
DECEMBER 2024

# Confronting Armageddon

## *Wargaming Nuclear Deterrence and Its Failures in a U.S.-China Conflict over Taiwan*

AUTHORS
Mark Cancian
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A Report of the CSIS Defense and Security Department and the MIT Security Studies Program Wargaming Lab

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

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# About the MIT Wargaming Lab

The MIT Security Studies Program (SSP) Wargaming Lab is a research group that seeks to innovate war-gaming to better understand how to deter conflict and preserve peace. The lab strives to be a center of excellence that advances the practice of wargaming and builds networks of scholars and practitioners.

Leveraging SSP's expertise in security studies and its extensive network of scholars and national security practitioners, the Wargaming Lab engages policymakers, informs public policy, and advances academic research on critical national security issues. To do this, the lab designs and runs wargames and simulations, develops wargaming best practices, and hosts scholarly conferences and workshops that support research and help train the next generation of wargaming experts.

Through these efforts, the SSP Wargaming Lab develops the use of wargames and simulations as rigorous, accessible, and transparent tools to enhance understanding of international politics and security.

This report does not represent the views of the U.S. government or any part thereof.

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The authors thank the many wargame players who took a day out of their busy schedules to participate in a game iteration. They not only played the game, thus providing the data on which this report is based, but also provided constructive feedback to identify strategic insights arising from gameplay. The authors appreciate the extensive discussions with the staff of the DTRA Research and Development and Strategic Integration Directorates. These discussions were particularly helpful in understanding the effects of nuclear weapons. Finally, the authors thank the working group members and reviewers—inside and outside CSIS—who answered questions, read the draft report, and provided valuable comments. The contributions of these participants and discussants improved the research and final report, but the content presented here, including any errors, remains solely the responsibility of the authors.

# Contents

# Executive Summary

This study examines nuclear dynamics in a Chinese invasion of Taiwan, a war that the authors hope will never occur. What creates the greatest pressure for nuclear weapons use in such a conflict? What happens if nuclear weapons are used? To answer these questions, the CSIS-MIT team modified its existing U.S.-China wargame to include nuclear weapons and ran it 15 times.

The greatest pressure for nuclear use came when China teams reached a crisis: their invasion of Taiwan was in danger of a defeat that might threaten Chinese Communist Party (CCP) rule. To dissuade China from gambling for resurrection—using nuclear weapons to salvage a failing conventional campaign—U.S. diplomacy was much more important than nuclear brinksmanship. Favorable outcomes were possible, but total victory was unachievable. The United States must therefore be prepared to successfully prosecute a high-end conventional war while at the same time providing face-saving off-ramps to the adversary. To do otherwise risks a nuclear holocaust, as indeed occurred in three game iterations.

## The Challenge

The confluence of Chinese nuclear force development and the increasing risk of conflict over Taiwan makes study of nuclear escalation imperative. China's nuclear forces are developing at a rapid rate, acquiring capabilities that may increase the chance of nuclear use in war. Although China has maintained a no-first-use policy regarding nuclear weapons, extreme circumstances

might cause it to override this commitment. Some analysts suggest that the prospect of failing in an invasion of Taiwan might be such a circumstance.

Others have worried that the United States might incite Chinese nuclear use during a conventional conflict either by striking the Chinese mainland or by degrading (inadvertently or intentionally) Chinese nuclear capabilities—for example, by destroying dual-use missiles or command and control networks. Alternatively, the United States might use nuclear weapons first. U.S. Nuclear Posture Reviews (NPRs) have not ruled out nuclear first use.[1] Indeed, some U.S. strategists have suggested using nuclear weapons against a Chinese invasion fleet to compensate for perceived conventional weakness.[2]

## Key Questions

These trends create two research questions about nuclear escalation in a Taiwan invasion scenario:

1. What creates the greatest pressure for nuclear weapons use? The literature on this subject proposes many hypotheses. Separating the more important from the less important is critical to designing policy that reduces the likelihood of nuclear use during a conventional conflict.
2. What happens if nuclear weapons are used? Although it would be too late to avoid the tragedy of nuclear use, there is a range of outcomes. Consider the difference in destruction from a single high-altitude electromagnetic pulse (HEMP) followed by a ceasefire versus the mutual destruction of urban populations. Better-prepared decisionmaking could reduce the damage of nuclear conflict while still producing favorable outcomes.

## The Wargame

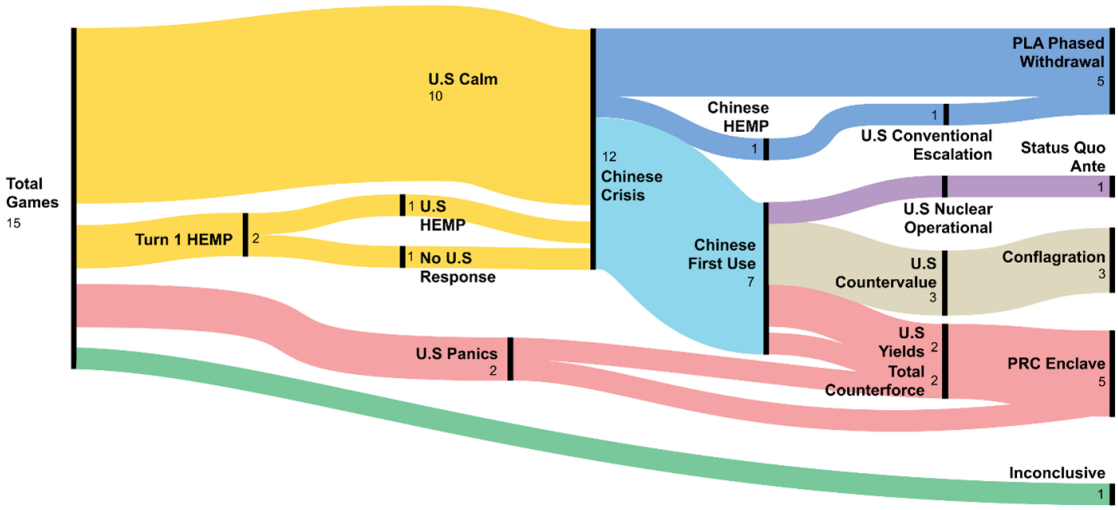
To investigate these research questions, the project employed a series of wargames including conventional and nuclear elements to assess the potential actions of China, the United States, and Japan in an operationally realistic and competitive environment. The wargame built on a previous U.S.-China conventional wargame developed by the authors.[3] This project added nuclear elements, updated the wargame for a 2028 time frame, and then ran the game 15 times, varying U.S. mainland strike authorities and Chinese nuclear posture. Game participants had expertise in regional affairs, military operations, and nuclear strategy, many at a senior level, but gameplay represented their individual perspectives, not the policies or plans of the U.S. government.

By placing players in the role of operational commanders with the latitude to recommend nuclear use and negotiated settlements, the wargames explored the military considerations of nuclear use and their effect on the campaign. The study did not address the likelihood of nuclear use, focusing instead on military factors and minimizing political factors.

## The Results

The Sankey diagram (Figure 1) shows the game outcomes and the many paths taken to them. Although complex, the chart captures a key point: initiating nuclear use is truly a roll of the "iron dice." (A full discussion of the chart and pathways is in the main text under Game Results.)

Figure 1: Game Pathways and Outcomes




Source: CSIS Defense and Security Department.

The game outcomes (listed on the right side of Figure 1) were as follows:

- **People's Liberation Army (PLA) Phased Withdrawal (5 outcomes):** a ceasefire with a People's Republic of China (PRC) withdrawal from Taiwan and the return of Chinese prisoners of war (POWs)
- **Status Quo Ante (1 outcome):** destruction of Chinese forces on Taiwan but no Taiwanese independence
- **Conflagration (3 outcomes):** strategic nuclear exchange with millions of casualties
- **PRC Enclave (5 outcomes):** a ceasefire with the establishment of a PRC enclave on Taiwan
- **Inconclusive (1 outcome):** no settlement or nuclear conflagration by the end of gameplay

Although each game started in the same place, gameplay took many pathways to arrive at the five outcomes. Similar pathways could lead to different outcomes. For example, in two iterations, China teams opened with a nuclear-created HEMP. In one of the iterations, the U.S. team responded with its own HEMP, and in the other the U.S. team did not respond. Both iterations continued with conventional operations until the China team experienced a crisis as its invasion failed.

In twelve games, China teams experienced a crisis as their invasion forces faced defeat on Taiwan. Seven games saw China teams recommending nuclear use, leading to the following results:

- In two, the U.S. team withdrew from the conflict, accepting a PRC enclave on Taiwan.

- In one, the U.S. team responded with a total counterforce attack, which similarly led to a PRC enclave.
- In three, the U.S. team conducted a countervalue attack, leading to a global conflagration.
- In one, the U.S. team attacked Chinese operational targets with nuclear weapons, resulting in the status quo ante.

No set of circumstances allowed a complete U.S. coalition or Chinese victory. All victories were partial.

It is important to note that the probability of nuclear use cannot be inferred from these results. A game with political authorities fully represented might produce a different frequency of nuclear use. Further, using nuclear weapons would produce unpredictable and momentous political effects not modeled in the game. Thus, the ultimate political effect of the conflict would depend on actions taken after the point at which gameplay ended.

## Analysis and Recommendations

The greatest pressure for nuclear weapons use came from imminent conventional defeat. In seven of eight cases of nuclear use, China teams employed nuclear weapons first when they were facing conventional defeat on Taiwan and decided to gamble for resurrection; the only other case of nuclear use was by one U.S. team when it mistakenly believed it was losing the conflict. This occurred because the models of conventional conflict employed in the game tended to produce early Chinese success but subsequent setbacks.

The Chinese amphibious fleet was particularly vulnerable. Between weeks three and five of conflict, losses to the amphibious fleet made China teams' positions increasingly unsustainable. Regarding decisive defeat as a potential existential threat to the CCP, many China teams decided to risk nuclear escalation to change the dynamics of conflict. China teams typically employed between 12 and 30 weapons in these cases. This leads to our recommendations:

- **Prepare off-ramps for a conflict with China.** There can be no complete victory in a conflict between nuclear powers. Magnanimity in victory—agreeing to settlement terms that are advantageous to the United States but do not humiliate China—could allow Beijing to back down without facing a decision on nuclear use versus possible regime collapse.[4] The United States must work with allies and partners ahead of time to evaluate what face-saving off-ramps they could offer China in exchange for the substantive victory of ending the conflict with an autonomous Taiwan. Without having thought through these proposals ahead of time, there is a real danger that events will outpace U.S.-coalition diplomacy.
- **Do not preclude the U.S. military from striking the Chinese mainland with conventional weapons.** Several factors sometimes said to either encourage or discourage the use of nuclear weapons did not play a decisive role. Decisions to escalate or not were driven primarily by an evaluation of the stakes of defeat and the off-ramps available. Chinese access to low-yield nuclear weapons was marginally influential. Other hypothesized drivers of nuclear escalation that the results did not support included inadvertent escalation from

attacks on nuclear systems, U.S. conventional attacks on the Chinese mainland, substitution for dwindling stocks of conventional munitions, and deliberate conventional attacks on nuclear capabilities. As strikes on the Chinese mainland did not evoke a nuclear response, U.S. war plans should be more accepting of risk in that domain.

- **Do not pursue quantitative nuclear superiority with the expectation that it will deter China from using nuclear weapons.** Enduring U.S. quantitative nuclear superiority and counterforce capabilities similarly played no role in the China teams' calculations. China teams that recommended nuclear use knew that they were embarking on a risky course of action given that the United States could devastate China with a nuclear attack; however, whether the risk of devastation was from 300 or 1,000 nuclear weapons, they accepted it. There was no evidence that a deeper U.S. nuclear inventory would have strengthened deterrence.
- **Accustom U.S. military and political leaders to the possibility of large initial losses in the event of a war with China.** Many U.S. teams were shocked at their large losses early in the conflict. By the end of the first week, the United States and Japan typically lost 270 aircraft and 20 ships, including two carriers. Shaken by these large losses, two U.S. teams believed they were headed toward defeat. In both cases, game adjudicators saw the course of conflict as unexceptional and believed the United States would regain conventional advantage without nuclear use. However, shock led one team to accept an adverse settlement early in the conflict, while another used nuclear weapons to redress a perceived weakness in the conventional balance. Experience in wargames could accustom leaders to the likely contours of the conflict.
- **Continue extended deterrence messaging.** Extended deterrence proved generally successful. During early phases of the games, before any nuclear use, all U.S. teams reiterated statements of extended deterrence covering Japan. Most China teams regarded a nuclear attack on Japan as tantamount to a nuclear strike on the United States. China teams refrained from attacking Japan with nuclear weapons in all but one case (compared with five instances of nuclear use against the United States).
- **Develop an understanding with Japan on the nuclear environment.** Major changes to regional nuclear posture (e.g., basing nuclear weapons in Japan) are not necessary to deter an attack on Japan. However, even if extended deterrence works, Japan might face a region in which nuclear weapons are used. This differs in key aspects from what the United States and Japan have discussed and exercised in the past.
- **Develop nuclear branch plans for Chinese operational targets.** When faced with Chinese first use, all responses carried risk, though of different kinds. A nuclear strike against Chinese operational targets was the best nuclear option. These plans should therefore be refined and exercised.
    - *Withdrawal*: In response to China's first use, some U.S. teams, averse to the risks of continuing nuclear conflict in any form, accepted unfavorable ceasefire terms to end the

conflict. However, most U.S. teams were unwilling to do this, believing doing so would sacrifice a U.S. partner and undermine the U.S. global position.

- *Continuing Conventionally*: Some U.S. teams tried to ignore China's use of nuclear weapons and continued the conventional campaign. However, this invited further Chinese nuclear use, effectively forcing the U.S. teams to choose between a nuclear response or withdrawal.
- *Countervalue*: Some U.S. teams pursued countervalue responses, either by deliberate nuclear attacks on Chinese urban populations or by targeting military or economic infrastructure located in Chinese cities and thus inflicting high civilian casualties. Countervalue responses always led to a cycle of escalation that resulted in the deaths of hundreds of millions.
- *Counterforce*: The Chinese nuclear buildup precluded a disarming nuclear attack by the United States. Thus, any counterforce attack would have to aim at the narrower goal of damage limitation. However, these attacks still left China with enough nuclear weapons to retaliate against the United States and force a negotiated settlement.
- *Operational Forces*: A limited U.S. nuclear response against Chinese conventional operational forces did not surrender Taiwan to Chinese rule and did not lead inexorably to countervalue exchanges. Destroying the Chinese amphibious fleet or forces ashore on Taiwan neutralized any advantages that Chinese nuclear use gained. The single instance of a U.S. tactical nuclear strike against Chinese operational targets on Taiwan employed fewer than 10 weapons.

- **Do not develop additional nuclear weapons for a conflict with China beyond current nuclear modernization plans.** U.S. teams did not lack the tactical nuclear means to conduct the limited nuclear attacks on operational targets described above. Executing the current nuclear modernization plans provided sufficient tools for a 2028 time frame.
- **Rebalance nuclear inventories over time, from gravity bombs to air-launched cruise missiles.** As with conventional attacks, the U.S. teams needed to use long-range nuclear systems to stay outside China's air defense zone. U.S. teams rarely used nuclear bombs because of their short range. However, U.S. modernization plans are weighted heavily toward bombs. Over time, this distribution should be shifted toward long-range air-launched cruise missiles.
- **Work with China to facilitate mutual understanding about deterrence and the unpredictability of nuclear escalation.** Nuclear escalation is inherently unpredictable and difficult to control. This is particularly true if U.S. and Chinese leaders lack a shared understanding of escalation dynamics. During the Cold War, Soviet rhetoric about the ultimate victory of socialism led some Western thinkers to believe the Soviet Union was pursuing a first-strike capability. In a similar way, China's opacity in nuclear force development and doctrine could create misunderstandings. Furthermore, China's apparent faith in its capability to manage nuclear crises could prove disastrous in an actual conflict. China's key concern is for the United States to recognize mutual vulnerability. A series of nuclear talks might make progress on these concerns, facilitate mutual understanding, and help prevent arms racing, crisis instability, and ultimate catastrophe.

1

# Background

## *Why This Report?*

The United States and China have profound interests in peace, but conflict is far from unthinkable. The United States has five treaty allies in the Indo-Pacific and commitments to their security, as well as broader interests in maintaining a regional balance of power. China, for its part, seeks to redress what it views as historical grievances. Both states now openly acknowledge that they are engaged in strategic competition with each other. They highlight the other as their primary strategic competitor and operate military forces in close proximity. Nowhere is the risk of conflict higher than Taiwan. China seeks reunification with the island, peacefully if possible but through force if necessary. It has employed diplomatic and military tools to signal its unwillingness to see Taiwan move toward independence.

Taiwan is not a treaty ally of the United States, which maintains a policy of "strategic ambiguity" toward events there.[5] But Washington insists that any change to the status quo be peaceful and that the United States might intervene in the event of Chinese attack. Because both the United States and China are nuclear powers, the question of nuclear use or threats of nuclear use would loom large if a conflict over Taiwan were to pit U.S. and Chinese forces against each other. Coupled with China's ongoing nuclear modernization, this creates an important area for study.

The goal of this project was to employ wargaming to inform U.S. policy regarding potential nuclear escalation during a Chinese invasion of Taiwan. Chapter 1 outlines the background events that motivated the study. Chapters 2 and 3 summarize the literature and hypotheses associated with nuclear deterrence and use, particularly as these topics relate to a potential Taiwan conflict. Chapter 4 details the research design and addresses scenario variations, orders of battle,

comparisons to other recent wargames, and the scope conditions associated with this study. Chapter 5 summarizes the results of the 15 wargames conducted with a total of 85 participants. Chapter 6 draws on game results to assess hypotheses about what creates the greatest pressure for nuclear first use. Chapter 7 assesses hypotheses about what happens if nuclear weapons are used, including the targets that might be attacked, adversary responses, and the factors that shape military and political outcomes. Finally, Chapter 8 presents policy recommendations for U.S. military and political leaders in light of the analysis. Four appendices summarize the course of the games, nuclear use, nuclear effects modeling, and the terms employed in the study.

## China's Nuclear Modernization

China's nuclear forces are growing and evolving rapidly. What are the contours of that change? Is Chinese nuclear policy changing? What is driving change? And what are the implications for stability and nuclear dynamics between China and the United States? The answers to some of these questions, particularly those related to observable changes, are relatively clear, while others represent significant areas of uncertainty.[6] All these questions are interconnected; understanding how China's nuclear forces might evolve and how that evolution might impact nuclear escalation dynamics is, for example, closely connected to the drivers and motivations for these nuclear force changes.

### CONTOURS OF CHANGE

Historically, China has fielded what many Western observers have described as a "minimum nuclear deterrent."[7] Chinese nuclear strategists describe the objective as a "lean and effective" force, meaning one that is, at the minimum level, sufficient to ensure retaliatory capability in the event of first use against China.[8] However, that definition can be operationalized in various ways. Over the last two decades, China's nuclear forces have grown in size and sophistication. China has deployed new families of mobile intercontinental ballistic missiles (ICBMs), a new class of ballistic missile submarines (SSBNs, the Jin class), new classes of submarine-launched ballistic missiles (SLBMs), and air-launched ballistic missiles, giving China a nascent nuclear triad. As the force has grown in size and capability, Western analysts have suggested that its capabilities endow China with an "assured retaliation" capability.[9]

Recent events have raised the possibility that growth is accelerating. In 2021, open-source intelligence revealed that China was building hundreds of new silos deep in the country's interior.[10] With the construction of new nuclear reactors in China, more than doubling capacity since 2014, and the opening of its first breeder reactor in 2023, China can produce fissile material for many new warheads.[11] The 2023 China Military Power Report (CMPR) projects that China's warhead inventory will grow from an estimated 500 in May 2023 to 1,000 by 2030, with growth continuing apace through at least 2035.[12]

It is unknown whether China's intent is to become a "near peer" to the United States in the nuclear domain or whether its intentions are greater. However, examining the drivers of change gives some insights.

## DRIVERS OF CHANGE

What is motivating the qualitative improvements and expansion of China's nuclear forces? While the question is impossible to answer with certainty, some combination of the following four drivers is probably at work.[13] The first driver is the need to maintain a secure and credible second-strike capability against technological and capability uncertainty. Chinese nuclear strategists highlight the perceived insecurity of this capability in the face of improved U.S. intelligence, surveillance, and reconnaissance (ISR), conventional strike, and missile defense capabilities.[14] Long before China's nuclear buildup accelerated, some Western observers predicted that improved U.S. counterforce capabilities would pressure China to expand its arsenal and adopt higher levels of readiness.[15]

A second driver is to support great power status and what Chinese president Xi Jinping[16] calls a "new type of major power relations."[17] At the ceremony creating the People's Liberation Army Rocket Force (PLARF) in December 2015, he said the force would increase "support for our country's major power status."[18] The 2013 *Science of Military Strategy* asserts that China's nuclear forces play a role in "guaranteeing that [China's] status as a powerful country does not waver."[19] Some Chinese pundits have asserted that the inventory should be "commensurate with China's standing as a country . . . and the international obligations it shoulders."[20] U.S. realists have argued that China, like past great powers, is unlikely to accept nuclear inferiority indefinitely.[21]

The third driver may be deterring U.S. tactical nuclear use, particularly in a Taiwan contingency. Chinese leaders and strategists and the Chinese public are aware of increased U.S. discussion of tactical nuclear options in a Taiwan contingency.[22] Denying the United States escalation dominance would discourage U.S. nuclear tactical use. U.S. analysts have therefore asked: Does Beijing believe that possessing more advanced nuclear technologies will allow it to go on the offensive conventionally while deterring U.S. entry?[23]

Finally, domestic factors, such as changes to the bureaucratic politics of nuclear decisionmaking in China, also likely play a role. Specifically, the role of the competing military services is thought to have grown in policymaking relative to the nuclear specialist community.[24] Determining the relative weight of these explanations is not possible, though all probably play a role.

