, including its Rocket Force, could engage in deterrence activities to demonstrate its resolve and to shape the risk calculus of its opponents in a crisis.[110] Such signaling could involve broadcasting capabilities, increasing readiness levels, deploying forces, simulating operational preparations, and conducting exercises and tests.[111] The goals of these steps would be to instill fear, apply psychological pressure, and create uncertainty. As the 2020 *Science of Military Strategy*, published by the Chinese National Defense University, explains, "When security threats increase and may trigger a crisis, appropriate adjustments should be made to military deployment to send a real deterrent signal to the opponent to make it feel the pressure of the coming war."[112] Notably, the document calls for maneuvering China's nuclear triad as one method of strategic deterrence. Yet theater systems, including HSWs, will give Beijing new ways to maneuver—and new ways to pursue decoupling.

In sum, the combination of China's growing theater arsenal, its experience with theater weapons, lessons from both the past and the present, and its well-established doctrine for deterrence signaling might incline Beijing to issue early nuclear threats to undercut U.S. extended deterrence and isolate America's allies and partners in a crisis. HSWs are only one aspect of this potential threat, which also includes China's IRBM and MRBM systems. Therefore, they alone are not a major driver of instability. They could nonetheless increase Beijing's willingness to embrace this type of coercive nuclear strategy, especially if they help to sharpen a growing asymmetry in the theater's nuclear balance and enable the PLA to confidently hold at risk regional targets despite future improvements in local defenses.

109 Minnie Chan, "PLA Adopts Nuclear Deterrence to Stop Foreign Intervention on Taiwan: Analysts," *South China Morning Post*, August 21, 2022.

110 Koichiro Takagi, "The Future of Cognitive Warfare: Lessons from the War in Ukraine," *War on the Rocks*, July 22, 2022; and David Logan, "The Dangerous Myths."

111 Michael S. Chase and Arthur Chan, *China's Evolving Approach to "Integrated Strategic Deterrence"* (Santa Monica, CA: RAND Corporation, 2016), pp. 35–45.

112 肖天亮 主编 [Xiao Tianliang, ed.], 战略学 [*Science of Military Strategy*] (Beijing: National Defense University, 2020), p. 137.

CHAPTER 6

Conclusion

Despite frequent proclamations that the current security environment is characterized by an unprecedented degree of technological change, as states work to develop and exploit advantages in areas such as robotics, artificial intelligence, quantum computing, and advanced manufacturing, few emerging technologies have generated the degree of concern that seems to accompany hypersonic weapons. Given the anticipated speed, maneuverability, and accuracy of both HGVs and HCMs, as well as efforts by some states to equip these capabilities with nuclear warheads, fears of costly arms races and crises that spiral out of control abound. By contrast, this report has argued that the connections between hypersonic weapons and strategic instability are not nearly as clear as they might seem. At least in the context of the Sino–U.S. competition, which is now the focal point for defense planners in Beijing and Washington, the most commonly identified escalation pathways do not suggest that hypersonic weapons are a game-changer that could soon bring both parties to the brink of nuclear use. Although there are many reasons to be skeptical that HSWs are as dangerous as some analysts believe, a key factor is the growth of China's strategic nuclear arsenal and its implications for the Sino-U.S. competition.

Beijing now appears on its way to fielding an arsenal that is large enough and survivable enough to dampen concerns that U.S. employment of conventionally armed hypersonic weapons could seriously degrade its assured retaliation capability. That would make inadvertent escalation a much less salient concern. At the same time, as inadvertent escalation comes off the table, the United States could, if necessary, fight a conventional war with fewer restraints. That should reduce the likelihood that it would seriously consider relying on nuclear weapons to offset its conventional military disadvantages. Finally, while China is developing nuclear capabilities that could be used in a decapitating strike, its larger strategic arsenal is unlikely to become large enough over the next decade to pose a credible disarming threat to the United States, especially if Beijing needs to keep at least one eye on its other nuclear rivals.