## CHINESE NUCLEAR POLICY

China's nuclear policy and lexicon remain ostensibly unchanged, anchored to a no-first-use retaliatory policy under which China stipulates it will not be the first to employ nuclear weapons in conflict but will respond in kind if attacked. At the same time, however, China's nuclear modernization has significantly enhanced its military capabilities, potentially enabling it to execute a wider range of strategies.[25] Some Chinese analysts have suggested that China, as the weaker party, might initiate the use of nuclear weapons in a conflict with the United States over Taiwan if U.S. missiles target the mainland or if Chinese forces are defeated on Taiwan.[26] Although individuals making such comments acknowledge that their comments do not reflect Chinese policy, several U.S. analysts have suggested that the stakes in a Taiwan conflict could, under the right circumstances, lead China to violate its own policy.[27]

## UNCERTAINTY IN CHINESE NUCLEAR PRIORITIES

All else equal, the quantitative increase in warhead numbers makes China's second-strike capability more survivable, but the degree of the survivability enhancement and doctrinal changes are uncertain.

There is speculation about China moving a portion of the force to a launch-on-warning (LOW) posture. Between 2017 and 2021, China deployed a large P-band phased array radar (so-called "Chinese PAVE PAWS"), X-band radar oriented toward Alaska, an S-band phased array radar capable of detecting stealth aircraft and cruise missiles, and seven FireEye infrared detection satellites.[28] The 2023 CMPR concludes that the PLA has a "developing 'Early Warning Counterstrike' (预警反击) posture," which "allows the Rocket Force to maintain a portion of its units on a heightened state of readiness while leaving the other portion . . . with separated launchers, missiles, and warheads."[29] However, China has not announced an LOW policy, and it is uncertain how much of the force would be affected by such a shift or on what time scale.

There is also uncertainty about the specific changes to the nuclear force structure underway. Three new silo fields may accommodate 350 silos, most of which will house solid-fueled DF-31s and DF-41s, though silos for liquid-fueled DF-5s will also increase from 18 to 48.[30] It is possible that not all silos will be filled.[31] New road-mobile DF-26 units have been established, as have new brigades, to be equipped with as yet unknown weapons. Notably, different sources at different times have asserted that various missiles (including the DF-5, DF-31, DF-41, and JL-2) have multiple independently targetable reentry vehicles (MIRVs), with the number of warheads at between 3 and 10 depending on the missile and source.

Given the number of permutations and combinations—basing modes, warheads per missile, and readiness—the same inventory of 1,000 warheads may be more or less survivable. All else equal, a force of 1,000 warheads deployed largely on silo-based missiles, many or most of which are MIRVed, will not be as survivable as the same 1,000 warheads deployed on mobile missiles and with fewer warheads per missile. Higher readiness postures would greatly improve survivability, though LOW would carry externalities, including greatly increased risks of an accidental launch.

A second area of uncertainty is the extent of Chinese emphasis on nuclear warfighting capabilities. Chinese nuclear doctrine has always included rudimentary warfighting. For example, doctrine mandates strategic forces be capable of surviving to engage in several rounds of nuclear exchanges. Potential targets include military infrastructure targets, such as naval and air bases.[32] In recent years, China has deployed more accurate missiles and improved the ability of missile forces to maneuver. Both changes derive largely from the conventional functions of the PLARF but allow China to conduct a wider variety of counterforce attacks over a more prolonged nuclear fight.[33]

Future changes are more speculative. Recent iterations of the CMPR, citing "PRC military writings," argue that China "probably seeks lower yield nuclear warhead capabilities."[34] There are reasons why China might wish to acquire lower-yield nuclear weapons, though similar motivations would have existed in the past.[35] Assuming China does deploy such weapons, it is unclear how it

would plan to use these weapons and the extent to which Chinese thinking about tactical nuclear warfighting might change.

### IMPLICATIONS OF CHANGE

Assessments of the implications of China's nuclear buildup, like those of Soviet efforts to catch up to the United States in nuclear forces during the early Cold War, are unclear. On the one hand, when both sides in a military competition have assured retaliatory capability, deliberate escalation to the nuclear level becomes less likely.[36] On the other hand, most scholars also acknowledge the workings of a so-called stability-instability paradox: knowing that higher levels of warfare are less likely because of nuclear risks, nuclear-armed states are paradoxically more prone to initiate low-level conflicts.[37] Hence, robust nuclear capabilities may embolden those in China who advocate for conventional action against Taiwan.[38]

A key element of uncertainty is whether and how China's no-first-use policy might affect its actions during war. No scenario would test that policy more than a Taiwan conflict, given that China considers Taiwan one of its "core interests."[39] Chinese strategists disagree on the response. Famously, in 2005, Major General Zhu Chenghu warned that China would use nuclear weapons if the United States targeted the mainland during a Taiwan conflict.[40] Shen Dingli of Fudan University has also said that China would likely resort to nuclear weapons if its conventional forces were devastated and Taiwan moved toward independence.[41]

However, Chinese officials quickly disavowed Zhu's comments in 2005, and individuals within China's strategic community continue to assert that Chinese policy has not changed. U.S. analysts disagree on whether a no-first-use policy continues to constrain Chinese action. However, even many of those who find that Chinese policy is unlikely to change warn that the exigencies of a Taiwan conflict make predictions difficult and that the United States should be prepared for all possibilities.[42] Brad Roberts, former U.S. deputy assistant secretary of defense for nuclear and missile defense policy, warns that although experts "can make many predictions about China's nuclear future," that future is "littered with uncertainties."[43]

## U.S. Responses

Until at least the 2010s, U.S. nuclear policy was not driven primarily by China-related concerns, and nuclear issues played a secondary role within the U.S.-China military dynamic. Since the late 2010s, a variety of developments have converged to dramatically change U.S. nuclear calculations and spark debates in the United States about nuclear forces and strategy.

Historically, Russia (and its predecessor, the Soviet Union) has been the "pacing threat" in the nuclear domain and remains so today.[44] Russia's 4,300 warhead inventory greatly exceeds that of China, which the Department of Defense's CMPR listed as more than 400 in 2022 and more than 500 in 2023.[45] The United States and Russia/Soviet Union greatly reduced the number of warheads under START I, SORT (Treaty on Moscow), and New START. The United States went further through unilateral actions, such as taking nuclear weapons off ships and submarines, and policies designed

to deemphasize the role of nuclear weapons in U.S. security strategy outlined in successive post-Cold War iterations of the NPR.

The Chinese nuclear buildup has upset this long history of U.S.-Russia/Soviet bilateral nuclear policies and negotiations. It means that U.S. nuclear relations have become a "three-body problem," even if China's arsenal does not yet rise to the level of the U.S. or Russian arsenals.

As a result, several recent analyses published by the Heritage Foundation, the Atlantic Council, and the Institute for Defense Analyses call for an increase in the number and variety of U.S. tactical nuclear weapons and platforms beyond those currently planned. The authors offer two rationales. The first is that the United States must be prepared to deter two simultaneous wars with major powers, and tactical nuclear weapons could compensate for conventional limitations.[46] U.S. first use might be presumed in that case.[47] The second rationale is that the United States should have a credible nuclear answer to the limited use of nuclear weapons.[48] The 2023 Congressional Commission on the Strategic Posture of the United States recommended that tactical nuclear weapons be forward deployable, survivable against preemptive attack, and capable of penetrating advanced missile defenses.[49] For similar purposes, a 2024 Heritage Foundation report recommends reviving the nuclear-armed sea-launched cruise missile (SLCM-N) while continuing to introduce a low-yield SLBM.[50] Opponents argue that the addition of both the B-21 and the long-range standoff weapon (LRSO) made the SLCM-N "excessive to need."[51]

Other opponents emphasize operational opportunity costs in terms of munitions carried at sea, as well as financial trade-offs, estimated at $2.1 billion over five years.[52] Finally, some argue that the focus on nuclear warfighting will drive an arms race.[53]

Administrations have always disagreed somewhat about how much the United States should emphasize nuclear weapons in its national security strategy—a disagreement reflected in different iterations of the NPR. By the mid-2010s, Russian nuclear modernization had proceeded to the point where successive administrations from both U.S. parties had supported modernizing much of the aging U.S. nuclear inventory. In 2023, the Congressional Budget Office estimated 10-year costs for nuclear forces between 2023 and 2032 at $756 billion, of which $355 billion would be spent on modernizing weapons, warheads, platforms, and laboratories.[54]

Publicly available descriptions of modernization include production of the following elements:

- 650 Sentinel ICBMs (400 in silos and 250 spares) to replace Minuteman III
- new or modified warheads (W87-1) for Sentinel ICBMs
- 12 Columbia-class SSBNs to replace the retiring Ohio class
- new or modified Trident II (D5LE2) SLBMs for the Columbia class
- new or modified warheads (W93 and W76-2) for the Trident II SLBM
- upgraded radar and other equipment on the B-52 (to produce the B-52J)
- 100 B-21 bombers to replace the B-2 and nonnuclear B-1B
- LRSOs to replace the AGM-86B air-launched cruise missile (ALCM)

- new or modified warheads (W80-4) for the LRSO
- new versions of the B61 bomb (12 and 13) to replace older versions[55]

Over the last several years, new pressures have prompted reevaluation of U.S. nuclear forces and policy. Russia's hesitation to negotiate a replacement for the New START treaty signaled that strategic arms control between the United States and Russia might crumble after the current five-year extension (to 2026). The continuing Russian invasion of Ukraine underscores that possibility. The growth of China's nuclear forces, especially after the revelation of large new silo fields in 2021, raises the prospect that China will become a near-peer competitor in the nuclear domain earlier than expected. That, in turn, confronts the United States with two near-peer nuclear competitors for the first time in its history. The possibility of facing two peer nuclear powers has engendered calls to expand U.S. nuclear forces.[56] Conversely, dissenters believe that as long as the United States does not require damage-limiting capabilities against the nuclear forces of adversaries, it already possesses sufficient forces to threaten devastating attacks on the civilian infrastructure (and populations) of both adversaries.[57] U.S. national security adviser Jake Sullivan said, "I want to be clear here—the United States does not need to increase our nuclear forces to outnumber the combined total of our competitors in order to successfully deter them."[58]

Finally, characterization of the U.S.-China strategic relationship has changed. In 2015, senior defense officials began describing the U.S.-China relationship as a "great power competition," and "strategic competition" became enshrined in U.S. policy under the 2018 National Security Strategy.[59] Relentless, rapid increases to China's defense budget made China the pacing threat in conventional terms. Eying eroding conventional advantage, some U.S. strategists argue that U.S. nuclear advantage could restore deterrence, while others worry that China's improved nuclear capabilities might signal a shift in its willingness to employ nuclear weapons to backstop conventional power. These factors have renewed attention to debates about nuclear escalation that began in the Cold War and continue to this day.

2

# Literature Review

## *What Creates the Greatest Pressure for Nuclear First Use?*

There is an immense body of literature on nuclear weapons strategy and employment stretching over 80 years. This chapter reviews prominent theories about factors that create pressure for or against nuclear first use. Rather than take an a priori stance on each subject, each section concludes with a positive hypothesis—that a given theory is correct. Chapter 3 addresses the literature and hypothesis about what might happen *after* the first use of nuclear weapons. The analysis chapters then test the hypotheses.

### The Nuclear Revolution

In 1946, Bernard Brodie wrote, "Thus far the chief purpose of our military establishment has been to win wars. From now on its chief purpose must be to avert them."[60] Over his tenure as secretary of defense, Robert McNamara shifted away from counterforce strategies to focus on "assured destruction" of Soviet cities and later stipulated that "Mutual Assured Destruction is the foundation of deterrence."[61]

At the end of the Cold War, Robert Jervis argued, "Nuclear weapons have drastically altered statecraft."[62] Summarizing the logic of a nuclear revolution, he argued that war among nuclear powers had become so destructive it was unthinkable, easing the security dilemma and the impetus for arms racing and making the status quo relatively easy to maintain.[63]

Recent critics of the idea of a nuclear revolution observe a puzzle: there has been a high degree of military insecurity and competition among major powers during the nuclear era despite no large-scale

war between these actors.[64] These critics argue that acquiring and maintaining a robust and survivable second-strike capability is difficult, time consuming, and impermanent.[65] Proponents counter that maintaining assured retaliatory capability was never said to be automatic but that wealthy major powers could afford adaptations that would keep retaliatory forces survivable and viable.[66]

## The Nuclear Taboo

Another possible restraining factor is the "nuclear taboo," the idea that norms against nuclear use have become deeply rooted since the end of World War II.[67] As evidence, proponents point to the nonuse of nuclear weapons since World War II, despite numerous wars involving nuclear powers. These normative considerations have created reputational costs of nuclear use that may also help explain the historical nonuse of nuclear weapons, especially against nonnuclear powers.[68] Others suggest that state policies, such as policies of no first use, discourage use outside the parameters of that policy, especially when force structure and practice are consistent with the stipulated policy.[69] China has maintained a consistent no-first-use retaliatory policy for six decades since first testing nuclear weapons in 1964, and its force structure has historically been consistent with the policy.[70]

The concept of a generalized nuclear taboo has been contested on several grounds. Public opinion in the United States might be more accepting of nuclear use than the term "taboo" would suggest, particularly when nuclear use is perceived as necessary for national security.[71] As a result, the U.S. attitude is mixed. The United States has never ascribed to a no-first-use policy, and its forces have been designed for a wide variety of missions. Its current policy, outlined in the 2022 NPR, allows nuclear use, though only in a narrow range of cases. Research on public opinion in Europe and China demonstrates a similar willingness to use nuclear weapons in extreme circumstances.[72]

*Hypothesis: Teams will be reluctant to employ nuclear weapons, even in situations where nuclear use would be militarily advantageous.*

## Inadvertent Escalation

Large-scale conventional military operations might inadvertently threaten core components of a state's nuclear arsenal, pressuring the target state to escalate to the nuclear level.[73] In the Taiwan context, U.S. incentives to attack China's conventionally armed ballistic missile forces would be high, but China's conventional and nuclear missile forces are difficult to distinguish from one another.[74] Hence, the United States might destroy nuclear-armed missiles incidental to the campaign against conventional missiles and create pressure on China to escalate ("use or lose"). Similar issues surround potential attacks on Chinese command and control, which may use the same systems for nuclear and conventional forces.[75] Some have argued that incidental attacks on nuclear forces, combined with uncertainty over the intent of those attacks, could spark escalation.[76] Chinese attacks on U.S. early warning satellites would carry similar risks. U.S. officials have warned their Chinese counterparts that attacks on space-based early warning systems, such as U.S. Space-Based Infrared System (SBIRS) constellations, would constitute a red line. Chinese strategists counter that since those satellites would also be used to cue attacks against conventional targets, they are legitimate targets.[77]

*Hypothesis: Conventional U.S. strikes on China's nuclear forces will pressure China teams to respond with nuclear weapons.*[78]

## Mainland Strikes

Separate from inadvertent escalation is a concern that any conventional strike on the homeland of a nuclear power would pressure the target state to respond with nuclear weapons.[79] In the context of a war over Taiwan, China possesses some conventional ability to attack the U.S. homeland, but the United States has much greater ability to attack the Chinese mainland. Some argue that restricting such attacks would prolong the conflict and lead to a long, drawn-out war.[80] Jan van Tol and his coauthors warn that granting sanctuary status to high-leverage targets inside China would severely undermine U.S. efforts to maintain strategic stability in the region.[81] They argue that the United States might need to strike specific targets in China to preserve its military advantage, though such strikes should be geographically limited to the areas near the conflict site to minimize escalation risks. Critics argue that attacking the Chinese mainland could provoke escalation, including a nuclear response.[82] In any case, this would be a major presidential decision during a war. It is impossible to predict ahead of time where the sitting president will come out.[83]

*Hypothesis: U.S. conventional strikes on nonnuclear targets on the Chinese mainland will pressure China teams to respond with nuclear weapons.*

## Gambling for Resurrection

Faced with the apparent superiority of Soviet conventional forces during the Cold War, the United States and the North Atlantic Treaty Organization (NATO) developed strategies that included the potential use of nuclear weapons to buttress deterrence.[84] To strengthen credibility, the strategies emphasized a willingness to employ nuclear weapons and took measures to underscore the likelihood of use. China, in contrast, maintains a no-first-use doctrine and foreswears the acquisition of tactical nuclear weapons. Nevertheless, in the event of a failed attempt to invade Taiwan, China might be tempted to resort to nuclear weapons to gamble for resurrection.[85] As discussed in the Background section of this report, some Chinese and Western analysts question whether a no-first-use policy would necessarily survive a looming military defeat in Taiwan.[86] Matthew Kroenig, for example, argues, "If Chinese leadership believed that it was losing a conventional war over Taiwan, it might seek to escalate to nuclear use in hopes of compelling negotiations for a settlement."[87] According to the 2023 CMPR, Beijing "probably would . . . consider nuclear use to restore deterrence if a conventional military defeat in Taiwan gravely threatened CCP regime survival."[88] However, nuclear use would also carry major risks, most obviously the risk of nuclear retaliation by the adversary. This would threaten regime (and national) survival. Thus, some analysts believe nuclear use, though possible, is unlikely and depends on the Chinese leadership seeing no viable off-ramp for the regime's survival.[89]

*Hypothesis: Conventional defeat will pressure teams to use nuclear weapons.*

## Deliberate Conventional Attacks on Nuclear Forces

Some strategists have advocated conventional attacks on strategic assets to pressure adversaries. The U.S. Maritime Strategy of the 1980s called for attacks on the Soviets' far eastern SSBN bastion. The intent was to alter Soviet perceptions of the nuclear balance "by destroying their SSBNs" and thereby "encourag[e] war termination."[90] After the Cold War, some saw conventional strike as a substitute for nuclear weapons. Conventional Prompt Global Strike could "cover practically one-hundred (100) percent of the North Korean, Iranian and Syrian target bases previously covered by nuclear forces."[91] New technologies, such as hypersonic weapons, could further enhance conventional counterforce.[92] Chinese and Western analysts have considered whether such capabilities would be directed at Chinese strategic targets. Some U.S. analysts have suggested reprising the 1980s Maritime Strategy, this time directing it against Chinese SSBNs in the South China Sea. U.S. commanders would "keep any conflict conventional as long as possible" to allow the search for "Chinese SSBNs in coastal waters within the protection of Chinese ASW assets."[93] Public advocacy of the idea is not widespread, so few have written against it. Nevertheless, many of the same arguments about the escalatory potential of incidental attacks on nuclear systems would apply with even greater force to more systematic attacks.[94]

*Hypothesis: Deliberate conventional attacks on nuclear capabilities will create pressure for nuclear use.*

## Counterforce Capabilities

The Cold War witnessed a debate between advocates of countervalue and counterforce doctrines, and a similar debate is currently playing out over nuclear strategy vis-à-vis China. During the Cold War, some strategists held that the nuclear revolution (discussed previously) made counterforce both futile and dangerous because it encouraged arms racing. In their view, "Deterrence comes from having enough weapons to destroy the other's cities; this capability is an absolute, not a relative, one."[95] Advocates of damage limitation argued that moving to a purely countervalue strategy provided a choice only between suicide and surrender. Such a strategy, they held, therefore lacked credibility.[96]

Through the early 2010s, residual Cold War capabilities endowed the United States with counterforce capabilities for damage limitation against China's relatively small nuclear forces. More recently, the acceleration of China's nuclear modernization has revived the debate over nuclear strategy. Charles Glaser and Steve Fetter, for example, argue that China's deployment of more missiles in different basing modes has eroded prospects for meaningful damage limitation and that pursuing damage-limiting capabilities could usher in an arms race.[97] These commentators also argue that the economic costs and political risks of pursuing damage limitation are not worth the marginal gains to survivability in the highly unlikely event of nuclear conflict. While no one has argued explicitly for returning to the countervalue strategy of the early Cold War, that approach is the natural corollary of many of these arguments.

Critics of this position counter that advances in space-based ISR, computation, and stealth technology provide new opportunities for counterforce strategies. They suggest that nuclear

superiority would provide deterrent leverage, especially against the employment of limited nuclear options (LNOs), since China would understand it is at a disadvantage at higher levels.[98] The emergence of two nuclear peers—Russia and China—has reignited debate over the size of the U.S. arsenal. The 2023 NPR notes that Russian and Chinese nuclear weapons present "new stresses on strategic stability."[99] The 2023 Strategic Posture Commission report calls for increased deployment of nuclear warheads and enhanced industrial capacity to produce nuclear weapons.[100] A study group at Lawrence Livermore National Laboratory echoes these recommendations.[101] The critical assumption in both of these reports is that a damage-limiting strategy, which can require large numbers of warheads, is a continuing requirement.[102]

*Hypothesis: U.S. counterforce capabilities will deter China teams from nuclear use.*

## Quantitative Nuclear Superiority

Scholars generally dispute the linkage between nuclear superiority and deterrence. Lauren Sukin, employing a large set of cases from the International Crisis Behavior (ICB) data set, concludes that resolve often trumps material advantage in the nuclear domain.[103] Proponents of the "nuclear revolution" emphasize the primacy of resolve, arguing that beyond a certain point, more nuclear weapons do not contribute further to deterrent or coercive capability. As Henry Kissinger put the case in 1977, "The essence of the contemporary problem in the military field is that the term 'supremacy,' when casualties will be in the tens of millions, has practically no operational significance."[104]

However, some strategists argue that strategic nuclear superiority is important to deterrence and successful resolution of crises. As Elbridge Colby argues, "Nuclear weapons are, after all, the ultimate trump card: if you can convince your enemy that you have a way to play the card and are actually prepared to go through with it, nothing is more powerful."[105] Kroenig defines nuclear superiority as "a military nuclear advantage over an opponent" that is operationalized "according to a state's expected cost of nuclear war." Specifically, he measures advantage in terms of cities struck and casualties suffered.[106] Quantitative comparisons, superiority, and overmatch are also frequent themes in the U.S. political and public media discourse on nuclear weapons.[107] Indeed, players in previous U.S.-China wargames often believed U.S. nuclear superiority would deter China from nuclear use.[108]

*Hypothesis: U.S. quantitative nuclear superiority will deter China teams from nuclear use.*

## Chinese Tactical Nuclear Forces

During the Cold War, the United States and the Soviet Union fielded tactical nuclear weapons in large numbers. Proponents of such weapons argued they provide an intermediate step between suicide (a massive nuclear exchange) and surrender. Others argued that possession of low-yield nuclear weapons lowers the threshold for nuclear use and creates risks of relatively quick nuclear escalation. When the Soviet Union collapsed, Russia's weakened military adopted an "escalate to

de-escalate" policy—use nuclear weapons to offset conventional weakness and force a favorable settlement. This engendered concerns that Russia would use nuclear weapons early in a conflict.[109]

This concern has carried over to China's nuclear buildup as some nuclear experts suggest China may be developing low-yield nuclear weapons.[110] While China does not currently field low-yield nuclear weapons, analysts are watching carefully. A Chinese decision to deploy low-yield nuclear weapons could also indicate a shift in nuclear warfighting concepts that imagines a more central role of nuclear weapons in its defense planning.[111]

*Hypothesis: China teams will be more likely to use nuclear weapons if they possess low-yield nuclear weapons.*

## Substitution for Conventional Munitions

Some commentators have speculated that combatants might use nuclear weapons when their inventories of conventional munitions run out. Nuclear use was almost always part of NATO's plan to counter Soviet conventional dominance, particularly if conventional munitions were insufficient to prevent Soviet forces from massing. Kroenig draws a parallel to a potential attack on Taiwan: "Similarly, the United States could rely on threatening nonstrategic nuclear strikes to deter and, as a last resort, thwart a Chinese amphibious invasion of Taiwan or a Russian tank incursion into Europe."[112] Likewise, a Center for a New American Security (CNAS) study speculated after conducting tabletop exercises (TTXs) on a U.S.-China conflict over Taiwan: "There might be increased pressure to use nuclear weapons as conventional weapons stocks became depleted."[113]

*Hypothesis: Shortages of conventional munitions will create pressure for nuclear use.*

3

# Literature Review

## *What Happens If Nuclear Weapons Are Used?*

The challenge for strategists is that nuclear weapons can kill most of an adversary's population but not change the minds of its people or leaders. Thus, nuclear use must be applied in ways to compel the other side to acquiesce to a political outcome they oppose. For this reason, conflict between nuclear powers has long been described by nuclear theorists as coercive bargaining.[114]

This chapter reviews the literature on what might happen after nuclear use. It is divided into three sections. The first addresses what targets might be struck during nuclear first use. It then surveys how the adversary might respond to nuclear use. It concludes with an assessment of how the conflict might end. Chapter 7: Analysis–What Happens If Nuclear Weapons Are Used? describes how the games provide insights into these questions. Appendix C: Nuclear Weapons Use and Effects contains details on nuclear weapon capabilities.

### What Could Be Targeted During First Use?

Since the beginning of the nuclear age, the question of targeting has generated heated debates. During the Cold War, the United States and the Soviet Union developed nuclear weapons to strike a wide variety of targets on land, at sea, and in the air. Targeting was not just a technical judgment of connecting weapons with aiming points. In peacetime, targeting plans drove decisions about the types of nuclear weapons and delivery platforms needed. In wartime, targeting would determine the course of conflict, the number of civilian casualties, and effects on other countries. With the end

of the Cold War, many target sets were put aside. For example, the United States no longer has any nuclear weapons designed to target ships, aircraft, or missiles in flight. China never had any.

Three target sets can be struck with today's nuclear weapons: cities/population (countervalue), nuclear forces (counterforce), and operational conventional forces—ports and airfields, ground forces, and ships at sea. Attacks on command and communications (through high-altitude electromagnetic pulses, HEMP) and targeting of nonnuclear allies are addressed as special cases.

### POPULATION AND CIVIL INFRASTRUCTURE (COUNTERVALUE)

The aim of countervalue first use would be to cause pain by attacking the enemy's population. This was the motivation for the United States in targeting Hiroshima and Nagasaki during World War II and is the most common usage in the minds of the general public. The primary effect was not in the material damage of destroying two large cities, but in the promise of more pain to come if Japanese decisionmakers did not comply.[115] A countervalue targeting strategy would not accomplish its goal if it destroyed all of an enemy's urban centers, as there would then be nothing left to hold at risk. The most sophisticated formulations of countervalue targeting call for a menu of infrastructure targets, ranging from remote sites causing few civilians deaths to society-destroying target sets.[116] However, these strategies are often difficult to discuss because of their moral implications.[117] For this reason, the United States (at least during the late Cold War) officially abjured the targeting of civilians in countervalue strikes; however, by targeting military and economic targets in cities, the United States kept an essentially countervalue option while allowing some psychic distance from mass murder.[118] Whether the actual target is a rocket factory in a city or the population of a city itself, China would likely react with a nuclear attack of its own on or near population centers.

Of note, none of the recent wargames or studies of nuclear use in a Taiwan scenario have postulated a countervalue first strike by either side, perhaps because it is unclear how a countervalue attack could compel an adversary to withdraw from the conflict.

*Hypothesis: Neither team will launch countervalue first strikes.*

### ENEMY NUCLEAR FORCES (COUNTERFORCE)

As discussed earlier, the effectiveness of damage-limiting counterforce attacks was a key debate in the Cold War and continues to this day. China does not possess today, nor will it possess in 2028, the ability to launch a disarming counterforce attack against the United States. Conversely, given the expansion of China's nuclear arsenal, the United States could not disarm China in retaliation for a Chinese nuclear attack, although it could destroy many Chinese nuclear ICBMs. This is true even if it were done early in the conflict, before China's nuclear arsenal is dispersed. As RAND argues, "The United States must treat Beijing as if it already has a second strike capability—especially by 2030."[119] Thus, the most likely scenario for counterforce first strikes would be an attempt by the United States to limit damage from China's arsenal and communicate a threat of continued attacks if China did not withdraw.

As with countervalue targeting, none of the recent wargames or studies of nuclear use in a Taiwan scenario have postulated a counterforce first strike by either side, likely because of the inability of either side to disarm the other.

*Hypothesis: Neither team will launch counterforce first strikes.*

## OPERATIONAL CONVENTIONAL TARGETS

During World War II, General George Marshall argued that U.S. nuclear weapons should be employed against Japanese military targets, such as naval installations or outlying islands with military facilities, rather than against industrial targets or cities.[120] Discussions about employment options against conventional targets continued after the war and included the use of large-yield weapons in tactical roles. Starting in 1952, the United States began to produce and deploy tactical nuclear weapons with reduced yields. Both the United States and, later, the Soviet Union deployed thousands of tactical nuclear weapons in Europe during the Cold War.[121] Although many Western military leaders and theorists during the Cold War believed that tactical use would benefit the defender, Soviet and Warsaw Pact sources indicate that they believed that the attacker could also benefit.[122]

A variety of targets are possible in the context of a Taiwan conflict. The discussion of tactical nuclear options and doctrine, then and now, can be divided into thinking on deterrence questions (discussed earlier) and thinking about wartime use. The latter can be further divided into the assessment of operational effects, on the one hand, and their political impact and influence on wartime outcomes, on the other. The former is discussed below, while the latter is addressed in a later section (see How Did the Conflict End?).

**Ports and Airfields:** Ports and airfields offer significant benefits to the conventional fight, as one nuclear weapon could achieve the effect of many conventional ballistic missiles. The RAND Corporation, for example, did an extensive and highly influential series of studies in the 1950s on the vulnerability of bomber bases to nuclear attack.[123] Recently, Russia has reintroduced the concept of using nuclear weapons as part of a conventional conflict, with NATO airfields as a potential target.[124] Table C4 in Appendix C shows the reason that airbase attacks are attractive: Even a relatively small nuclear detonations are devastating for unprotected aircraft on the ground. For example, a 10 kiloton (kt) detonation will destroy nearly all aircraft, even at large air bases where aircraft can spread out. This is not surprising since aircraft are complex, sensitive, and thin-skinned.[125] Ports are also attractive targets because ships there are stationary and easily located by overhead surveillance, and therefore vulnerable to attack by GPS-guided munitions. Commentators have therefore speculated that ports might be good nuclear targets.[126]

For this reason, nuclear attacks against airfields have been a common part of previous wargames. Three previous wargames have resulted in nuclear attacks against Guam (either as part of the scenario designed by the researchers or independently decided on by players).[127] On the other hand, bases further afield (in the continental United States or Australia) have not been targeted.

*Hypothesis: Teams will target ports or airfields in the theater with nuclear weapons to gain an operational advantage despite the retaliation risk.*

**Ground Forces:** Targeting enemy ground forces with nuclear weapons can provide significant operational benefits while limiting the likelihood of enemy retaliation. One weapon can have an outsized effect on enemy forces because of its great power. A single 10 kt weapon has the explosive power of 20,000 1,000-pound bombs. By using air bursts, attackers can destroy adversary forces without causing a lot of radioactivity. They can then move around the relatively small radioactive area and attack into an adversary's rear. On the assurance side, battlefield use has less effect on civilians than strategic attacks on cities or nuclear forces. However, even limited effects can be devastating; Appendix C describes these effects on civilians from battlefield usage of nuclear weapons on Taiwan.

Because of the battlefield advantages of using nuclear weapons, many commentators have speculated that China might use them on Taiwan, particularly if the invasion force gets stalemated.[128] Matthew Kroenig argues that if Chinese forces had landed on Taiwan but not yet broken out of their bridgeheads, the Taiwanese defending units might be lucrative targets for U.S. nuclear strikes.[129]

*Hypothesis: Both teams are likely to use nuclear weapons against ground troops on Taiwan.*

**Ships at Sea:** The possibility of using nuclear weapons against ships at sea is appealing because it offers the potential to communicate resolve by attacking a strictly military target while avoiding a homeland attack that might provoke a general nuclear conflict.[130] Discussion of this possibility has resurfaced in the context of a U.S.-China war. Several analysts have posited that China would act on this logic to attack U.S. ships during a war over Taiwan. For example, Andrew Metrick et al. argue that a nuclear attack on U.S. carrier strike groups "would limit casualties and infrastructure damage, improve the conventional balance, and destroy an asset with significant prestige value."[131] Similarly, Jacob Stokes argues that U.S. ships at sea are an attractive target because "China's leaders would be looking for a way to take limited action that the United States would not be willing to match or exceed."[132]

The challenge is that ships are robust targets. A 15 pounds per square inch (PSI) shockwave is needed to incapacitate most ships. This requires a nuclear weapon to detonate near the target ship, about 800 m for a Hiroshima-sized weapon. Without terminal guidance on nuclear missiles, which both sides lack, this is nearly impossible to do without using a pattern of detonations. (See Tables C2 and C3 in Appendix C for details.)

Several commentators have suggested that the United States use nuclear weapons against Chinese amphibious ships off the beach. George Weaver of the Atlantic Council has stated: "[The option] that combines the highest effectiveness with the least escalation potential would be a nuclear strike on China's amphibious force as it prepares to offload near the Taiwanese shore."[133] China has noticed these discussions: "By late 2018, PRC concerns began to emerge that the United States

would use low-yield weapons against its Taiwan invasion fleet, with related commentary in official media calling for proportionate response capabilities."[134]

The reason for U.S. nuclear use against Chinese amphibious ships is that such attacks would not suffer from these same difficulties as attacks against ships at sea. During a Chinese invasion of Taiwan, many amphibious vessels must be accommodated off narrow beaches. These vessels cannot spread out as much as ships at sea and need to stay relatively stationary while off-loading. This eases the ISR problem. Being stationary and bunched together, these ships would be targetable by the coordinate-seeking nuclear weapons in the U.S. arsenal; one nuclear weapon might even neutralize multiple ships. Nuclear detonations offshore would also be less damaging to Taiwan and its population than detonations ashore. There are some downsides. As with ground use, many nuclear weapons must be used against the Chinese amphibious ships to destroy enough capability to have an operational effect. Also, offshore nuclear attacks would still affect Taiwan through blast and radiation effects.[135]

Nevertheless, because the amphibious fleet is critical to the invasion's success, it will be an attractive target.

*Hypothesis: U.S. teams will target Chinese ships, but only during the amphibious offloading. China teams will not use nuclear weapons at sea.*

### SPECIAL CASES

**High-Altitude Electromagnetic Pulse (HEMP):** HEMP occurs when a specially designed nuclear weapon detonates high in the atmosphere. The resulting electronic pulses disrupt electronics and communications.[136] It is attractive because the disruption provides a military advantage without causing kinetic or thermal damage to civilians or military forces. Its effects were demonstrated dramatically by the 1962 Starfish Prime nuclear test in space, which affected radio signals on Hawaii 900 miles away.[137] Other nuclear tests also showed the phenomenon. Nuclear weapons testing in space ended in 1963 with the Partial Test Ban Treaty, but lab experiments have been ongoing to the present day.[138]

It is unclear whether HEMP usage would be treated the same as nuclear weapons that cause direct effects. For example, the U.S. EMP Commission warned: "Our increasing dependence on advanced electronics systems results in the potential for an increased EMP vulnerability of our technologically advanced [military] forces, and, if unaddressed, makes EMP employment by an adversary an attractive asymmetric option."[139] HEMP also appears frequently in the popular literature as a trigger for social and economic collapse.[140] The Congressional Research Service summarized the threat: "An EMP attack directed at the United States involving no violent destruction, nor instant death for large numbers of U.S. citizens, may not necessarily evoke massive retaliation by the U.S. military."[141] In a previous wargame by the Center for New American Security, the China team used a HEMP to communicate resolve.[142]

*Hypothesis: Both teams will conduct HEMP attacks because they are perceived as less escalatory than other nuclear options.*

**Targeting Nonnuclear Allies:** Although they are not a distinct target type, the special nature of nonnuclear allies must be addressed. Extended nuclear deterrence refers to the provision of deterrent guarantees, backed by the threat of response, by one country to another. In the nuclear context, extended deterrence is provided by a nuclear state to protect a nonnuclear partner or ally. It has been practiced primarily by the United States. After the Soviet Union gained the ability to strike U.S. cities with large numbers of ICBMs in the mid-1960s, strategists questioned whether nuclear guarantees to NATO were credible in light of likely counterstrike by the Soviets.[143] Tactical nuclear weapons were deployed to Europe and South Korea to increase credibility by making it more likely that nuclear weapons would be used in defense of allies.[144] In the immediate aftermath of the Cold War, the United States deemphasized nuclear weapons in its national security strategy and removed them from warships. However, the growth of Chinese military power has prompted concerns on the part of Asian allies. In 2010, the United States began an Extended Deterrence Dialogue with Japan and established an Extended Deterrence Policy Committee with South Korea.[145] Nevertheless, insecurity among allies persist, and some U.S. and regional analysts have called for stronger measures to buttress credibility, lest Seoul explores indigenous nuclear options.[146]

In the context of a Taiwan invasion, China could attack Japan with nuclear weapons to compel its withdrawal from the war. Losing Japanese access, basing, and overflight would doom the U.S. conventional campaign.[147] Kroenig tacitly treats extended deterrence as strong, bundling U.S. and Japanese territory in the same category of targets.[148] None of the previous wargames postulate a nuclear attack on Japan.

*Hypothesis: China teams will avoid targeting Japan because of the logic of extended deterrence.*

## How Does the Adversary Respond?

After nuclear first use, what happens? While there are an infinite variety of responses, this section groups them into five categories, describes each category, and highlights the most relevant considerations for or against each. The two nonnuclear responses include withdrawing from the conflict and continuing the conventional campaign. The three nuclear responses are grouped by target: operational, countervalue, or counterforce.[149]

### NONNUCLEAR RESPONSES

**Withdrawing:** One response to nuclear first use is to withdraw from the conflict. "Withdrawal" is more accurate than "surrender" because a country targeted by the threat of nuclear use (made credible by actual nuclear use somewhere) need not change its form of government and accept occupation to avoid the threatened pain of continued nuclear use. It would not be necessary to choose to be "Better Red than Dead."[150] Assuming that the terms demanded by the nuclear first user are limited and understood correctly, acquiescing to them could spare the target of nuclear use the pain of further nuclear attacks. For example, in the face of Soviet nuclear use during an invasion, the United States could have withdrawn from Western Europe without surrendering Washington to the Soviet Union. However, the balance of global power would have been profoundly affected. And

the Soviets could not have provided meaningful assurances that occupying Western Europe (or any portion thereof) would end Soviet ambitions.[151]

In a Chinese invasion of Taiwan, the stakes are different for the two sides. PRC withdrawal following U.S. nuclear use might threaten Chinese regime survival. U.S. withdrawal would be unlikely to threaten the U.S. form of government, although it might strain the credibility of its other security commitments, trigger extensive nuclear proliferation, and set a precedent for other states' pursuing conquest backed by nuclear threats or use. Offsetting this, U.S. withdrawal in the face of PRC nuclear first use in an offensive war might give the United States the moral high ground in world opinion. Moreover, unlike the Cold War, changing ownership of Taiwan would not substantively affect the international balance of power.[152] However, this might count for little in what would surely be a transformed international system.

*Hypothesis: China teams will be less likely than U.S. teams to withdraw from the conflict in response to nuclear first use.*

**Continuing the Conventional Campaign:** Alternatively, an adversary could continue the fight at the conventional level. This offers the prospect of obtaining victory without suffering the moral stigma of employing nuclear weapons. While continuing the war conventionally was not considered in the Cold War due to the perceived superiority of Soviet conventional power, it might be feasible in a conflict between the United States and a smaller adversary, such as North Korea. For this option to be successful, two conditions would have to hold. First, initial nuclear use could not have decisively changed the conventional balance of power. Second, the first user could not be willing and able to use additional nuclear weapons in ways that would subsequently change the balance of conventional power.[153] For example, if the nuclear first use took the form of a nuclear demonstration or HEMP and the first user was not willing to use nuclear weapons in direct strikes, continuing the conventional campaign would be a way for the targeted adversary to call the first user's bluff. However, just as with withdrawal, there is no assurance that the nuclear first user would not continue using nuclear weapons.

*Hypothesis: Continuing the conventional campaign will not lead to successful outcomes unless the adversary cannot continue nuclear attacks.*

## NUCLEAR RESPONSES

All nuclear responses to nuclear first use have benefits by signaling resolve, reassuring allies and partners, and discouraging future proliferation.[154] They also have costs and risks. They contribute to nuclear destruction and risk further nuclear use or escalation by the adversary, together with its attendant destruction.[155]

**Use Against Operational Conventional Targets:** The advantages of attacking conventional battlefield targets as part of first use apply equally to the adversary's nuclear retaliation. Indeed, depending on the nature of operations and the target set available to the adversary, nuclear retaliation could generate operational effects greater than those gained in nuclear first use. During European Cold War scenarios, many nuclear strategists felt that the "massed troops" of Soviet

attacking forces, "would be an inviting target for NATO's tactical nuclear weapons."[156] However, it is also possible that the Soviets might have gained more operational advantages from nuclear use either because higher casualty rates would favor the manpower-rich Soviets or because static defensive positions would be more vulnerable than mobile, offensive columns.[157] The conclusion of NATO studies was that "large-scale use of nuclear weapons against a massive Warsaw Pact attack in Europe was unlikely to produce a decisive military victory."[158] Echoing NATO's assessments, Soviet war plans assumed that they would be able to retake the initiative with nuclear retaliation to NATO's nuclear first use.[159] Therefore, at the operational level, a nuclear retaliation targeted at the first user's conventional forces might be able to overcome the tactical advantages that the first user gained in the initial strike.

In the context of a Chinese invasion of Taiwan, both sides have operational nuclear targets that could, if struck, help them regain the initiative following nuclear first use by the adversary. Many operational targets for the United States (ports, airfields, and missile bases) are on the Chinese mainland, and the same targets for China are largely in Japan or Guam. However, such targets would require many nuclear weapons and carry a high risk of escalation. There are also Chinese ships at sea, although these would be difficult to target with the United States's current arsenal of coordinate-seeking weapons; furthermore, destroying them would not be decisive. The exception is the amphibious fleet and the lodgment itself on Taiwan; as discussed above, these targets are relatively compact and their destruction is more likely to be decisive for the conventional campaign. China's target set for operational nuclear retaliation looks similar: there are bomber bases in the United States and fighter bases in Japan, striking either of which would make another round of nuclear use by the United States likely. China similarly lacks nuclear weapons suited for targeting U.S. ships and submarines. Taiwanese ground forces are vulnerable to many Chinese nuclear weapons, although they would be more dispersed than the Chinese lodgment and therefore require a larger strike to neutralize. To return to the larger point, any retaliation would have to communicate resolve and have a political effect, lest the first user simply continue.

*Hypothesis: Operational nuclear retaliation will prevent first users from gaining decisive military advantage.*

**Countervalue:** As in the case of first use, countervalue retaliation would aim to compel the first user to cease military operations on favorable terms. During the early Cold War, countervalue attacks were considered in the context of "limited strategic war" but fell out of favor as the scale of nuclear armament increased. The same logic that makes countervalue targeting in first use risky—that it might create an escalatory spiral—should logically hold for countervalue retaliations.[160]

*Hypothesis: Countervalue retaliation will not achieve anticipated political results and will produce escalatory spirals.*

**Counterforce:** A counterforce retaliation would seek to limit further nuclear damage. As the first user has already demonstrated that they are prepared to use nuclear weapons, their nuclear capability is demonstrably a threat. Although Kroenig postulates two variants of counterforce retaliations against Chinese first use (either against the Chinese facility generating the strike or as

part of a broader damage-limitation strategy), he notes the risks that this would entail because of the survivability of Chinese road-mobile ICBMs.[161] Whether a damage-limiting counterforce attack could coerce war termination has been debated. On balance, the literature suggests that teams will be dissuaded by the risks of counterforce retaliations.