There is, however, one escalation pathway that has gone relatively unnoticed so far, but which could raise the risk of nuclear use. Specifically, as China develops a much more robust set of theater nuclear options—including missile delivery systems equipped with hypersonic weapons —it could be tempted to make nuclear threats early in a regional crisis. The goal of these threats would be to prevent the United States from intervening, for instance in defense of Taiwan, or to hamstring any intervention by ensuring that key U.S. allies such as Japan remain on the sidelines. Although hypersonic weapons are not necessarily central to this prospective contingency, they could contribute to the credibility of Beijing's threats by ensuring that it can accurately deliver limited nuclear strikes against regional targets, despite any local defenses.

These arguments, focused more narrowly on the linkages between hypersonic weapons and nuclear use, do not discount the real dangers that HSWs could pose in other areas of the Sino-American military rivalry. For example, hypersonic weapons could wreak tremendous havoc on the conventional battlefield. Their speed, maneuverability, and flight altitude could defeat enemy defenses to destroy various high-value frontline combat units and the bases and platforms from which they are launched. Chinese analysts anticipate that the U.S. military and the PLA would deliver powerful blows against each other with hypersonic weapons in a conventional conflict. Looking to the future, one study forecasts that U.S. forces operating in a "counter-intervention environment" could employ hypersonic aircraft armed with hypersonic missiles to "penetrate anti-access zones" erected by China.[113] Another author finds that China's advances in hypersonic technologies give the PLA a warfighting edge over the U.S. military. According to Zuo Xiying, "China has occupied a superior position in this area [of hypersonics], undoubtedly enhancing China's conventional deterrent power against the United States."[114] A naval strategist predicts that the future deployment of ship-launched hypersonic anti-ship missiles across China's surface fleet would be a "huge boost to the Chinese navy's overall anti-access/area denial capabilities."[115] Such Chinese assessments of the conventional utility of hypersonic weapons suggest that Western observers should pay close attention to potential hypersonic interactions in force-on-force engagements.[116]

113 李文杰 孟丽娜 [Li Wenjie and Meng Lina], "从研发项目看美国高超声速飞机发展策略 [Looking at U.S. Hypersonic Aircraft Development Strategy from Research Programs]," 战术导弹技术 [*Tactical Missile Technology*], September 2022, p. 13.

114 左希迎 [Zuo Xiying], "美国对华常规威慑战略的调整 [U.S. Adjustments in Conventional Deterrence Strategy Against China]," 国际安全研究 [*Journal of International Security Studies*], no. 5 (2022), p. 56.

115 银河 [Yin He (pseudonym)], "高超音速舰舰导弹在中国区域拒止与反介入作战中的作用 [The Role of Ship-to-Ship Hypersonic Missiles in China's Anti-Access and Area Denial Operations]," 舰载武器 [*Shipborne Weapons*], no. 11, 2022, p. 29. The article is a three-part special series that examines the weaknesses of sub-sonic and supersonic anti-ship cruise missiles, the advantages of hypersonic anti-ship missiles, and the likely inability of the U.S. surface forces to defend against Chinese salvoes of hypersonic ship-killing missiles.

116 Seth Cropsey, for example, argues that the initial round of Chinese and Russian deployments of conventional hypersonic weapons, even if modest in scale, could be "enough to influence the balance of forces" by the end of this decade. See Seth Cropsey, "Can We Deploy Hypersonic Weapons before China and Russia Outgun Us? It's up to Congress," *The Hill*, January 25, 2023.

The foregoing analysis also yields important policy implications. For instance, they suggest that the United States should not prematurely allow concerns about inadvertent escalation to slow its pursuit of conventionally armed hypersonic weapons. Instead, decisions about investments in hypersonic weapons should be driven by technological feasibility and operational utility. Moreover, regarding the latter, Washington should reexamine earlier operational concepts involving deep strikes that were criticized as excessively dangerous, in part because they advocated holding at risk targets in China that raised the apparent risk of a nuclear response.[117] As Beijing's arsenal becomes more survivable in the face of conventional military strikes, the United States can exploit this fact to impose greater costs on China both in peacetime and, if necessary, during a conflict.

Related, Washington should also cast a critical eye toward any claims on Beijing's part that its strategic arsenal is highly vulnerable, especially if and when the size of that arsenal approaches the numbers projected by recent Pentagon reports. It would be entirely predictable for Chinese leaders to exaggerate its weakness in this area and "bluff" U.S. officials into exercising more military restraint in a future conflict than might be warranted. In addition, Washington should prioritize reducing its first strike vulnerability to China in any future nuclear force sizing discussions. The disparity in arsenal size between the two powers, although not as large as it once was and likely to become smaller, still puts disarming options beyond the reach of Beijing, and therefore provides a check on the instability that decapitating threats can introduce.