*Hypothesis: Counterforce retaliation will not achieve the anticipated political result of coercing the adversary into favorable war termination.*

## How Does the Conflict End?

This section examines debates about conflict termination and generates associated hypotheses. First, the conventional balance created by nuclear use might not affect the bargaining outcome. Second, nuclear superiority and escalation dominance might determine the outcome, not any targeting or negotiating decisions. Third, any nuclear use might ineluctably end in conflagration, making any attempt at bargaining pointless. Finally, neither side might be able to achieve complete victory; either a compromise will be struck, or a general nuclear war will occur.

### BARGAINING AND NUCLEAR SUPERIORITY

Many strategists, such as Robert Jervis and Thomas Schelling, emphasize non-military factors in nuclear bargaining, especially when both sides have an assured retaliatory capability. Schelling famously contrasted the relative nature of conventional arms and the absolute nature of nuclear weapons: "Brute strength is usually measured relative to enemy strength, the one directly opposing the other, while the power to hurt is typically not reduced by the enemy's power to hurt in return."[162] Jervis puts the case directly, "if the arguments about the nuclear revolution are correct, there should be only tenuous links between the details of the military balance and political outcomes."[163] Empirical studies on whether nuclear advantage, variously defined, correlates with successful outcomes have come to differing conclusions.[164]

Strategists sympathetic to the nuclear revolution have tended to view nuclear bargaining and outcomes as largely contests of resolve, within which interests, signals of commitment, and strategies of brinksmanship are critical to outcomes. To a point, resolve will depend on material interests, such as geographic or historical proximity to the subject at stake. But both sides are likely to assert the importance of interests, and, as Robert Jervis has observed, statements of commitment can themselves become interests.[165] Moreover, brinksmanship and the manipulation of risk can also be employed to demonstrate commitment and gain bargaining leverage, regardless of their respective military strengths. Indeed, much of U.S. deterrence strategy in Europe during the Cold War rested on an engineered risk of tactical nuclear use that would not require a presidential order. This is, in Schelling's words, the "rationality of irrationality." One recent empirical study on nuclear advantage and outcomes finds that attempts at coercion against those with much weaker (asymmetric) nuclear capabilities are likely to fail due to some combination of the stakes involved for those countries and the need for weaker parties to demonstrate extreme resolve.[166]

However, while many observers have stressed the roles of non-military factors in bargaining strategy, others have emphasized nuclear capabilities.[167] If one side enjoys escalation dominance, an advantage

at the current and higher levels of warfare, then a positive political outcome is presumably more likely. For example, in the Taiwan context, Kroenig's writing about deliberate nuclear use largely focuses on escalation dominance. "In the event of Chinese nuclear use during a war over Taiwan," he writes, "the United States would need to convince China that any further nuclear use would be met by a decisive US response and would, therefore, not advance Chinese objectives."[168]

*Hypothesis: Nuclear superiority will be important in bargaining outcomes.*

### BATTLEFIELD STATUS AND THE WAR'S OUTCOME

While the nuclear balance is often emphasized in the literature on nuclear outcomes, less has been said about the status of the operational fight and its impact. Thomas Schelling, for example, writes that "What happens on the battlefield may be of only moderate interest compared with the conduct of such a nuclear war of nerve and endurance." Some, however, have touched on the issue. In his discussion of five possible positions that nuclear adversaries might adopt during nuclear conflict bargaining, Herman Kahn lists "compromise settlement that more or less reflects the current status of occupied and unoccupied territory … but also includes some quid pro quo trades."[169] Although this position does not have a privileged position in Kahn's list, prospect theory might suggest that it is a likely option for any contenders seeking an off-ramp. Prospect theory, an idea originating in behavioral economics, suggests that actors are willing to run higher risks to defend or protect what they already have than to gain something new.[170] Theories of deterrence and compellence, which reference prospect theory, suggest that attempts to compel an adversary to surrender values in its possession will be more difficult than efforts to deter an adversary from attempting to seize what it does not.[171]

*Hypothesis: Battlefield advantage will convey some benefit in shaping positive outcomes to the side holding that advantage.*

### CONTROLLING NUCLEAR WAR

Implicit in nuclear use as a form of military bargaining is the question of controllability of nuclear conflict. Some have argued that nuclear war, once begun, is exceedingly difficult, if not impossible, to control. These individuals view the critical threshold not between tactical and strategic use but rather between conventional and nuclear conflict. As Alain Enthoven put it in 1975, "nuclear war is indivisible." "Once it starts, there are no recognizable firebreaks or stopping points," and, he concluded, "general nuclear war . . . will ensue."[172] Lawrence Freedman and Jeffrey Michaels expressed the problem that both sides must understand the need for limitations, writing, "It takes two to keep a war limited."[173] For these reasons, Enthoven and like-minded thinkers opposed deployment or reliance on nuclear weapons.[174] The fear of unlimited war was also prevalent in the popular imagination.[175]

However, for precisely the same reasons, many, especially in Europe, supported the deployment of tactical nuclear weapons to Europe and the delegation of their use to battlefield commanders.[176] If tactical nuclear weapons might be employed and if the use of these weapons will lead eventually to strategic nuclear exchanges, then tactical nuclear weapons provide a credible and relatively inexpensive deterrent against attack.

Others have argued that nuclear war may be controllable, but, in contrast to the escalation dominance school, emphasize the importance of proportionality and restraint in the weapons employed and targets struck. Brodie wrote that "[t]here was no problem in distinguishing between tactical and strategic bombing in World War II, and in avoiding the latter where it seemed politically desirable." Brodie believed "it is hardly self-evident that the distinction would be more difficult where nuclear weapons are involved."[177]

As Vincent Manzo writes, "[e]very deterrent threat contains a promise of restraint: do not attack us, and we will not attack you." Following from this, escalation management, "requires combatants not to use certain types of weapons and avoid attacks on certain types of targets even after efforts to deter conflict in the first place fail."[178]

Thus, during the 1960s and 1970s, U.S. planners struggled to develop more flexible and nuanced nuclear plans with options between "surrender and suicide." These efforts reached their most advanced state under Secretary of Defense James Schlesinger's doctrine of limited and controlled nuclear strikes.[179] Schlesinger developed this concept while at RAND and implemented it as Secretary of Defense in NSDM-242: "Plans should be developed for limited employment options which enable the United States to conduct selected nuclear operations, in concert with conventional forces."[180] The nuclear war plan SIOP-5 reportedly turned this guidance into specific targeting.[181] The literature is severely divided on this subject without a clear consensus.

*Hypothesis: Nuclear wars cannot reliably be controlled.*

### THE VALUE OF OFF-RAMPS

Assuming that war does prove controllable, there is, finally, the question of off-ramps, war termination, and what form conflict termination might take. Just as many argue that limits on the means of nuclear conflict (i.e., the use of smaller-yield or smaller numbers of nuclear weapons) might make nuclear war more controllable, many also argue that limiting the ends of nuclear conflict would be central to terminating conflict and preventing general nuclear war. Herman Kahn, for example, wrote "neither side should attempt to force the other to unconditional surrender," and "successful negotiations require some compromises even by the 'winning' side."[182] Given both the stakes and the time pressures of nuclear conflict, one cannot "fight a war to a conclusion and then settle most of the details of the peace," but rather necessary to "start negotiations at the onset of war."[183] During the Cold War, the need for limiting objectives in nuclear conflict was also emphasized by Henry Kissinger, Robert Osgood, and many other prominent practitioners and theorists.[184]

*Hypothesis: Neither side will achieve complete victory; they will reach a settlement or general nuclear war will occur.*

4

# Research Design

This project examines policy-relevant nuclear aspects of a hypothetical Chinese invasion of Taiwan in order to inform U.S. policy regarding nuclear deterrence and escalation. The authors do not argue that an invasion is inevitable or even likely, but they do argue that invasion is plausible. China could decide to invade Taiwan for a variety of reasons: domestic political needs, the personal priorities of President Xi Jinping, perceived Taiwanese provocation, perceptions by Beijing that Washington has fundamentally abandoned its One China policy, misestimation of the military balance, or fear that time Taiwanese unification would only get harder over time. The authors chose the year 2028 for two reasons. First, it is during the "Davidson window," the period when many U.S. officials have said there is risk of an invasion.[185] Second, 2028 was the end of the Department of Defense's Future Years Defense Program, which allows enough time for current programs to mature and policy changes to take hold. Yet it was not so far in the future that U.S. and Chinese capabilities became uncertain.

The research focused on two questions about nuclear escalation in a Taiwan invasion scenario:

1. What creates the greatest pressure for nuclear first use?
2. What happens if nuclear weapons are used?

To address these questions, the research team adapted its Taiwan Operational Wargame (TOW) for nuclear play and conducted 15 iterations of the new wargame.[186] TOW was developed for a previous project examining a conventional conflict over Taiwan in 2026. The adaptation updated the orders of battle and inventories of key conventional munitions to estimated 2028 figures, developed estimates for nuclear weapons inventories, refined game mechanics based on lessons from the first

*Left: Participants debate their next move in a 1963 wargame run by Professors Lincoln Bloomfield and Thomas Schelling at MIT's Endicott House. Right: Participants study the map in the same room 61 years later during one iteration for this project.*

Source: MIT Security Studies Program; and CSIS Defense and Security Department.

project, simplified the conventional warfighting mechanics, incorporated nuclear weapon effects, and added modules for political bargaining and nuclear posture changes.[187]

The games were conducted at CSIS in Washington, D.C., at MIT in Cambridge, MA, at the Naval War College in Newport, RI, and at the Naval Postgraduate School in Monterey, CA. Two iterations took place at MIT's Endicott House Conference Center, the same location where Thomas Schelling and other nuclear strategists ran POLEX nuclear wargames in the 1950s and 1960s.[188] The picture below on the left shows a nuclear wargame from the 1960s; the picture on the right is from this project in 2024. The challenges of nuclear weapons have plagued the world for a long time.

The base assumptions for all 15 game iterations came from the original wargame. These assumptions included China mobilizing 30 days out, the United States responding after 15 days, Japan remaining neutral unless attacked but allowing the United States to use its bases in Japan, and no opportunistic aggression by other hostile powers.[189] China, seeking to maintain ambiguity about its intentions, did not increase its nuclear posture before the invasion. Similarly, the United States refrained from increasing its nuclear posture to avoid escalating the crisis.

Players were divided into three teams: the United States, Japan, and China. For the sake of convenience and playing speed, the U.S. team controlled Taiwanese forces. Participants took the role of military theater commanders: the Indo-Pacific Command (INDOPACOM) for the United States, the Eastern Theater Command for China, and an ad hoc Joint Forces Command for Japan.[190] The order of battle for each country assumed that, in addition to the peacetime forces from the respective commands, significant forces arrived from other commands.

As with the previous project, the 85 game participants were experts from a variety of governmental, think tank, academic, and military backgrounds. All participants had expertise in relevant fields

such as military operations, Asian affairs, and nuclear capabilities. Players on the Japan team had at least some background in Japanese security policy, and most had extensive expertise in that area. China teams generally included some country expertise. Many nuclear strategy experts participated to ensure realistic consideration of strategic issues. With one exception, participants played only once each. About one-third of the participants were considered senior flag/general officers, senior scholars with government experience, or former government officials at the assistant secretary of defense (ASD) level or above. This meant that most teams had at least one senior member.

Game participants were told to play their best game. Decisions therefore came from the participants' individual perspectives and were not based on the policies of the U.S. government or any plans that government agencies might have. The high degree of expertise and experience among the participants meant that gameplay reflected plausible courses of action.

*The high degree of expertise and experience among the participants meant that gameplay reflected plausible courses of action.*

Teams had full control over conventional forces—naval, air, and ground—as well as cyber, space, and counterspace capabilities. Each turn represented 3.5 days. Engagements (e.g., missile attacks on air bases and antisubmarine operations) were adjudicated using probability tables that the authors derived from operations research.

Teams did not have ultimate authority over nuclear posture, nuclear use, or political off-ramps, which are the purview of the national command authority (NCA) in both the U.S. and Chinese systems.[191] Instead, they provided recommendations to their respective NCAs about these actions based on the expected military utility and the adversary's likely response (including nuclear responses). The teams were told that their NCA would address political and moral considerations related to nuclear use.

The teams were instructed to meet campaign objectives "preferably without the use of nuclear weapons," but failure to achieve objectives "would carry national and personal consequences." The control team, in its additional capacity as the NCAs for China and the United States, decided all requests for nuclear posture changes, nuclear weapons employment, and negotiated off-ramps. To explore as many instances of nuclear escalation and nuclear operational effects as possible, the control team approved all such requests, though the players were not told that this would be the case.

To calculate nuclear weapon effects, the project worked with the Defense Threat Reduction Agency Research and Development Directorate (DTRA RD) to use the Mission Impacts of Nuclear Events Software (MINES) tool.[192] The team developed simplified tables covering the employment of nuclear weapons against operational targets. Where data from MINES was unavailable or impractical, publicly available tools such as NukeMap and Nuclear War Simulator were substituted.[193] In the case

of targeting ships at sea, the project also employed original modeling to analyze target movement and the kill chain. Adjudication rules employed these MINES-derived algorithms to cover nuclear attacks on ports, airfields, and frontline troops, as well as strategic attacks against cities and nuclear forces. The results were expressed in terms of civilian casualties and the destruction of or damage to operational targets.

Finally, the game included political-military decisionmaking related to war termination. Without the possibility of ceasefire off-ramps, every iteration could lead to total nuclear war as each side sought a final resolution to the conflict. Therefore, at the end of every turn, each team could send a note to the other team explaining its position and offering a ceasefire with one of four conditions (though teams could, and sometimes did, offer modified conditions):

1. **PLA Surrender:** PLA troops ashore surrender and become prisoners.
2. **PLA Phased Withdrawal:** Taiwan and the United States allow PLA troops to withdraw from Taiwan, and any Chinese prisoners of war (POWs) are returned in stages.
3. **PRC Enclave:** All forces maintain their current positions, and mutual resupply is allowed. This creates a PRC-controlled enclave on Taiwan.
4. **U.S. Withdrawal:** The United States agrees to withdraw from the area around Taiwan during ceasefire, presumably leading to CCP dominance over the island.

Conditions two and three represent outcomes that are substantively similar to conditions one and four but with face-saving modifications. A phased withdrawal from Taiwan would mark substantive failure for the CCP but allow it to claim victory. Chinese leaders would worry that a failed invasion would undermine its domestic legitimacy. It would be particularly difficult to deny defeat if there were scenes of captured PLA POWs being paraded through Taiwan. Absent such stark, undeniable scenes, the Chinese leadership could claim it had always intended its invasion to be a punishment campaign and that, having accomplished this goal, it was ending the operation. Thus, by returning PLA POWs and allowing uncaptured PLA soldiers to return (presumably via small boats, leaving most of their equipment behind), Taiwan and the United States would be forgoing one of the fruits of victory without substantively undermining their overall operational success.

On the other side, allowing a PRC enclave on Taiwan represents a partial victory for China, one that might, over time, become a fuller victory. The PLA could build up considerable forces and supplies in this enclave and perhaps coerce a substantive takeover of the whole island. On the other hand, Washington might change its China and Taiwan policies in response to the conflict and deploy troops to the island. In any case, this was a better outcome for the United States than an unconditional withdrawal.

All of these offers assume some kind of follow-on negotiations that were not part of the wargame. Gameplay continued until the teams agreed to a settlement or nuclear use escalated to a general nuclear exchange.

## Scenario Variations

The project varied scenarios along two dimensions in the 15 iterations: U.S. rules of engagement (ROEs) concerning conventional strikes against the Chinese mainland and the evolution of Chinese nuclear capabilities. These factors are believed to affect decisionmaking on nuclear escalation and would be outside the span of control of military commanders during a conflict.[194] Thus, they were appropriate for scenario construction rather than gameplay.

The literature and previous wargames suggest three levels of U.S. ROEs to explore both the impact of conventional strikes on the Chinese mainland and the risk of inadvertent escalation. In the first condition, the NCA does not allow any U.S. conventional strikes on the Chinese mainland. This limits U.S. military options against the Chinese invasion but avoids both escalation from striking Chinese territory and inadvertent escalation from accidentally striking Chinese nuclear forces. In the second condition, the NCA allows conventional strikes on mainland targets that are unambiguously nonnuclear in nature (e.g., Chinese ports used for the loading of amphibious ships). This grants military advantages at the risk of incurring Chinese escalation in response to strikes on the mainland but again avoids inadvertent escalation. In the third condition, U.S. conventional forces can strike any targets on the mainland, even if those strikes could affect Chinese dual-use systems and nuclear early warning and command and control facilities. This grants maximum U.S. warfighting advantage while risking a nuclear response both for mainland strikes and inadvertent escalation.

Two variations involve Chinese nuclear capabilities: Assured Retaliation Focused and Low Yield Enabled. Both variants posited that by 2028 China will have expanded the number of warheads in its arsenal in accordance with the most recent CMPR.[195] In Assured Retaliation Focused, China continues its traditional assured-retaliation nuclear posture. By improving early warning systems and spreading its warheads onto more missiles by reducing the proportion of missiles with MIRVs, China gains a significantly more secure second-strike capability than it has today. However, in this variant, China does not deploy low-yield nuclear weapons.

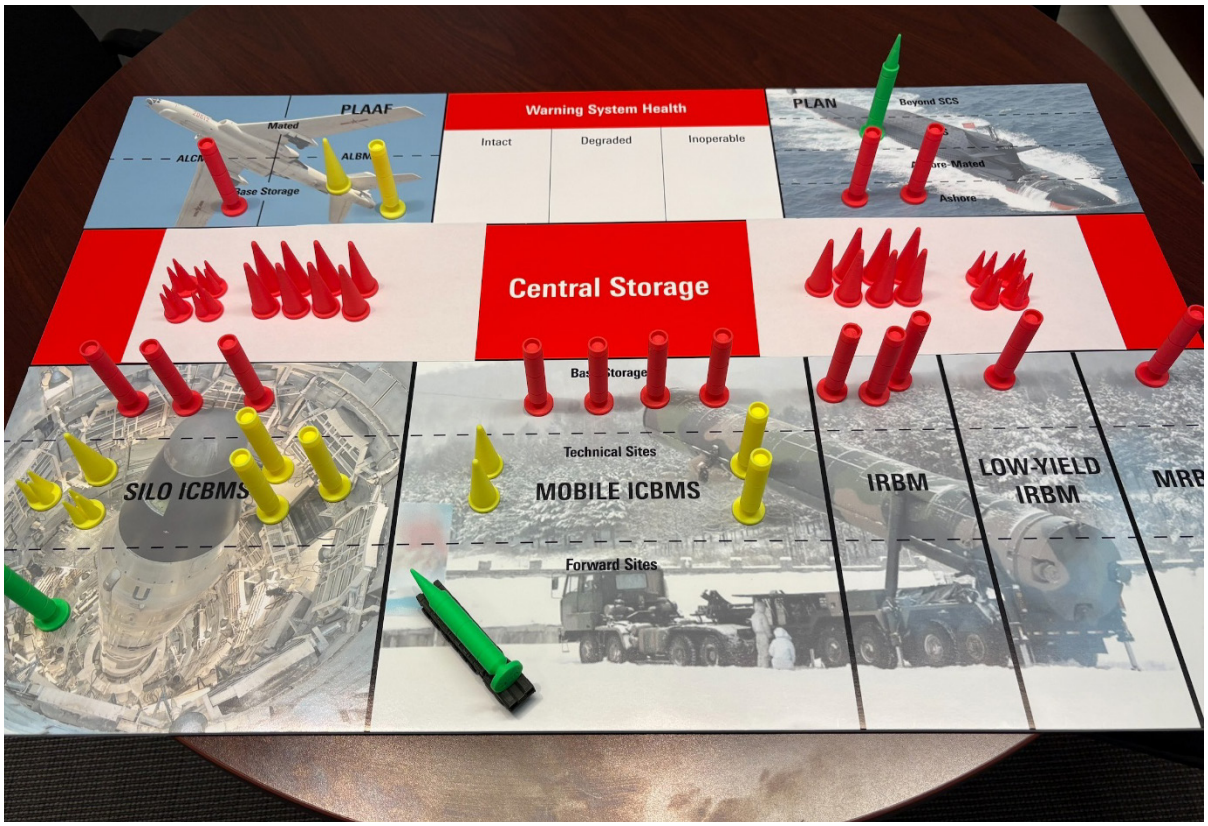
In Low Yield Enabled, China has changed its nuclear posture to become more like the United States by deploying low-yield weapons. If China developed low-yield weapons, it would possibly reflect a change in attitude toward nuclear use that could not be modeled by non-Chinese players; however, by giving China teams low-yield weapons, it was possible to test whether the possession of these options changed deterrence and use patterns. Although China would still possess a secure second-strike capability in the Low Yield Enabled posture, this second strike is weaker than for the Assured Retaliation Focused variant.

Each of the three ROE cases was run with the two potential Chinese nuclear force structures to produce six distinct scenarios. With 15 iterations, three of the scenarios were run twice each, and the other three were run three times each to explore the impact on nuclear thinking and use.

Prior to the 15 games for record, beta testing was conducted at MIT on January 19–20, 2024, and a series of six ground-only games were conducted as pilots to test new game procedures and then continued to gain additional observations.

## Chinese Nuclear Forces

To implement these different trajectories in Chinese nuclear posture, the project created two variants of Chinese nuclear forces with the same number of total warheads but with different allocations, one consistent with greater emphasis on survivability (Assured Retaliation Focused) and one consistent with greater emphasis on the deployment of tactical, or low yield, capabilities (Low Yield Enabled).[196] The primary source for these projections was the most recent CMPR, informed by the *Bulletin of the Atomic Scientists* and feedback from experts in the field.[197] To avoid giving the appearance of a government-funded project taking a specific position on the yield, number of warheads, and ranges of specific Chinese systems, the project parameterized weapon yields to low yield or high yield, all MIRVs to three warheads, and all ranges to short, medium, intermediate, or intercontinental. The project standardized the quantities of each relevant category to increments of 24 to facilitate gameplay.




*This image shows the elements of Chinese nuclear posture in game: green ready-to-fire missiles in the foreground, yellow unmated but collocated missiles and warheads, red warheads in central storage, and red missiles without warheads.*

Photo: CSIS Defense and Security Department staff

The means of delivery for Chinese weapons was as important as the range, yield, and number of warheads because each delivery method has advantages and disadvantages. Placing nuclear missiles on mobile transporter erector launchers (TELs) allows missiles to be dispersed and hidden

from enemy surveillance. Basing nuclear missiles in silos is cheaper, can accommodate even the largest missiles, and can be hardened so that, on average, more than one missile is required to destroy each with confidence, However, their static nature makes them vulnerable to counterforce attacks. Missiles in SSBNs are survivable as long as a country can get them safely out of port and foil the enemy's antisubmarine warfare efforts in open waters. Finally, air-launched missiles can be delivered en masse and might be more difficult to intercept, but the bombers themselves are vulnerable and slow. Table 1 shows the resulting inventories for the two variants.

### Table 1: Chinese Nuclear Weapons Inventories

| **Chinese Nuclear Weapons** | | | **Variant 1** | | | **Variant 2** | | |
|---|---|---|---|---|---|---|---|---|
| | | | **Assured Retaliation Focused** | | | **Low Yield Enabled** | | |
| *Range* | *Delivery* | *Yield* | *Warheads* | *2028 missiles* | *2028 warheads* | *Warheads* | *2028 missiles* | *2028 warheads* |
| MRBM / IRBM | TEL | Low | 1 | 0 | 0 | 1 | 24 | 24 |
| MRBM / IRBM | TEL | High | 1 | 96 | 96 | 1 | 96 | 96 |
| ICBM | TEL | High | 1 | 144 | 144 | 1 | 144 | 144 |
| ICBM | TEL | High | 3 | 48 | 144 | 3 | 24 | 72 |
| ICBM | Silo | High | 1 | 288 | 288 | 1 | 24 | 24 |
| ICBM | Silo | High | 3 | 24 | 72 | 3 | 120 | 360 |
| ICBM | SSBN | High | 1 | 72 | 72 | 1 | 72 | 72 |
| ALCM | Air | Low | 1 | 0 | 0 | 1 | 24 | 24 |
| ALCM | Air | High | 1 | 24 | 24 | 1 | 24 | 24 |
| **Total** | | | | **696** | **840** | | **552** | **840** |

Note: ALCM = air-launched cruise missile; ICBM = intercontinental ballistic missile; IRBM = intermediate-range ballistic missile; MRBM = medium-range ballistic missile; SSBN = ballistic missile submarine; TEL = transporter erector launcher.
Source: CSIS Defense and Security Department.

China's historic assured-retaliation posture meant that the readiness of each missile must also be tracked. Although China's nuclear posture and doctrine are evolving, there are no indications China has abandoned its historical adherence to centralized storage of warheads. If, as postulated by Wu Riqiang, only one-sixth of Chinese warheads are deployed to their firing units, then a large and highly visible effort is required to deploy the remaining warheads.[198] Having been moved to firing units, those warheads would have to be prepared and mated. In the case of mobile launchers, the TELs would then need to be dispersed. While this might take only a week for a single warhead, the large number of warheads in an expanded Chinese arsenal means China would likely need a month to transition from a peacetime posture to fully deployed. It would be impossible to conceal this

change in posture. Therefore, it was important to capture the interaction between the China teams' deployment decisions and the U.S. coalition teams' reactions.

To show this transition, the project developed a system of displaying Chinese warheads by color, iconography, and location on a board. Warheads and missiles were represented in increments of 24 using 3D-printed models by igMakes.[199] Missiles ready to fire with mated warheads were shown in green, but only a proportion of the Chinese arsenal started that way. Many warheads are held in central or regional storage, and even some of the deployed warheads are not mated at any given time. To get ready to fire, an unmated warhead and unmated missile had to be collocated at a firing unit; once collocated the unmated warhead and missile were replaced with yellow pieces. To be collocated, a red warhead from central storage had to be shipped to a firing unit with an unmated red missile without a warhead. The games, therefore, always began with a Chinese nuclear status board mostly populated by red warheads and missiles in separate areas. Most China teams opted to ship and mate missiles, producing higher levels of readiness (with green missiles), which worried U.S. coalition teams.

## U.S. Nuclear Forces

The key elements of the U.S. nuclear order of battle for this project were the weapons and delivery platforms available in 2028. The estimates used in the study assumed execution of the nuclear modernization and force structure plans as they stood in 2024 (see Table 2). Changes to those plans by the new Trump administration would be unlikely to have a major effect by 2028. All information used for the game came from unclassified sources (as indicated in the notes to Tables 2 and 3). To comply with DTRA's security requirements, the tables do not include yields, even those available in unclassified documents.

Table 2: U.S. Nuclear Weapons

| Weapon | Compatible with | Reported number available | Comments |
|---|---|---|---|
| B61-11[200] | B-2, F-15E, F-16C/D, F-35 (future), B-21 (future)[201] | 50 | Continuing; earth penetrating |
| B61-12 | B-2, F-15E, F-16C/D, F-35 (future), B-52, B-21 (future)[202] | 250, including Europe | Replacing B61-3, 4, 7; fully fielded by FY 2028 |
| B61-13[203] | Air delivered | — | For "harder and large-area military targets"; unlikely to be available within the timeline of the wargame |
| B83 | B-2, B-52 | Few | Small numbers maintained for hardened underground targets |
| W76-1 | Trident[204] | 240 | |

| | | | |
|---|---|---|---|
| W76-2 | Trident | | Only a few W76-2 warheads for specialized targets |
| W88 | Trident[205] | | |
| W78 | Minuteman[206] | 400 | |
| W87-1 | Minuteman[207] | | |
| W80 | ALCM, B-52 | 300 plus 200 in reserve[208] | |
| W80-4 | Long-range cruise missile, B-52[209] | None available in 2028[210] | LRSO replacing ALCM |
| **Total deployed** | | **1,550[211]** | |

Source: CSIS Defense and Security Department.

This listing includes only weapons in the active inventory.[212] In addition to weapons in the active inventory, 1,938 warheads are reported to be in "reserve (hedge and spares)," and another 1,536 are "retired, awaiting dismantlement."[213] The reserve category has three levels of readiness from "ready to deploy" to various stages of disassembly.[214] The project assumed that 20 percent of the inactive inventory would be available—5 percent each week for four weeks.

Table 3 presents all expected U.S. nuclear platforms in 2028.

### Table 3: U.S. Nuclear Platforms in 2028

| Platform | Number | Max Load Out | Comments |
|---|---|---|---|
| B-2 | 20 total, 12 available | 16 gravity bombs | B61 series |
| B-52 | 46 nuclear capable, 26 available | 20 cruise missiles each | W80 series, either on ALCM or LRSO; B61 series |
| B-21 | A few[215] | — | Not used in game because of limited numbers |
| SSBNs | 14 | 90 warheads each | Mix of W76-1/2, W88 |
| ICBMs | 400 | 1 warhead each | Mix of W78 and W87-1 |
| Fighters | Many | 5 B61s each | F-35s, F-15s, and F-16s have nuclear capability[216] |

Source: CSIS Defense and Security Department.

The key conclusion from Tables 2 and 3 is that by 2028, the United States will have a variety of delivery options and will still possess quantitative nuclear superiority over China (about 1,550 versus 840 warheads).

## Methodological Differences with Other Wargames

Some of the hypotheses examined by this project relate to topics treated by four other recent projects that have used wargames to explore the nuclear dimensions of a near-future U.S.-China war over Taiwan:

- A 2022 Center for New American Security (CNAS) wargame concluded with the China team using a HEMP near Hawaii. The report recommended further research into the nuclear dimensions of a Taiwan conflict.[217]
- In 2023, a CNAS team conducted two TTXs to explore pressures that might lead to nuclear deterrence failure.[218] The project highlighted the impact of differences in the future Chinese arsenal; the China team used a nuclear weapon in the 2030 TTX with a more developed Chinese nuclear arsenal but did not in the 2027 TTX with a less developed arsenal.
- CNAS's most recent 2024 project explored the consequences of nuclear first use in two TTXs.[219] The underlying analysis appears to have been extensive, but the project report contained few details on the course of events during the TTXs. The report suggested that the intersection of conventional and nuclear escalation deserved analysis.
- A 2024 Atlantic Council report featured a TTX to explore U.S. reactions after China employed nuclear weapons first during a Taiwan conflict.[220]

Differences in focus mean that some conclusions of other projects lie outside of this project's scope. For example, the Atlantic Council project drew lessons about the broader diplomatic context of Chinese nuclear escalation decisions, whereas this project focused on military operations, nuclear decisionmaking, and the consequences of nuclear weapon use. The Atlantic Council TTX featured different cells within the Blue team to draw insights into U.S. decisionmaking, which was similarly beyond the scope of this project. The present study also did not model the possibility of opportunistic aggression by Russia or other powers, a possibility discussed by the Atlantic Council in a 2024 article.[221]

To strengthen rigor, this project contained several methodological enhancements.[222] First, the project used multiple iterations; having 15 iterations allowed a more thorough analysis of the range of possible pathways and outcomes. Second, the game used operations research and rules-based adjudication to assess the outcomes of military interactions. This allowed a closer tie between the conventional operations driving the war and nuclear escalation decisionmaking. Finally, the wargame addressed both the drivers and consequences of nuclear weapon use. Although allowing the players to decide on nuclear first use meant that many wargames would see no nuclear play, it gave players more context for their nuclear decisions and a stronger sense of ownership since the decisions were not scripted.

*Having 15 iterations allowed a more thorough analysis of the range of possible pathways and outcomes.*

## Scope Conditions

This study focused on the military dimensions of nuclear weapon use and the results. It did not include other issues critical to a full understanding of nuclear use and its consequences. A full description of these scoping conditions is needed to set out what the study did and did not do.

- The project did not address the *likelihood* of nuclear use in a Taiwan scenario. Wargame design choices were optimized to understand the *military* logic of using nuclear weapons. Defining players as operational commanders and telling them to base nuclear recommendations on the military utility of employing nuclear weapons minimized political factors (though, as the analysis chapters demonstrate, some players nevertheless considered political factors). The frequency of nuclear weapon use in the game iterations, therefore, did not indicate the probability of their use in an actual conflict.[223]

*The project did not address the likelihood of nuclear use in a Taiwan scenario.*

- Political considerations might lead to nuclear use at times or in ways contrary to military advice. Political leaders might want to use nuclear weapons to demonstrate resolve, cause shock, or force surrender. However, it is more likely that political leaders would act as a brake, vetoing nuclear use even when militarily advisable. Factors pushing this way include fears of escalation, the likelihood of worldwide moral opprobrium, state interests in maintaining a global nuclear taboo, and the potential loss of domestic support. Nuclear powers have been involved in conventional wars many times since 1945, and although some may have considered using nuclear weapons, none have.[224] In the event of nuclear use, political leaders might also employ nuclear weapons differently than operational commanders recommend—for example, by vetoing targets that cause high civilian casualties.
- China players were not all experts on Chinese affairs, though a sizable minority (roughly 25 percent) were, giving half the teams a China expert. Several China experts posited that nuclear attacks on Taiwan, regarded as an integral part of China, would be anathema to Beijing. China experts also tended to be more sensitive to China's commitment to a no-first-use policy, which has historically guided its decisions on force structure, posture, and command authorities.
- The game did not have a separate Taiwan team and, therefore, did not cover Taiwanese political decisionmaking, including the possibility of surrender. The logic behind not modeling Taiwanese political decisionmaking during conflict was driven by the intended focus on U.S.-China strategic dynamics, the limited operational decisions available to Taiwan, and the difficulty of credibly assessing the pressures Taipei might experience during conventional, much less nuclear, conflict. The U.S. coalition team made decisions about Taiwanese actions assuming Taiwan would continue to resist. However, it is unknowable whether Taipei would

continue resistance if, for example, its territory were struck by a dozen or more nuclear weapons, each somewhat larger than the bombs employed against Nagasaki and Hiroshima.

*The game did not have a separate Taiwan team and therefore did not cover Taiwanese political decisionmaking, including the possibility of surrender.*

- More broadly, the game did not force players to consider popular reaction, the destructiveness of nuclear (or conventional) weapons use, or the likely second- and third-order economic, social, and political effects use when making nuclear decisions. In a world with ubiquitous cameras, social media, and other powerful means to mobilize opinion, pressures on governments after nuclear use could be truly unprecedented. However, it is unclear how those pressures would influence decisionmakers and over what timeline.
- This report addresses one scenario: invasion. China might employ force against Taiwan in other ways (e.g., a blockade or coercive firepower strikes). In those cases, nuclear use seems less likely and, if it occurs, might follow patterns not covered by this project.
- Like the original project modeling conventional combat (summarized in the *First Battle of the Next War* report), this adaptation used only unclassified data so that its results could inform public debate.[225] This does not necessarily limit the accuracy of the analysis. Much information is available from open sources. The appropriate use of historical data, because it incorporates all the friction of real-world operations, can sometimes be more accurate in modeling future conflicts than classified information, which suffers from a lack of broad review and scrutiny.
- The wargame assumed that neither side had a secret, exquisite capability that allowed a disarming counterforce attack.[226] Such a capability is highly unlikely to exist because it would require high effectiveness against all arms of an adversary's nuclear forces simultaneously. Although both sides are undoubtedly pursuing such capabilities, the history of the Cold War suggests that they are unlikely to be acquired in quantity and kept secret for long periods. For example, the United States developed the first stealth (low observable) aircraft in secret: the F-117. Though highly successful, the capability was limited (59 aircraft built), and its existence soon became known, though not all the technical parameters.[227]

5

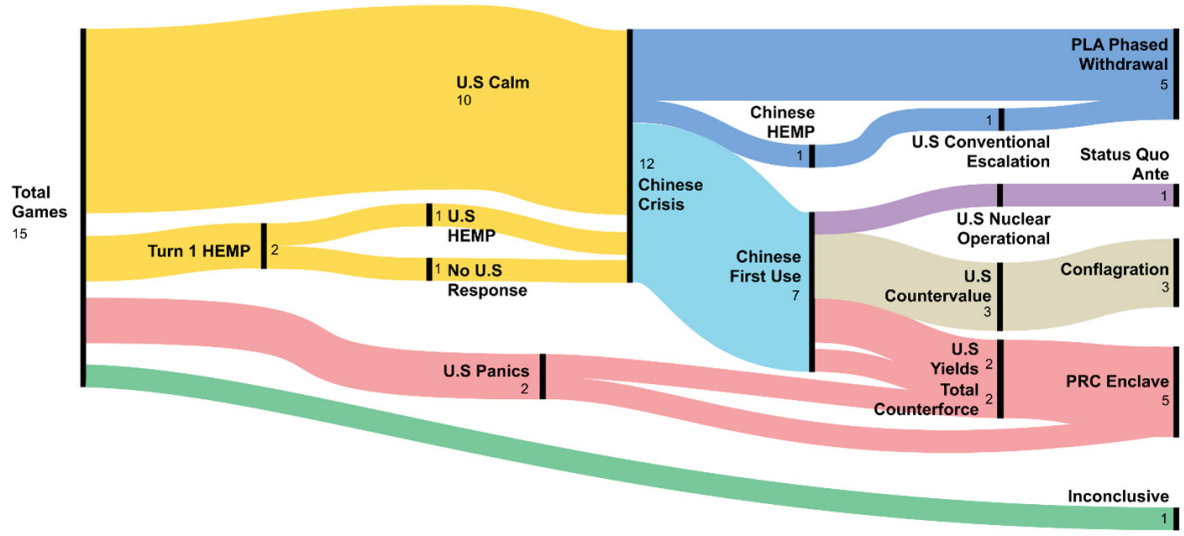
# Game Results

The five outcomes are described below along with the number of times that each occurred. No outcome constituted a total victory for the U.S. coalition (e.g., overthrow of the CCP and redirection of Chinese foreign policy) or for China (i.e., U.S. withdrawal from the Western Pacific and U.S. acknowledgment of China's sphere of influence). These were out of reach.

- **PLA Phased Withdrawal (5):** A ceasefire occurred, with PRC withdrawal from Taiwan and the return of Chinese POWs.
- **Status Quo Ante (1):** The prewar status was reinforced. Chinese forces on Taiwan were destroyed, but China gained a commitment that Taiwan would not seek independence.
- **Conflagration (3):** A strategic nuclear exchange occurred, with hundreds of millions of casualties.
- **PRC Enclave (5):** A ceasefire occurred, with the establishment of a PRC enclave on Taiwan. Some games had player-created amendments to the generic peace conditions. One game saw the United States and Taiwan allowing a PRC enclave but with the establishment of a formal U.S.-Taiwan alliance and a U.S. force permanently deployed on Taiwan.
- **Inconclusive (1):** No ceasefire deal had been reached and no nuclear conflagration had occurred by the time gameplay ended.

Because the game did not assess political approval or disapproval of nuclear use, outcomes did not represent the probability of nuclear use but rather potential military recommendations for nuclear use.

## Figure 2: Game Pathways




Source: CSIS Defense and Security Department.

Figure 2 shows the pathways and outcomes for the 15 games.

As noted in the scope conditions, the wargame did not model Taiwanese decisionmaking during the conflict. Chinese nuclear use could induce the Taiwanese to surrender. The China teams sometimes made nuclear threats and attacks directly aimed at forcing Taiwanese capitulation (Game 2). Even if China aimed only to have operational effects with its nuclear use (Games 4, 5, 9, 11, and 13), Taiwan might still decide the cost of nuclear attacks on its territory outweighed the benefit of continued resistance.

The outcomes represented only agreements between the respective adversaries; the second- and third-order political and economic consequences were not treated and would certainly be momentous. Economic and political isolation of China, significant nuclear proliferation to states in the region (or beyond), and a possible strengthening of the U.S. alliance system are among the many possible negative consequences for China. Hence, the idea of a Chinese "victory" or "success" through nuclear use should be understood in the limited sense of immediate conflict settlement. Economic disruption would affect all nations but was not estimated.

Intermediate waypoints show the many paths that conflicts could take from start to outcome:

- **Early HEMP:** Two China teams used HEMP at the outset of conflict (Turn 1 HEMP); the United States responded with its own HEMP in one game (U.S. HEMP) but did nothing in the other (No U.S. Response). Both games continued without further immediate nuclear use.
- **U.S. Panic:** Two U.S. teams, shocked by high early losses, incorrectly believed they were losing the conventional fight; most teams correctly assessed that their position would improve (U.S. Calm).

- **Chinese Crisis:** Around weeks three to five, the China teams realized they were losing the conventional war.
  - One China team used a HEMP (Chinese HEMP), to which the United States responded with attacks on Chinese command and control with hypersonic weapons (U.S. Conventional Escalation).
  - Many other China teams used nuclear weapons to cause physical destruction (Chinese First Use); in response, the United States launched a damage-limiting nuclear counterforce attack (Total Counterforce), sought an immediate ceasefire (U.S. Surrender), attacked Chinese cities with nuclear weapons (U.S. Countervalue), or used nuclear weapons operationally on Taiwan (U.S. Operational).
- **U.S. Nuclear Operational:** The U.S. team attacked the Chinese lodgment with nuclear weapons.
- **Total Counterforce:** The U.S. team used nuclear weapons to attack Chinese nuclear capabilities.
- **U.S. Countervalue:** The U.S. team used nuclear weapons on Chinese cities or on military targets within cities.
- **U.S. Conventional Escalation:** The U.S. team responded with conventional attacks on high-value targets such as early warning radars.
- **U.S. Yields:** The United States accepted an unfavorable outcome rather than continue the fight.

Similar pathways could lead to different outcomes. For example, the pathway U.S. Calm ➜ Chinese Crisis ➜ Chinese First Use produced three different outcomes. The key takeaway is the difficulty in predicting how nuclear escalation will end. There was one exception to this rule of uncertainty: countervalue strikes always engendered countervalue responses and the "deaths" of millions.

*The key takeaway is the difficulty in predicting how nuclear escalation will end.*

6

# Analysis

## *What Creates the Greatest Pressure for Nuclear First Use?*

The wargame results support several hypotheses developed in Chapter 2; they do not support others. The strength of these findings must be viewed in light of the scenarios, methodology, and scope conditions outlined earlier.[228]

The wargames supported three such hypotheses, fully or partly:

- When nuclear use occurred, the first use (other than a HEMP) was always initiated by a team that believed it was losing on the conventional battlefield and wanted to gamble for resurrection.
- Players showed some deference to a nuclear taboo despite the fact that ethical considerations and broader politics were not an explicit part of the game.
- Finally, there was limited support for the hypothesis that China's possession of tactical nuclear options would make nuclear weapon use more likely.

Most hypothesized drivers of nuclear first use were not supported. Table 4 lays out all the hypotheses and whether game outcomes supported them.