Finally, China's theater nuclear options and the prospect that it could resort to nuclear coercion early in a crisis could have major implications for U.S. extended deterrence guarantees. If fears increase in allied capitals that Washington will be reluctant to uphold its commitments given these nuclear risks, as some Chinese analysts expect, those allies may look for concrete American steps, including assurances, that reduce the danger of decoupling and abandonment. They may find such measures particularly appealing if alternatives such as aligning with China or developing the conventional military power sufficient to balance Beijing alone appear undesirable and infeasible, respectively. Should the theater nuclear balance continue to shift in Beijing's favor, Washington should anticipate and prepare for a future in which Asian allies might become more receptive to new arrangements designed to bolster extended deterrence. Indeed, the late former Japanese prime minister Shinzo Abe called for public debate in Japan about the possibility of "nuclear sharing" mechanisms

117 See, for example, Jan van Tol, Mark Gunzinger, Andrew F. Krepinevich, and Jim Thomas, *AirSea Battle: A Point-of-Departure Operational Concept* (Washington, DC: Center for Strategic and Budgetary Assessments, 2010).

with the United States akin to those in place for NATO.[118] His controversial comments came shortly after Russia's invasion of Ukraine and amid growing concerns about the possible lessons that China might have drawn from the war. That these sentiments were even uttered aloud by a former leader showed just how far attitudes have changed in a country where the nuclear taboo remains alive and well.

If past is prologue, Europe's experience in the late Cold War suggests that demand signals from allies can be just as powerful as U.S. strategic imperatives in driving decisions related to American nuclear posture and presence.[119] Asia itself is no stranger to robust extended deterrence: South Korea and Taiwan were home to U.S. tactical nuclear weapons for decades. Moreover, since the demise of the Intermediate-Range Theater Nuclear Force Treaty in 2019, the United States now boasts more options for righting the theater nuclear imbalance than it has hitherto enjoyed. It thus behooves policymakers to consider and adopt strategies—in close consultations with allies—for an increasingly inhospitable and nuclearized operational environment in Asia. In short, Washington may have to become more accustomed to the practices and norms about nuclear matters as well as the associated risk tolerance that prevailed in Cold War Europe and Asia.

118 Jesse Johnson, "Japan Should Consider Hosting U.S. Nuclear Weapons, Abe Says," *Japan Times*, February 22, 2022. In the context of NATO, nuclear-sharing arrangements allow select alliance members to host U.S. nuclear weapons on their territory, under the custody of U.S. forces, and to deliver them with U.S. authorization during a conflict. On the prospect of U.S.-Japan nuclear sharing, see Evan Braden Montgomery, *Extended Deterrence in the Second Nuclear Age: Geopolitics, Proliferation, and the Future of U.S. Security Commitments* (Washington, DC: Center for Strategic and Budgetary Assessments, 2016); and Evan Braden Montgomery, "Sources of Instability in the Second Nuclear Age: An American Perspective."

119 Eric Edelman, Tyler Hacker, and Josh Chang, *Arming America's Allies: Historical Lessons for Implementing a Post-INF Treaty Missile Strategy* (Washington, D.C.: Center for Strategic and Budgetary Assessments, 2022), pp. 23–29.

LIST OF ACRONYMS

A2/AD	anti-access/area denial
CPGS	conventional prompt global strike
CSBA	Center for Strategic and Budgetary Assessments
DARPA	Defense Advanced Projects Research Agency
FOBS	fractional orbital bombardment system
HCM	hypersonic cruise missile
HGV	hypersonic glide vehicle
HSW	hypersonic weapon
ICBM	intercontinental ballistic missile
IRBM	intermediate-range ballistic missile
MIRV	multiple independently-targetable reentry vehicle
MRBM	medium-range ballistic missile
NATO	North Atlantic Treaty Organization
New START	New Strategic Arms Reduction Treaty
NPR	Nuclear Posture Review
PLA	People's Liberation Army
PRC	People's Republic of China
SLBM	submarine-launched ballistic missile
SLCM-N	submarine-launched cruise missile - nuclear

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