Table 4: Nuclear Use Hypotheses and Wargame Results

| Title | Hypothesis | Supported? |
|---|---|---|
| Gambling for resurrection | Teams will use nuclear weapons when they are faced with conventional defeat. | Yes |
| Nuclear revolution<br>Nuclear taboo | Teams will be reluctant to employ nuclear weapons, even in situations where nuclear use would be militarily advantageous. | Yes |
| Chinese tactical nuclear forces | China teams will be more likely to use nuclear weapons if they possess low-yield nuclear weapons. | Partial |
| Mainland strikes | U.S. strikes on nonnuclear Chinese targets on the mainland will increase the likelihood of China teams initiating nuclear use. | No |
| Inadvertent escalation | U.S. strikes on Chinese nuclear command, control, and communications (NC3) will increase the likelihood of China teams initiating nuclear use. | No |
| Deliberate conventional attacks on nuclear forces | Deliberate conventional attacks on nuclear capabilities will create pressure for nuclear use. | No |
| Counterforce capabilities | China teams will be deterred from nuclear use by U.S. counterforce capabilities. | No |
| Quantitative nuclear superiority | China teams will be deterred by U.S. quantitative and qualitative nuclear superiority. | No |
| Substitution for conventional munitions | Teams will use nuclear weapons to substitute for conventional munitions that have been exhausted. | No |

Source: CSIS Defense and Security Department.

## Supported Hypotheses

The wargames supported two hypotheses—gambling for resurrection and the nuclear taboo—and partially supported a third—Chinese possession of tactical nuclear forces.

### CHINA TEAMS GAMBLING FOR RESURRECTION

Nuclear first use was most often initiated by China teams that believed conventional defeat had become inevitable. The models of conventional conflict employed in the game—which the authors believe reflect the most likely case—tended to produce early successes but steadily mounting

setbacks for the China teams. The Chinese amphibious fleet was particularly vulnerable and suffered attrition over time while the lodgment's logistical needs grew. Between weeks three and five of the conflict, the Chinese flow of logistics onto the island declined below the level needed to sustain troops already on the island. Thus, no additional troops could then be transported with the available lift. After this point, with further losses to the amphibious fleet and the absence of a functioning captured port or airfield, Chinese supplies became increasingly inadequate, so units lost combat power and could no longer attack. Defeat became imminent, leading to a crisis for the China teams and a harsh choice: agree to an adverse settlement, fight on to likely defeat, or use nuclear weapons.

*Nuclear first use was most often initiated by China teams that believed conventional defeat had become inevitable.*

Conventional defeat for China could pose an existential risk for the CCP, particularly if no face-saving off-ramp is available. If the invasion force surrenders due to lack of supplies, tens of thousands of soldiers would march into captivity. The resulting visuals would make it impossible for Chinese leaders to spin results or deny catastrophic defeat. As Brad Roberts, director of the Center for Global Security Research at Lawrence Livermore National Laboratory, points out, "Concerns about domestic political stability also factor into Chinese leadership perspectives in a way few Americans appreciate."[229] China teams that perceived this risk as existential were tempted to gamble for resurrection by using nuclear weapons.[230] As discussed in Chapter 7: What Happens If Nuclear Weapons are Used?, sometimes this gamble worked, leading the U.S. team to withdraw from a conventional war it was winning and granting the China team an advantageous settlement (though no U.S. team conceded completely). However, at other times, the China team's gamble backfired, leading to a sounder defeat or even to a global nuclear cataclysm.

It is unclear whether this pressure for nuclear use would override restraining factors in an actual crisis. Sinologists who participated in the game disagreed on whether Chinese leaders would resort to nuclear use in such a situation. Some believed that they would be willing to gamble for resurrection to protect the regime. Others cited a belief in the security of the CCP's hold on power and its ability to potentially reconstitute for a renewed invasion following a ceasefire.[231]

### PANICKED U.S. TEAMS GAMBLING FOR RESURRECTION

Many U.S. teams were shocked at their large losses early in the conflict. These losses included at least one carrier in the first week (sunk or critically damaged) and a second carrier in 9 of 15 games. The last time the United States lost a fleet carrier in combat was the USS Princeton in October 1944. By the end of the first week of the game, the United States and Japan typically lost 270 aircraft and 20 ships. Shaken by these large losses, several teams believed they were headed toward defeat. Some were alarmed enough to believe they faced essentially the same choices discussed in the Chinese context: agree to an adverse settlement, accept defeat, or use nuclear weapons. Although

U.S. teams, unlike the China teams, did not believe defeat would threaten the United States' form of government, defeat would nevertheless carry grave domestic and international consequences, including the collapse of the U.S. alliance system.

The reaction of the U.S. teams that believed they were losing varied. Some persevered in the conventional conflict without pursuing either nuclear use or negotiated off-ramps and were pleasantly surprised by their improving conventional situation later in the games. One U.S. team (Game 7) chose to withdraw from the conflict, granting a PRC enclave on Taiwan after only a week of combat.

Another U.S. team (Game 6) undertook a damage-limiting nuclear counterforce strike against Chinese nuclear and nuclear-related targets. The attack involved more than a thousand U.S. warheads, which would likely have caused at least 10 million prompt deaths in China and several times that many deaths from radiation and other causes.[232] The goal of this preemptive counterforce attack was to force the China team to capitulate on the theory that it could not retaliate with its nuclear weapons without effectively committing national suicide. The U.S. team still held hundreds of nuclear weapons and could retaliate against any Chinese response with a massive strike against Chinese cities. However, with China's expanding nuclear arsenal and investment in ICBMs launched from TELs, the authors modeled that it would be impossible for the United States to disarm China's nuclear force completely; it could only hope to coerce China into capitulation and, if that failed, limit damage from China's nuclear retaliation. When the China team failed to capitulate as planned, a nuclear exchange ensued that led to several million U.S. civilian casualties and eventual U.S. concession to a PRC enclave on Taiwan.[233]

### NUCLEAR TABOO AS DRIVER OF NONUSE OR LATE USE OF NUCLEAR WEAPONS

Despite instructions to players that nuclear recommendations should be based on military utility—a mechanism designed to study potential military drivers of nuclear weapons use—many players said during the game or postgame hotwash that they were committed to not using nuclear weapons.[234] Their rationales included (variously) the likelihood of escalation to the strategic level, the importance of maintaining a global nuclear taboo, and, among U.S. players, the importance of the United States not being the first to use nuclear weapons since World War II. Some China teams (Games 1 and 12) refrained from even mating warheads, signaling that they would not escalate to the nuclear level. Most Sinologists who played the game suggested Chinese leaders would view nuclear use against their 同胞 (*tóngbāo*, or compatriots) on Taiwan as anathema. Similarly, China's no-first-use policy, which, unlike Russia's, has historically driven nuclear force structure decisions, provides a soft constraint. Whether the actual U.S. or Chinese leadership would feel the same normative constraints is unclear, but the game results show the taboo's broad strength.

### CHINESE POSSESSION OF TACTICAL NUCLEAR WEAPONS

The games only partially supported the hypothesis that Chinese possession of tactical nuclear weapons would increase Chinese propensity for nuclear first use—a principal assumption of the game scenarios. As shown in Table 5, China teams decided on nuclear first use five times despite not possessing low-yield weapons compared to four times when they did. Whenever a China team believed it should gamble for resurrection, possessing low-yield weapons had some influence but

was not determinative. Instead, conversations principally revolved around the trajectory of the conventional campaign and the implications of a defeat for the CCP.

Although possession or lack of low-yield options did not determine nuclear use, it did affect gameplay. When China teams had low-yield nuclear weapons and decided on nuclear escalation, they almost always used low-yield weapons on first use. One China team that did not have low-yield nuclear weapons (Game 3) said that having tactical nuclear weapons might have prompted them to consider nuclear use earlier or more seriously. Another China team with lower-yield nuclear weapons (Game 14) decided against use based on the probability of high civilian casualties and political damage in the event of urban use, even though lower-yield weapons would reduce these effects. Thus, Chinese possession of lower-yield weapons had some influence on military decisionmakers, albeit not a decisive one.[235]

Political leaders (unmodeled, as the control group implemented the majority recommendations of both sides) might view nuclear use differently than the game players, rejecting the use of high-yield weapons but accepting the use of low-yield weapons. This perception might make nuclear use with low-yield weapons more likely than portrayed in the games. Nevertheless, the plurality of games indicated that possession of low-yield weapons was not as central to operational commanders' thinking on nuclear use as assessments of the conventional conflict. Table 5 shows game outcomes and nuclear use by scenario. It shows all six scenarios, whether nuclear weapons were used, who used them first, and the outcome.

### Table 5: Game Outcomes and Nuclear Use by Scenario

| | 1: Assured Retaliation Focused | 2: Low-Yield Enabled |
|---|---|---|
| No mainland strike | Nuclear (China) | Nuclear (U.S.) |
| | | Nuclear (China) |
| Only unambiguously conventional mainland strikes | Nuclear (China) | Nuclear (China) |
| | | Nuclear (China) |
| All mainland strikes allowed | Nuclear (China) | Inconclusive (China) |
| | | |
| | Nuclear (China) | |

Note: Blue = U.S. coalition victory; red = Chinese victory; gray = conflagration; Nuclear = nuclear weapons used. The country name in parentheses indicates which side used nuclear weapons first. This table does not count HEMP as nuclear use. Status quo ante was considered a U.S. coalition victory.
Source: CSIS Defense and Security Department.

## Unsupported Hypotheses

### MAINLAND STRIKES

U.S. conventional strikes on unambiguously nonnuclear targets on the Chinese mainland never led China teams to seriously consider nuclear first use. Although China teams always regarded such strikes as escalatory, they considered conventional responses only. In iterations where the game scenario restricted U.S. teams from attacking the Chinese mainland, the China team sometimes reciprocated and refrained from attacking Guam or Japan.

When U.S. teams were allowed to strike the mainland and did so, China teams frequently cited these mainland strikes in their justifications for attacking Japan with conventional weapons. However, at no point were nuclear attacks ordered or even seriously considered.

### INADVERTENT ESCALATION

Inadvertent destruction of limited numbers of Chinese strategic assets did not lead China teams to a nuclear response. Chinese SSBNs were sunk with conventional weapons during U.S. antisubmarine warfare operations against Chinese attack submarines (Games 1 and 2), nuclear IRBM warheads were destroyed during attacks on conventional PLA rockets (Game 3), satellite-based ISR was disrupted to increase U.S. freedom of maneuver (Games 5 and 7), and dual-purpose command and control nodes were targeted for their conventional effects (Games 3 and 14). None of these provoked a Chinese nuclear response or even serious consideration of a nuclear response. China teams invariably concluded that these attacks did not threaten their second strike, regardless of the Chinese force posture in the scenario. Likewise, Chinese kinetic antisatellite attacks, including those that destroyed early warning capabilities, prompted U.S. escalation to counterspace attacks of their own but did not prompt consideration of nuclear use.

### DELIBERATE CONVENTIONAL ATTACKS ON NUCLEAR FORCES

China did not respond with nuclear weapons in the one game in which the U.S. team embarked on a deliberate conventional counterforce campaign. In Game 2, the U.S. team attacked all the Chinese nuclear platforms that it could reach (particularly SSBNs and bombers), attempted to disrupt Chinese nuclear command and control, and even struck Chinese leadership targets. The China team took these attacks in stride, noting it still retained sufficient nuclear forces to destroy a large number of U.S. cities. The losses to nuclear systems were modest in scale; larger-scale losses might produce different results.

### QUANTITATIVE NUCLEAR SUPERIORITY

All teams understood that the United States continued to hold advantages in the nuclear domain despite a major and accelerating expansion of PLA nuclear inventories over the decade before 2028.[236] Even in the Low Yield Enabled scenarios, China would have many fewer low-yield options than the United States. Although China might possess more types of ICBMs, this would not translate into qualitative or quantitative parity. Moreover, China's peacetime readiness is far lower than that of the United States, and the game assumed (for reasons outlined earlier) that its nuclear posture was unchanged in the lead-up to war.

Nevertheless, U.S. quantitative nuclear superiority did not deter China teams from employing nuclear weapons. China teams knew that using nuclear weapons risked nuclear retaliation by the United States and that the United States possessed more escalatory options and the ability to launch a damage-limiting counterforce strike against China. But so long as the United States could not launch a disarming counterforce strike, the China teams judged that the United States would not launch strategic nuclear attacks. Thus, U.S. qualitative and quantitative nuclear superiority was not central in its calculations. Echoing the results of Hannah Dennis and Stacie Pettyjohn, the number of nuclear weapons that the United States could hit China with was not crucial to China teams.[237] China teams that decided not to use nuclear weapons were dissuaded by considerations other than their nuclear inferiority.

### U.S. COUNTERFORCE CAPABILITIES

The powerful U.S. nuclear counterforce capability was not enough to deter the China teams from using nuclear weapons when they faced a crisis. No matter how capable U.S. forces were, they could not destroy all Chinese ICBMs, particularly those based on mobile systems. As long as the China teams believed they had a secure second strike of any magnitude, they were not deterred from using nuclear weapons.

### SHORTAGES OF CONVENTIONAL MUNITIONS

No team opted for nuclear use as a substitute for depleted stocks of conventional weapons during the game. Despite the United States running out of Long-Range Anti-Ship Missiles (LRASMs) in the first few days of combat, no U.S. team considered using nuclear weapons to sink the rest of the Chinese amphibious fleet as it sat anchored to debark; teams always had other options. Conversely, no China team reached for nuclear weapons to replace the exhausted magazines of theater ballistic missiles.

7

# Analysis

## *What Happens If Nuclear Weapons Are Used?*

This chapter focuses on the consequences of nuclear use. Because only one U.S. team initiated nuclear use, whereas seven China teams did, it focuses primarily on Chinese use and U.S. responses. This chapter walks through the consequences of nuclear first use in three stages:

1. What did the first use target?
2. How did the adversary respond?
3. How did the conflict end?

### What Did First Use Target?

In selecting targets for nuclear attack, China teams never initiated nuclear use with either a counterforce or countervalue attack. Even with an expanded arsenal, China could not have achieved an effective damage-limiting counterforce attack on the larger U.S. nuclear arsenal. Additionally, China teams never initially launched a countervalue attack or attacked military targets in U.S. cities because they believed this would inevitably provoke an immediate and potentially massive U.S. retaliation. Similarly, China teams believed that using nuclear weapons against Japan, even if aimed at U.S. bases, would be equivalent to a nuclear attack on U.S. territory and would also provoke U.S. nuclear retaliation. Thus, the China teams focused on attacking operational targets with their first use of nuclear weapons.

*China teams believed that using nuclear weapons against Japan, even if aimed at U.S. bases, would be equivalent to a nuclear attack on U.S. territory and would provoke immediate and potentially massive retaliation.*

Most China teams decided that ships at sea, airfields, and ports were either unprofitable or too escalatory as nuclear targets. This left nuclear attacks on Taiwanese ground forces as the best of several bad options. Although China would prefer not to risk collateral damage to its ground forces or kill large numbers of ostensibly Chinese civilians, Taiwanese ground forces offered the best operational utility with the lowest risk of U.S. retaliation.

Table 6: Hypotheses About Targeting

| Target | | Hypothesis | Supported (U.S. / Chinese First Use) |
|---|---|---|---|
| Countervalue | | Neither team will launch countervalue first strikes. | Supported (0 / 0) |
| Counterforce | | Neither team will launch counterforce first strikes. | Not supported (1 / 0) |
| Operational Targets | Ports and Airfields | Teams will target ports or airfields in the theater with nuclear weapons to gain an operational advantage despite the retaliation risk. | Weakly supported (0 / 1) |
| | Ground Forces | Both teams are likely to use nuclear weapons against ground troops on Taiwan. | Supported (0 / 6) |
| | Ships at Sea | U.S. teams will target Chinese ships, but only during the amphibious offloading. China teams will not use nuclear weapons at sea. | Not supported (0 / 1) |
| Special Cases | HEMP | Both teams will conduct HEMP attacks because they are perceived as less escalatory than other nuclear options. | Weakly supported (0 / 3) |
| | U.S. Nonnuclear Allies | China teams will avoid targeting Japan because of the logic of extended deterrence. | Supported (1 case of 7) |

Source: CSIS Defense and Security Department.

### FREQUENT CHINESE TARGETING OF GROUND FORCES ON TAIWAN

In six of seven games during which China teams initiated nuclear use, they targeted Taiwanese ground forces. Most teams saw little point in crossing the nuclear threshold unless such use provided major battlefield advantages. Knocking out a few enemy battalions would not produce significant results because reserves and reinforcements would move into the gaps created by the attack. Thus, when the China teams used nuclear weapons, they used them extensively in five of six instances, employing either large numbers (35 weapons in Game 6 and 19 weapons in Game 13) or large-yield weapons (5 high-yield warheads in Game 9, 8 in Game 11, and 3 in Game 5).[238] The exception was in Game 2, where the China team launched a single nuclear weapon against the Taiwanese leadership bunker in Taipei.[239]

*In six of seven games where China teams initiated nuclear use, they targeted Taiwanese ground forces. . . . When the China teams used nuclear weapons, they used them extensively.*

Using nuclear weapons on the front lines—particularly high-yield weapons—caused friendly casualties as well as enemy casualties. For example, in Game 5, in which China did not have low-yield weapons, it lost five battalions in addition to the casualties inflicted on the Taiwanese. Thus, most China teams targeted Taiwanese units away from the front lines.

When used on the ground, Chinese nuclear attacks destroyed between 6 and 38 Taiwanese battalions, with an average of 18, all from a single salvo of strikes. The number varied with targeting and the number of weapons employed. Eighteen battalions represented 15 percent of Taiwan's 120 battalion total, roughly equaling Taiwan's losses in conventional conflict (17) at that point in the games. Therefore, the single strike was not decisive but severely weakened the Taiwanese defenses; a second such strike would have been decisive in the absence of U.S. retaliation.[240]

Each battalion represented about 1,000 military personnel, including associated support, so military casualties from a nuclear strike could be estimated at 6,000–38,000. Casualties from conventional operations averaged 17 battalions, or 17,000 personnel.

The project also estimated civilian casualties on Taiwan using average population density in different types of terrain and the lethal range of each weapon yield. (See Table CI in Appendix C for details.) The total number of civilian fatalities from nuclear weapons varied from an estimated 80,000 (under 10 low-yield weapons) to 350,000 (4–5 large-yield weapons or very large numbers [35] of low-yield weapons). The single low-yield weapon striking an urban area in Game 2 caused 80,000 fatalities, about the same level of casualties as inflicted by the atomic weapons in World War II.[241]

Civilian casualties from nuclear use thus greatly outnumbered military casualties from all sources. This was true even though the weapons were aimed almost entirely at military targets in exurban and rural areas. Military forces are typically spread out and dug in, thus providing protection

against nuclear attacks. The civilian population is unprotected, and even the rural areas where fighting generally took place were relatively densely populated.

In general, China teams used nuclear weapons on Taiwanese troop concentrations to inflict maximum losses per weapon. The Taiwanese responded by spreading their forces out, which reduced vulnerability but also their combat effectiveness. However, because the situation quickly moved to either strategic exchanges or negotiated off-ramps, the games ended before the extent of this reduction became relevant.

### ONLY ONE CHINESE USE AGAINST SHIPS AT SEA

Many China teams considered using nuclear weapons against U.S. ships, particularly aircraft carriers, which are high-value targets because of their military capability and symbolism of U.S. power. However, only one China team did so. The lack of nuclear attacks at sea was surprising since the literature regards this as an attractive option because of the absence of civilians, the ability to strike solely military targets, and the limited radioactive fallout. The limited use of nuclear weapons against ships at sea resulted from a lack of need and a lack of effectiveness.

*The limited use of nuclear weapons against ships at sea resulted from a lack of need and a lack of effectiveness.*

There was a lack of need because conventional munitions were highly effective in sinking surface ships on both sides during the initial weeks of the conflict. China has many conventional weapons that were effective against ships, so there was little operational advantage from using nuclear weapons. U.S. surface forces were highly vulnerable when inside Chinese missile weapon employment zones. For example, U.S. carriers operating west of Guam generally launched only a handful of sorties before being sunk or otherwise neutralized. Conversely, Taiwan's ground-launched antiship missiles, U.S. submarines, and U.S. bomber-launched antiship missiles could grind down the Chinese fleet over the course of weeks.

At the same time, nuclear weapons lacked effectiveness against ships at sea, making them a less appealing option. The Crossroads nuclear tests in 1946 showed that nuclear weapons must strike near a ship to disable it, necessitating precision.[242] Conventional antiship missiles have terminal guidance to achieve this precision. However, neither the U.S. nor Chinese military has nuclear missiles with terminal seekers (most commonly an active radar) that can update the target location as the missile approaches a moving ship.[243] Without such guidance, time delays in the kill chain and the target's movement made such attacks difficult. Table C3 in Appendix C shows the quantity of weapons needed. This uncertainty also makes nuclear first use at sea a risky signal of commitment and seriousness because of the high probability of failing to inflict damage and then looking ineffective.[244]

In the one iteration where the China team used nuclear weapons against U.S. ships at sea (Game 10), the China team dropped patterns of nuclear weapons to cover all possible locations—48 high-yield weapons against a U.S. carrier and surface action group. Although they successfully destroyed their target, this did not significantly affect the conventional balance of power since China had already sunk many U.S. and Japanese ships with conventional weapons and viewed the nuclear strike as a one-time event.

### PORTS AND AIRFIELDS

Contrary to the expectations generated by the literature, there was only one targeting of airfields. In that case, the China team targeted U.S. airbases on Japan. Consistent with the logic of extended deterrence, the United States retaliated with a counterforce attack. Guam, the target of nuclear attack in three previous wargame projects by other organizations, was never targeted in the series of wargames run for this project.

The reason for this infrequent targeting was twofold. First, both ports and airfields are in or near cities, so attacks would likely engender retaliation. For example, a single 10 kt weapon dropped on a ship at the Chinese port at Quanzhou, the nearest to Taiwan and likely to be used in an invasion, would produce 77,000 civilian casualties.[245] For China teams, the ports and airfields most relevant for U.S. power projection are either on U.S. or Japanese territory; this makes a Chinese first strike on them likely to engender retaliation. Second, as with ships at sea, China already possesses a robust arsenal of conventionally armed ballistic missiles that could neutralize airbases and ports without nuclear escalation. Third, a major drawback of ports is that ships are spread out for loading and relatively resistant to nuclear attacks.[246] Thus, more nuclear firepower would be needed, increasing civilian casualties.

### HIGH-ALTITUDE ELECTROMAGNETIC PULSE (HEMP)

In two games, China teams began the conflict by using a HEMP over Taiwan. In one iteration (Game 4), the U.S. team responded with a HEMP of its own, and in the other (Game 14), the U.S. team continued the conventional war without a nuclear response. In both cases, the conflict continued as in other games. In another iteration (Game 12), the China team used a HEMP later in the campaign when it believed its conventional campaign was failing; the U.S. team continued the conventional campaign, and the China team accepted an unfavorable peace offer. The use of HEMP, therefore, did not move the conflict toward a conclusion, either an off-ramp or nuclear escalation, in the same way nuclear weapons did when used to create direct effects.

### TARGETING OF JAPAN

Despite having ports and airfields that were attractive targets, Japan was attacked only once with nuclear weapons.[247] There was a strong belief by China teams that an attack on Japan would prompt U.S. nuclear retaliation. As a result, the only attack against Japan was in Game 11, in which the China team attacked multiple Japanese airbases as part of a broader nuclear attack. Furthermore, no China team believed it could split the U.S.-Japan alliance with a nuclear attack on Japan. Indeed, when the China team attacked Japan, the U.S. team honored its extended deterrence commitment and responded with a large counterforce attack against China.

## How Did the Adversary Respond?

This section examines responses to nuclear use and characterizes these responses as withdrawal from conflict, continuing the conventional fight, or nuclear retaliation. Nuclear retaliation is further characterized as operational (against conventional forces), countervalue (against cities or infrastructure in cities), or counterforce (against nuclear weapons capabilities). Of the resulting five options, operational nuclear responses to adversary first use appeared to lead to the most favorable results in terms of agreements or outcomes on Taiwan. However, each has advantages and disadvantages across a broader spectrum of values and risks.

Table 7: Hypotheses About Retaliation

| Reaction | | Hypothesis | Supported? |
|---|---|---|---|
| Nonnuclear Responses | Withdrawal | China teams will be less likely than U.S. teams to withdraw from the conflict in response to nuclear first use. | Supported (2 U.S. withdrawals) |
| | Continuing Conventional | Continuing the conventional campaign will not lead to successful outcomes unless the adversary cannot continue nuclear attacks. | Supported (1 failed attempt) |
| Nuclear Responses | Operational Retaliation | Operational nuclear retaliation will prevent first users from gaining a decisive military advantage. | Supported (1 U.S. Nuclear Operational Retaliation led to status quo ante) |
| | Countervalue Retaliation | Countervalue retaliation will not achieve anticipated political results and will produce escalatory spirals. | Supported (All three countervalue retaliations led to conflagrations) |
| | Counterforce Retaliation | Counterforce retaliation will not achieve the anticipated political result of coercing the adversary into favorable war terminations. | Supported (1 iteration) |

Source: CSIS Defense and Security Department.

## NONNUCLEAR RESPONSES

The least risky response to Chinese nuclear first use was withdrawal. However, that did not preserve an autonomous Taiwan. Continuing the conventional fight produced unfavorable outcomes and risked further nuclear use.

**Withdrawal:** Some U.S. teams withdrew from the conflict in response to Chinese nuclear use. In Game 13, the U.S. team accepted a Chinese ultimatum for a PRC enclave after Chinese nuclear use on Taiwan and a nuclear demonstration over the Pacific. In Game 9, the U.S. team eventually accepted a PRC enclave after initially attempting to continue the war conventionally. In both cases, China did not gain a total victory. However, some participants judged a PRC enclave to be a precursor to the eventual Chinese takeover of Taiwan. If the United States responded to China's first use by accepting an unfavorable peace settlement, then China would have salvaged its conventional campaign via nuclear escalation. This was the best possible outcome for Chinese nuclear first use and achieved a successful roll of the iron dice in the gamble for resurrection. For U.S. teams, this represented the least-risky option with regard to the probability of further nuclear use or escalation in the short term, though longer-term consequences of defeat would be difficult to predict.

**Continuing the Conventional Campaign:** In Game 12, the U.S. team continued its conventional operations in response to a Chinese HEMP over the Pacific. A nonnuclear response by the U.S. team forced the China team to escalate or back down, leading them to accept a PLA-phased withdrawal. However, in the face of a committed China, attempting to continue the conventional campaign after Chinese nuclear first use was not successful. In Game 2, after the China team attacked Taiwanese leadership with a nuclear weapon and the U.S. team attempted to continue the conventional war, the China team made nuclear threats against Japan. The U.S. team responded with a countervalue attack to signal resolve, resulting in a general nuclear exchange.

Japan's influence is also important. In Game 9, after Chinese nuclear first use, the U.S. team continued the conventional campaign until Japan, fearing further escalation, demanded the United States accept a PRC enclave. The U.S. team acquiesced. Thus, continuing the conventional campaign in the face of adversary first use was successful only if the adversary conducted a strike that did not produce decisive operational effects, the adversary lacked the intent or means to escalate further and create such effects, and allies and partners were willing to continue fighting in the face of one-sided nuclear use.

## NUCLEAR RETALIATION

Players never opted for nuclear demonstrations in response to adversary nuclear first use. Although players were assigned roles as military commanders, many considered the impact on the credibility of U.S. security commitments if the United States did not respond to nuclear use with nuclear strikes of its own. Japan was at the forefront of U.S. thoughts, as losing Japanese access, basing, and overflight would doom the U.S. conventional campaign.[248] However, Japan teams did not unanimously support nuclear retaliation; some were concerned that Japan might become a nuclear target if nuclear exchanges continued.

Beyond these regional considerations, many U.S. players expressed concern that a nonnuclear response to Chinese nuclear first use would create global doubts about U.S. extended deterrence elsewhere, from South Korea to Europe. Finally, many U.S. teams were motivated by the idea that nuclear retaliation discouraged future nuclear proliferation and use by powers outside of the current conflict. However, nuclear retaliation could continue an escalatory spiral beyond the respondent's control.

The risks and benefits of a nuclear response varied based on the target selected. Retaliation against operational targets produced the best U.S. outcomes in the fight for Taiwan.

**Operational:** Just as with nuclear first use, nuclear retaliation targeting enemy conventional forces can achieve significant operational effects. Among all options other than withdrawal, an operational nuclear response is also often the least escalatory, especially if it does not threaten adversary population centers or nuclear capabilities.

Such a response can signal that the responder wants the nuclear exchange to remain limited. Its feasibility relies on having an operationally relevant target that is not on adversary territory. If nuclear use had occurred early in the conflict, Chinese amphibious ships off Taiwan would have been an attractive target, but because destruction of this capability usually triggered Chinese nuclear use, the amphibious fleet was not available as a target in practice.

The lodgment on Taiwan was a compact target critical to Chinese operations. In the one game (Game 5) the U.S. team retaliated against Chinese first use by striking the Chinese lodgment on Taiwan with nuclear weapons. The attack caused a near complete loss of China's operational capabilities on Taiwan and led to Chinese withdrawal from the campaign and a status quo ante peace. However, this nuclear option for the United States would inevitably cause significant collateral damage to Taiwan.

*The lodgment on Taiwan was a compact target that was critical to Chinese operations.*

**Counterforce:** Most U.S. teams considered a counterforce retaliation to Chinese first use, aiming to limit damage from further Chinese strikes by destroying a large portion of Chinese nuclear warheads, delivery systems, and NC3.[249] However, even when Chinese nuclear forces were targeted with counterforce attacks (Games 6 and 11), the China teams retained enough nuclear capability to launch nuclear counterattacks on the U.S. homeland. The China teams rode out the U.S. counterforce attack and used their residual mobile ICBMs to coerce an advantageous outcome (PRC Enclave) in both games. Thus, a counterforce retaliation to Chinese nuclear use did not produce war-winning advantages for U.S. teams.[250]

**Countervalue:** In contrast to the restraint of an operational retaliation, a countervalue retaliation maximizes the resolve communicated to the adversary but also carries the highest likelihood of adversary nuclear escalation. As cities are destroyed back and forth, it becomes harder to stop the cycle because only committed adversaries will continue and the destruction creates animus on both sides, even in a wargame. In all three games in which the U.S. team responded to the China team's first use with countervalue attacks, the result was general strategic nuclear exchanges. In two of these games, the U.S. teams targeted Chinese military facilities in cities. Although the U.S. team justified this on military grounds, it caused massive civilian casualties. To the China teams, these civilian casualties constituted a countervalue attack, regardless of how the U.S. teams might have conceived it.

Escalation to conflagration after countervalue-countervalue retaliations might be due to the artificial nature of the game, in which players do not suffer the real consequences of nuclear war. It is possible that upon observing the actual effects of a countervalue retaliation, a nuclear first user would decide to exit the escalatory spiral and seek an off-ramp. Nevertheless, with all instances of countervalue strikes ending in conflagration, nuclear attacks on civilians appeared unlikely to lead to a favorable outcome and highly likely to start an escalatory spiral that ended in a conflagration.

*With all instances of countervalue strikes ending in conflagration, nuclear attacks on civilians appear unlikely to lead to a favorable outcome and highly likely to start an escalatory spiral that ends in a conflagration.*

## CONSIDERATIONS FOR THE U.S. NUCLEAR ARSENAL

The wargames did not indicate a need for more or different nuclear weapons beyond those already in current U.S. programs. Historically, China's limited arsenal and readiness posture might have allowed a disarming strike by the United States. However, the authors estimated that China's nuclear buildup precluded that possibility by 2028. Although China's integrated air defense system required U.S. nuclear responses to use standoff weapons like ALCMs and low-yield SLBMs, there were enough of these to conduct any desired U.S. nuclear response. Nor did U.S. teams express a belief that an expanded strategic arsenal and the ability to inflict more pain on China would have been beneficial. U.S. teams focused broadly on the benefits and risks of nuclear use. The specific extent of anticipated damage to the respective sides was not central to their calculations. No U.S. team asked for more or different types of nuclear weapons during the game.

Gravity bombs were not used much. As with conventional attacks, both the U.S. and China teams needed to deliver nuclear weapons with standoff systems because of the adversary's air defenses. For U.S. teams, this put heavy demands on ALCMs and low-yield SLBMs in tactical usage. Players rarely used bombs like the B61 because of the need for proximity to the target.

Players also did not distinguish between the risks posed by varying magnitudes of countervalue attacks. Within each of the game iterations, the China teams' countervalue and second-strike capabilities varied over time. At the start of each iteration, as the China teams' nuclear forces were at low readiness, the U.S. teams could plausibly have launched a damage-limiting counterforce strike that would have destroyed most Chinese nuclear weapons. However, the China teams could still have launched a countervalue second strike that would have destroyed around 10–30 U.S. cities. The China teams' ability to survive and retaliate against a U.S. damage-limiting counterforce strike increased over time during most iterations as China mated and dispersed more warheads. China's ability to execute a countervalue retaliation against a U.S. nuclear attack, therefore, varied between threatening tens of cities to hundreds.

However, no U.S. team believed that the certainty of losing 10–30 cities to a nuclear attack was better than continuing an uncertain conventional campaign. It is possible that a future U.S. president, channeling the controversial nuclear strategist Herman Kahn, would be willing to embark on such a damage-limiting first strike at the outset of a war over Taiwan.[251] There were no such players in these games. Recognizing this, China teams were therefore not deterred by intra-game variations in the effectiveness of U.S. counterforce options.[252] To paraphrase McGeorge Bundy, in the real world of real political leaders—whether in the United States or in China—a decision that brings even one hydrogen bomb on one city of one's own country would be considered a catastrophic blunder, 10 bombs on 10 cities would be a disaster beyond history, and a hundred bombs on a hundred cities are unthinkable.[253]

## How Did the Conflict End?

Gambling for resurrection with nuclear first use led to a diverse and unforeseeable set of outcomes. Depending on the adversary's response, this gamble could pay off with a favorable outcome (although not a total victory), lead to a conflagration, or end somewhere in between. The status of conventional forces was important in guiding outcomes; nuclear superiority was not. After nuclear use, firm resolve and openness to off-ramps were critical to avoiding the worst outcomes.

Table 8: Hypotheses About Outcomes

| Question | Hypothesis | Result |
|---|---|---|
| Does the status of conventional forces matter to the outcome of a nuclear exchange? | Battlefield advantage will convey some benefit in shaping positive outcomes to the side holding that advantage. | Supported |
| Does nuclear superiority affect the outcome of a nuclear conflict? | Nuclear superiority will be important in bargaining outcomes. | Unsupported |
| Can nuclear wars be controlled? | Nuclear wars cannot reliably be controlled. | Supported |
| Can complete victories be achieved? | Neither side will achieve complete victory; a settlement will be reached, or general nuclear war will occur. | Supported |

Source: CSIS Defense and Security Department.

### THE STATUS OF CONVENTIONAL CONFLICT SHAPES OUTCOMES AFTER NUCLEAR USE

Political outcomes in the case of nuclear use reflected not only diplomacy and nuclear brinksmanship but also the final balance of conventional forces. Even in games where the China team began nuclear use, and the U.S. team was unwilling to respond in kind (e.g., Games 6, 9, 11, and 13), negotiated settlements resulted in partial Chinese success (e.g., PRC Enclave) rather than unconditional U.S. withdrawal from conflict. This occurred because China teams could not quickly occupy the remainder of Taiwan by the time they had resorted to nuclear use in weeks three or four of the games. While these teams may have been motivated to avoid U.S. nuclear use (or further use), they frequently also considered their weak battlefield position. China teams believed they could make a deterrent demand of U.S. teams ("Stop the fighting in place") but not a compellent demand ("Taiwanese forces should surrender"). Similarly, when the U.S. team responded to China's first use by launching tactical nuclear weapons against the Chinese lodgment in Game 5, the near-complete destruction of Chinese forces ashore on Taiwan made any further demands by the China team compellent demands, which are inherently less likely to succeed than deterrent demands. The China team extracted an agreement from the U.S. team that it would not recognize Taiwanese independence, thus returning to the prewar status quo ante. Overall, however, this was an unfavorable outcome for China.

*Political outcomes in the case of nuclear use reflected not only diplomacy and nuclear brinksmanship but also the final balance of conventional forces.*

### NUCLEAR SUPERIORITY DID NOT DRIVE BARGAINING

Just as the United States' damage-limiting capabilities and quantitative nuclear superiority did not deter China teams from nuclear use, so too nuclear superiority did not drive bargaining outcomes. Game 5 saw the best scenario for U.S. damage limitation (a counterforce attack early in the campaign before Chinese warhead dispersion against a Chinese low-yield-enabled posture). However, the China team used a portion of its surviving warheads to coerce a U.S. withdrawal from the conflict. In general, the status of the conventional campaign, the employment of nuclear weapons, and the threat of mutually destructive escalation shaped bargaining behavior, and neither team considered the relative number of weapons as important to those dynamics.

### NUCLEAR WAR CANNOT RELIABLY BE CONTROLLED

In support of the hypothesis, only some nuclear wars remained limited. "Gambling for resurrection" was truly a roll of the nuclear dice, as some attempts were successful and others came up as catastrophic snake eyes.

Some China teams successfully employed limited nuclear attacks to coerce U.S. teams into reversing the outcome of the conventional war. First use by China teams in three games (9, 11, 13) led to a favorable settlement (a PRC enclave on Taiwan) against U.S. teams unwilling to climb the escalation ladder. In Game 9, the U.S. team attempted to continue the war conventionally but later relented in the face of escalating Chinese threats. In Game 11, the U.S. team responded with a nuclear counterforce attack, but the China team's intransigence, even with a severely depleted nuclear and conventional arsenal, led the U.S. team to accept an unfavorable settlement. Game 13 saw immediate U.S. acceptance of a PRC enclave in response to Chinese nuclear first use. Nuclear escalation, therefore, offered a conventionally defeated China the prospect of gambling for resurrection by transforming the conflict into a contest of resolve that, should the United States be irresolute, could be kept limited.

However, nuclear use also risked creating an uncontrolled spiral that led to the worst outcome for both sides: a nuclear conflagration. In Games 2, 4, and 10, first use by China teams led to a general countervalue exchange with the United States that would have resulted in hundreds of millions of Chinese civilians dying from the prompt effects and many more from delayed effects. Broad swathes of China would be uninhabitable. This outcome was orders of magnitude worse than the losses from a failed invasion attempt—both for the Chinese people and their leaders.

### OFF-RAMPS WERE NEEDED

Even after nuclear use, off-ramps remained critical to preventing uncontrolled escalation. As discussed above, nuclear first use by China could not compel the United States to withdraw and could only deter continued U.S. intervention against a Chinese lodgment. There were also cases of successful U.S. navigation of Chinese nuclear first use that avoided U.S. withdrawal and conflagration.

First, if China teams resorted to demonstrations of HEMP, the U.S. teams could ignore the threat and continue the conventional campaign in the face of Chinese first use (Game 12). If the China team was not committed to the extensive and escalatory nuclear use required to salvage its conventional forces, then it had to accept an unfavorable settlement.

Alternatively, if the U.S. team responded to Chinese nuclear escalation by using nuclear weapons against the Chinese lodgment (Game 5), then there was no way for the China team to continue its invasion attempt; the invasion would fail while provoking the global opprobrium of starting a nuclear war. Thus, nuclear first use sometimes resulted in a settlement advantageous to the United States, either through (1) a lack of Chinese resolve or (2) U.S. nuclear use against the Chinese lodgment. However, both cases fell short of total U.S. victory: Even when the United States destroyed the Chinese lodgment in retaliation for Chinese first use, the China team almost countered with continued nuclear use. Only a U.S. promise not to recognize Taiwanese independence (game 5) prevented a continued nuclear exchange.

### UNCERTAINTY AND THE NEED FOR ANALYTIC CAUTION

Nuclear use often produced results that surprised the team that first employed nuclear weapons. The considerations players believed might drive the other side often did not, and the beliefs and

background of individual players were often as important in shaping outcomes as the structure of the situation. Such human factors can never be fully predicted. However, the fact that three games—all played by professionals with significant expertise in regional and nuclear issues—resulted in large-scale strategic nuclear exchanges and the "deaths" of hundreds of millions should provide cause for circumspection.

*Nuclear use often produced results that surprised the team that first employed nuclear weapons.*

8

# Recommendations

The following recommendations build on the analysis of wargame results. The recommendations aim to strengthen deterrence and better prepare the United States in case nuclear weapons are used.

## To Strengthen Nuclear Deterrence

Five recommendations aim to strengthen deterrence so that conflict is less likely to occur: (1) Prepare off-ramps for a conflict with China, (2) do not preclude the U.S. military from striking the Chinese mainland with conventional weapons, (3) do not pursue quantitative nuclear superiority with the expectation that it will deter China from using nuclear weapons, (4) accustom U.S. military and political leaders to the possibility of large initial losses in the event of a war with China, and (5) continue extended deterrence messaging.

**Prepare off-ramps for a conflict with China.**

As the greatest risk of nuclear first use in a Taiwan scenario comes from Chinese leaders gambling for resurrection, U.S. planners should study and prepare off-ramps beforehand. Total victory—regime change, limits on Chinese armaments, war guilt, or the renunciation of sovereignty over Taiwan—is unachievable in a nuclear environment. This was one of U.S. Attorney General Robert Kennedy's main takeaways from the Cuban Missile Crisis when he noted "the importance of placing one's self in the adversary's shoes, of not humiliating him, and of leaving him a way out of the crisis short of disaster for all parties."[254] A recent Atlantic Council project similarly concluded, "China may

be open to a 'face-saving' resolution that would stave off a nuclear exchange."[255] This is compatible with U.S. nuclear employment guidance: "[T]he United States seeks to end any conflict at the lowest level possible on the best achievable terms for the United States and its allies and partners."[256] This series of wargames provides analytic support for the guidance's approach.

However, even a face-saving off-ramp requires some real concessions. The United States and its coalition will not be inclined to make any concessions to an authoritarian regime that has just launched an unsuccessful war of aggression against a democratic neighbor. Waiting until a bloody war begins to think about potential face-saving off-ramps would risk emotions overwhelming analysis. Further, time will be short, given how quickly nuclear events move. Armistice negotiations in the last Sino-U.S. war took nearly two years, from October 25, 1951, to July 27, 1953. There would not be that kind of time in any future war with China.

In thinking about off-ramps, it may be helpful to imagine the scene: A high-level White House meeting is held two weeks after a Chinese invasion begins. The INDOPACOM commander briefs over video: "Mister President, we have suffered about 10,000 casualties and lost 25 percent of our air force and two dozen ships, including two aircraft carriers. There is a humanitarian disaster unfolding on Taiwan, and our Japanese allies have been struck hard by China's missiles. However, we assess that the Chinese forces on Taiwan are out of supplies and, according to reports, have begun surrendering to Taiwanese forces."

A similar meeting is playing out in the Central Military Commission bunker outside Beijing: "Comrade chairman of the commission, our invasion force commander has been killed. His commissar reports that supplies are short, and morale is low. Our joint theater commander says that the only way to stabilize the situation is with nuclear weapons." The party secretary turns to the minister of foreign affairs: "What messages have we heard from the Americans?"

The United States should study beforehand what messages or terms would successfully terminate the conflict under terms that maintain U.S. interests but do not fuel Chinese temptation to gamble on nuclear use.[257] Some messages are likely to increase the temptation to resort to nuclear arms: "Chairman, we have heard nothing, but the U.S. Congress has just voted to recognize Taiwanese independence." Others are likely to decrease the risks: "We have received a message via the Indian ambassador that the United States and Taiwan are willing to agree to a ceasefire and allow our forces to withdraw, with all prisoners of war released." As Brad Roberts points out, "There is historical evidence pointing to the willingness of China's leaders to accept military losses as long as political points have been won."[258] China's militarily unsuccessful invasion of Vietnam in 1979 is an example. Research and wargaming are needed to conceptualize a settlement that offers China a face-saving off-ramp while still accomplishing key U.S. and coalition goals.

Potential settlements must be acceptable to allies, partners, and domestic audiences, lest their opposition derail negotiations. It would be tempting for the United States to give China concessions that clash with allied interests—for example, agreeing that Japan should immediately and permanently close its representative office in Taiwan. Such a concession would be perfect from the U.S. standpoint: highly visible, symbolic, face-saving for China, and costless for the United States.

Japan might not see it the same way. During the Korean War, disagreement between the United States and South Korea over the treatment of POWs was central to prolonging the war.[259] A delay caused by disagreement with the Taiwanese or Japanese government could be catastrophic in a war where both sides are armed with nuclear weapons.

The study of off-ramps must therefore consider the relative valuation of concessions to the United States, China, Taiwan, and U.S. allies. Selecting from the menu of concessions built by research and wargaming would still require great diplomatic skill, but having such a menu ahead of time would be far better than attempting to build it under the time constraints and duress of an ongoing war.

**Do not preclude the U.S. military from striking the Chinese mainland with conventional weapons in the event of war.**

Conventional strikes on the Chinese mainland, such as attacks on Chinese amphibious ships in port and Chinese airplanes at their airbases, could inflict significant damage while the ships and aircraft are stationary and vulnerable. Even limited mainland strikes would inflict virtual attrition on Chinese forces by requiring them to divert forces to homeland defense.

*The First Battle of the Next War* noted the uncertainty of authorization for mainland strikes because of escalation fears.[260] This wargaming series suggests the escalation risks are lower than the previous study and others believed. In the current study's wargames, amphibious ships in port, airbases, and command and control nodes were struck with conventional weapons in various games. Neither Chinese concerns about attacks on the mainland nor inadvertent escalation caused any China team to seriously consider nuclear first use in response.

There are drawbacks to such U.S. attacks. Chinese air defenses, other demands on U.S. airpower, and Chinese attacks on U.S. airbases would constrain the scale and frequency of mainland strikes. Striking the Chinese mainland could incite Chinese domestic opinion, potentially prolonging the war and reducing China's restraint in its attacks on U.S. and allied territory. However, the risk of nuclear retaliation by China seems to be lower than previously believed.

Nevertheless, authorization for such strikes would require a political decision at the highest levels weighing potential benefits against risks. Because of the uncertainty of this political decision, military planners should develop branch plans and capabilities that are flexible and capable of achieving objectives with or without conventional mainland strikes.[261] Force planners should keep in mind the need for flexibility: Force structure optimized for mainland attack may be less useful or even useless if authorization is not granted.

**Do not pursue quantitative nuclear superiority with the expectation that it will deter China from using nuclear weapons.**

Expanding the size of the U.S. nuclear inventory or the types of nuclear systems would not produce a military or political advantage in this scenario. As with previous wargames at CNAS, players in these games often believed that U.S. nuclear superiority would deter China from nuclear use.

However, within this project's 15 wargames, neither quantitative U.S. superiority nor damage-limiting capabilities produced psychological advantages in deterrence or bargaining.

As long as China teams thought they possessed a secure second-strike capability, the balance of nuclear power did not deter them from nuclear use. Both times that U.S. teams launched damage-limiting counterforce attacks on China, China teams retained sufficient nuclear weapons to retaliate against the U.S. homeland, continue nuclear bargaining, and achieve a favorable (if incomplete) settlement on Taiwan.

**Accustom U.S. military and political leaders to the possibility of large initial losses in the event of a war with China.**

Part of preparing for rapid and effective policymaking during such a conflict is psychologically preparing for the scale of the fighting. U.S. military and political leaders should not panic because of high early losses and take hasty and irreversible actions like accepting an adverse ceasefire or resorting to nuclear weapons. Historically, the United States has recovered from early defeats in conventional war when cool heads prevailed in council.[262]

This preparation must take place at multiple levels, both domestically and with allies and partners. For example, U.S. military planners should expect that China will attack communication and intelligence platforms like SBIRS as part of a conventional campaign and not interpret such moves as proof that China is inevitably moving toward nuclear first use. U.S. war colleges should include in their wargaming repertoires scenarios with high initial losses. Historical case studies should include high-intensity conventional conflicts that saw early setbacks and later recovery.

U.S. engagement with Taiwan should emphasize the time required for the United States to achieve operational effects that would bring relief to Taiwan. Combined wargames would be one way to do this. In the Monterey Talks and other engagements with Taiwan, the United States should share and support policies that enhance resilience so that Taiwan can persevere through this interval.[263]

**Continue extended deterrence messaging.**

The United States should continue messaging its commitment to extended deterrence. Improving the ability of allied (especially Japanese and Australian) political and military leaders to communicate on pressing nuclear questions during crises and wartime will both reassure allies and demonstrate to China that Washington takes its nuclear commitment to Japan and other allies seriously.

Regardless of how such discussions and preparations proceed, much uncertainty will continue to surround the future nuclear order in northeast Asia. If, as conditions evolve, Tokyo and Washington believe the political and military advantages of basing nuclear weapons in Japan exceed the drawbacks, they should make such changes as part of routine peacetime posture adjustments. Results of game iterations suggest that the United States and Japan should be cautious about doing so during crisis or conflict. Such moves during wartime could be seen in Beijing as preparation for a nuclear attack from Japanese soil and might compromise the protections that extended deterrence offers for that ally.

## To Prepare Should Nuclear Deterrence Fail

Although the U.S. aim is deterrence, the possibility of its failure cannot be dismissed. This section lays out five actions that will help bring about a favorable outcome for the United States while reducing the length and severity of a conflict involving nuclear weapons.

**Develop nuclear branch plans for Chinese operational targets.**

The United States should not start a nuclear conflict by using nuclear weapons first during a Taiwan conflict. Such use would have inevitably unpredictable (and potentially calamitous) consequences. The U.S. and coalition conventional capabilities are strong and have a high probability of prevailing over time.

If the United States decides to respond to Chinese nuclear first use with nuclear weapons, then a limited nuclear strike against Chinese operational forces is the best option. Other targeting had severe downsides. Countervalue retaliations led to nuclear conflagrations, damage-limiting counterforce attacks led to Chinese attacks on the U.S. homeland, and HEMP detonations did not drive outcomes.

*If the United States decides to respond to Chinese nuclear use with nuclear weapons, then a limited nuclear strike against Chinese operational forces is the best option.*

Two operational targets were most favorable. If the Chinese amphibious fleet still exists when China initiates nuclear use, then the United States could launch a nuclear attack on the amphibious fleet moored off the coast of Taiwan. Such an attack would accomplish the broader strategic goals of nuclear use (e.g., demonstrating resolve, reassuring allies), cripple Chinese military operations, and minimize collateral damage. However, if the Chinese amphibious fleet is essentially destroyed by the time of Chinese nuclear escalation (as was always the case in the games), then a U.S. nuclear attack on the Chinese lodgment would definitively end China's ground operations.

STRATCOM should have branch plans to its main war plan that describe nuclear support to conventional operations during a Taiwan scenario.[264] The current nuclear employment strategy discusses the importance of nonnuclear support of the nuclear deterrence mission, but planning for nuclear support of the nonnuclear mission is just as critical.[265] These plans will need extensive interagency coordination, but it is far better to coordinate before a war rather than during a war. Any attack affecting the territory of Taiwan would need to be coordinated with authorities there.

U.S. deterrence messaging in policy statements such as the INDOPACOM and U.S. Strategic Command (STRATCOM) annual posture statements and public documents such as the NPR should be clear about the effectiveness of possible U.S. responses to nuclear first use by any adversary, including China.

**Develop an understanding with Japan on the nuclear environment.**

Because Japan had a critical role in supporting conventional operations against China, Japan had a powerful (if unpredictable) influence on U.S. nuclear decisionmaking.[266] In some cases, particularly prior to nuclear use, Japan teams were more forward leaning than U.S. teams and were, for example, more inclined to strike targets on mainland China. Once nuclear use occurred, the opposite pattern sometimes resulted. Several Japan teams asserted that they would withhold basing access if Washington did not find an off-ramp that would terminate the conflict.

The United States and Japan should conduct joint analysis of nuclear escalation during Taiwan invasion scenarios and discuss possible joint plans of action. DOD, perhaps through DTRA, should sponsor collaborative U.S.-Japan wargaming that would enhance mutual understanding of national perspectives in nuclear deterrence and escalation scenarios. Such engagement should not be limited to Japan's Self-Defense Forces, as civilian officials will likely have primary influence on broader national security policy once nuclear use occurs. It should also include individuals who serve (or who have served) in political advisory capacities from the U.S. and Japanese think tank and academic communities. More immediately, U.S. policymakers should be cautious in interpreting Japanese statements of commitment to participation in a Taiwan scenario and whether that commitment would persist in the face of nuclear threats or use.

**Do not develop additional nuclear weapons for a conflict with China beyond current nuclear modernization plans.**

U.S. teams did not feel constrained by the available nuclear delivery mechanisms. U.S. players generally avoided using land-based ICBMs because of the necessity to overfly Russia on the way to China. However, they always found submarine- or air-launched nuclear weapons sufficient for retaliation against Chinese theater targets. At no point did players lament their inability to access new or different nuclear weapons, like the SLCM-N. Nor did China teams perceive any U.S. constraints in delivery mechanisms when deciding to initiate nuclear use.

All this must be noted with appropriate caveats. The wargames modeled U.S. nuclear forces as being modernized in accordance with the existing Future Years Defense Program. The results here therefore do not support the cancellation of these efforts. Second, findings on the sufficiency of the U.S. arsenal apply only to deterring China in a Taiwan invasion scenario. A more diverse nuclear arsenal might be needed for other contingencies or other actors. Players frequently discussed Russia's possible actions in this scenario, echoing other analyses that treat the two-peer nuclear problem.[267]

If the United States changes its planning guidelines for two simultaneous wars with China and Russia, then more nuclear weapons might be required, especially if it envisions maintaining damage-limiting counterforce capability for those scenarios.[268] But developing new nuclear weapons is both costly, taking resources away from conventional forces, and potentially destabilizing, leading to arms racing and proliferation pressures for third countries. These costs and risks, added to the lack of clear benefits in the pacing U.S. scenario, mean that proposals for nuclear

expansion need to be accompanied by clearer explanations of what scenarios an expanded U.S. nuclear arsenal would benefit and discussions of potential negative externalities.

**Rebalance nuclear inventories over time, from gravity bombs to air-launched cruise missiles.**

Although U.S. teams did not experience a lack of delivery options in this Taiwan invasion scenario, it was evident that Chinese surface-to-air missile capabilities had made air delivery of gravity bombs very difficult, even for stealthy platforms. Indeed, except for B-2s during total counterforce attacks, no U.S. team directed missions that used gravity bombs, opting instead for long-range missiles. The United States should, therefore, plan to rebalance the air-delivered inventory with more LRSO-like weapons and fewer nuclear gravity bombs.

Over time, the United States will need to extend the range and reduce the vulnerability of air-delivered nuclear munitions to allow delivery in the face of increasingly sophisticated Chinese air defenses. The United States does not have enough bombers and tactical nuclear missiles to sustain heavy attrition to air defenses.

**Work with China to facilitate mutual understanding about deterrence and the unpredictability of nuclear escalation.**

The United States should push for meaningful nuclear arms dialogue with China. Chinese scholarship on nuclear deterrence is confident about China's ability to manage nuclear escalation during a conflict.[269] Such confidence is misplaced. A common understanding of the language of nuclear signaling and countries' shared interests in avoiding and managing nuclear escalation is critically important. China's nuclear buildup ensures that the United States will be vulnerable to Chinese nuclear attack, just as China has always been vulnerable to U.S. nuclear attack. China has persistently asked the United States to acknowledge this mutual vulnerability.[270] The PRC claims that U.S. refusal to acknowledge mutual vulnerability has been a stumbling block in advancing nuclear dialogue. Of course, it is unclear whether acknowledging mutual vulnerability would pave the way for substantive discussions that reduce the likelihood of nuclear escalation during a conflict. The United States has concerns about the transparency and purpose of the Chinese nuclear buildup. Track 1.5 discussions should explore what the United States could realistically expect from an official acknowledgment of mutual vulnerability. Expanded nuclear talks might make progress on these concerns, facilitate mutual understanding, and help prevent arms racing, crisis instability, and ultimate catastrophe.

# Appendix A

## *Individual Game Descriptions*

This section provides a brief record of each iteration, designated by location and sequence number, and includes a summary of gameplay and the maximum extent of nuclear use. The scenario is described in two ways: first, by the U.S. ROEs (Max—all Chinese targets allowed; Mid—only unambiguously nonnuclear Chinese targets allowed; or Min—no Chinese mainland or SSBNs may be targeted); and, second, by the Chinese order of battle (ARF—Assured Retaliation Focused, with launch-on-warning capability, no low-yield weapons, and many missiles with single warheads; or LYE—low-yield weapons with no launch-on-warning capability and many MIRV-equipped missiles).

1. Naval Postgraduate School
    - **Scenario:** Max ROE, China LYE
    - **Summary:** China declined to substantially increase its nuclear readiness because it believed that it would win conventionally and that the United States had superior nuclear forces. A Chinese SSBN was sunk without provoking a reaction.
    - **Outcome:** Inconclusive
    - **Maximum extent of nuclear use:** None

2. CSIS

   - **Scenario:** Max ROE, China ARF
   - **Summary:** Seeing conventional failure ahead, China attacked the Taiwanese leadership bunker with nuclear weapons on D+12. On D+21, China threatened to use nuclear weapons against Japan if Japan did not withdraw from the war. The United States preemptively launched a nuclear attack on Ningbo; China responded with a general countervalue attack.
   - **Outcome:** Conflagration
   - **Maximum extent of nuclear use:** Countervalue

3. CSIS

   - **Scenario:** Max ROE, China ARF
   - **Summary:** Chinese conventional attacks on Alaska did not prompt U.S. nuclear use. Chinese position on Taiwan deteriorated. On D+22, China accepted a PLA phased withdrawal.
   - **Outcome:** PLA Phased Withdrawal
   - **Maximum extent of nuclear use:** None

4. CSIS

   - **Scenario:** Mid ROE, China LYE
   - **Summary:** On D-Day, China used a HEMP over Taiwan, to which the United States responded in kind. On D+14, China attacked Taiwanese ground forces with nuclear weapons. The United States responded with nuclear attacks on Chinese nuclear forces. China responded with nuclear attacks against U.S. nuclear forces. The United States responded with 10 countervalue attacks; a general countervalue exchange ensued.
   - **Outcome:** Conflagration
   - **Maximum extent of nuclear use:** Countervalue

5. MIT

   - **Scenario:** Max ROE, China ARF
   - **Summary:** On D+31, China launched three strategic nuclear weapons against Taiwanese ground forces. The United States responded with 10 tactical nuclear weapons against the Chinese lodgment. China accepted the status quo ante but successfully insisted on no Taiwanese independence.
   - **Outcome:** Status Quo Ante
   - **Maximum extent of nuclear use:** Operational use by both sides

6. MIT

   - **Scenario:** Min ROE, China LYE
   - **Summary:** On D+8, the United States launched a general nuclear counterforce attack on China. China responded with half of its surviving ICBMs launching counterforce attacks on the United States and launched 35 low-yield nuclear weapons against Taiwanese forces. China responded with half of its surviving ICBMs launching counterforce attacks on the United States. China demanded a PRC enclave; the United States declined. China attacked Honolulu with a nuclear weapon; the United States accepted the PRC enclave.
   - **Outcome:** PRC Enclave
   - **Maximum extent of nuclear use:** U.S. counterforce use; China counterforce and countervalue against Honolulu

7. MIT

   - **Scenario:** Max ROE, China LYE
   - **Summary:** On D+20, the United States offered a PRC enclave. Shaken by high early losses, the United States saw itself losing a conventional battle and did not want to use nuclear weapons. China accepted, believing its amphibious fleet was about to be destroyed.
   - **Outcome:** PRC Enclave
   - **Maximum extent of nuclear use:** None

8. Naval War College

   - **Scenario:** Min ROE, China ARF
   - **Summary:** On D+36, China accepted PLA phased withdrawal.
   - **Outcome:** PLA Phased Withdrawal
   - **Maximum extent of nuclear use:** None

9. MIT

   - **Scenario:** Min ROE, China ARF
   - **Summary:** On D+36, China launched five high-yield warheads against Taiwanese ground forces and conducted a nuclear demonstration off Hawaii. Japan convinced a divided U.S. team to accept a PRC enclave.
   - **Outcome:** PRC Enclave
   - **Maximum extent of nuclear use:** Chinese operational use

10. CSIS

    - **Scenario:** Mid ROE, China ARF
    - **Summary:** On D+21, China launched 50 nuclear weapons at U.S. surface ships and destroyed a U.S. carrier strike group (CSG). The United States responded with conventional strikes on Chinese early warning assets. China issued a 24-hour ultimatum to the United States. After no response, China launched a full strategic countervalue attack on the United States, and the United States retaliated in kind.
    - **Outcome:** Conflagration
    - **Maximum extent of nuclear use:** Complete global countervalue

11. CSIS

    - **Scenario:** Mid ROE, China LYE
    - **Summary:** On D+10, the United States moved tactical nuclear bombs to Japan. On D+15, China attacked all the air bases in Japan and many military targets on Taiwan with nuclear weapons. The United States responded with SLBMs against fixed ICBM sites; central nuclear weapons storage; and NC3 nodes. China responded with direct-ascent weapons, a cyberattack against the SBIRS, and nuclear weapons against Alaska and Hawaii. The United States decided against further nuclear retaliation and accepted a PRC enclave.
    - **Outcome:** PRC Enclave
    - **Maximum extent of nuclear use:** U.S. counterforce attacks; China used nuclear weapons against Japan, Taiwan, Alaska, and Hawaii.

12. CSIS

    - Scenario: Mid ROE, China ARF
    - Summary: On D+22, China used a HEMP over the Pacific during the transit of a B-52 squadron, causing it to abort. The United States responded with conventional hypersonic attacks against Chinese command and control nodes. China accepted a PLA phased withdrawal.
    - Outcome: PLA Phased Withdrawal
    - Maximum extent of nuclear use: Single Chinese HEMP over the Pacific

13. CSIS

    - **Scenario:** Min ROE, China LYE
    - **Summary:** On D+15, China launched 19 low-yield nuclear weapons against Taiwanese ground forces and a HEMP over the Pacific. The United States accepted a PRC enclave.
    - **Outcome:** PRC Enclave
    - **Maximum extent of nuclear use:** Operational against Taiwan and demonstration

14. MIT Endicott House

    - **Scenario:** Max ROE, China LYE
    - **Summary:** On D-Day, China launched a HEMP over Taiwan. On D+25, China conducted a nuclear test. The conventional campaign on Taiwan went badly for China, as its amphibious fleet was attrited. On D+30, China accepted a PLA phased withdrawal.
    - **Outcome:** PLA Phased Withdrawal
    - **Maximum extent of nuclear use:** HEMP over Taiwan and nuclear test

15. MIT Endicott House

    - **Scenario:** Min ROE, China ARF
    - **Summary:** With a dwindling amphibious fleet, China was unable to enlarge its lodgment northwest of Taipei; on D+15, China accepted a PLA phased withdrawal.
    - **Outcome:** PLA Phased Withdrawal
    - **Maximum extent of nuclear use:** None

# Appendix B

## *Summary of Nuclear Use*

The table below lays out nuclear use for each game iteration. The type of nuclear use is categorized as high-altitude electromagnetic pulse (HEMP), operational use against conventional forces (Op), counterforce (CF), or countervalue (CV).

Table B-1: Summary of Nuclear Use

| Game iteration | Nuclear use | First user | Type of use | Location of first use | Nuke response | Max extent of use | Outcome |
|---|---|---|---|---|---|---|---|
| 1 | No | — | — | — | — | — | Inconclusive |
| 2 | Yes | China | Op | Taiwan | Yes | CV | Conflagration |
| 3 | No | — | — | — | — | — | PLA Phased Withdrawal |
| 4 | Yes | China | HEMP | Taiwan | Yes | CV | Conflagration |
| 5 | Yes | China | Op | Taiwan | Yes | Op | Status Quo Ante |
| 6 | Yes | U.S. | CF | China | Yes | CF, small CV | PRC Enclave |
| 7 | No | — | — | — | — | — | PRC Enclave |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8 | No | — | — | — | — | — | PLA Phased Withdrawal |
| 9 | Yes | China | Op | Taiwan, plus demo off Hawaii | No | — | PRC Enclave |
| 10 | Yes | China | Op | CSG | No, conventional attack on early warning | CV | Conflagration |
| 11 | Yes | China | Op | Japan/ Taiwan | Yes (CF) | CV (Alaska/ Hawaii) | PRC Enclave |
| 12 | Yes | China | HEMP | B-52 in flight | No | HEMP | PLA Phased Withdrawal |
| 13 | Yes | China | Op | Taiwan, Pacific | No | Op | PRC Enclave |
| 14 | Yes | China | HEMP | Taiwan | No | Op | PLA Phased Withdrawal |
| 15 | No | — | — | — | — | — | PLA Phased Withdrawal |

Source: CSIS Defense and Security Department.

# Appendix C

## *Nuclear Weapons Use and Effects*

This appendix provides details on the use of nuclear weapons and their effects on ground forces, on ships at sea, and on airfields.

Ground Forces: During the Cold War, the United States developed many systems for employing nuclear weapons on the battlefield. Weapons ranged from the tactical Davy Crockett (range 1.25 miles, yield 0.02 kt) to the continent-spanning Pershing II (range 1,500 miles, yield 80 kt).[271] The United States also developed doctrine for operating on a nuclear battlefield and applied the doctrine in training exercises, even detonating nuclear weapons and having troops maneuver through them. The Soviets similarly developed a wide range of tactical nuclear weapons.

The United States retired all ground-to-ground tactical nuclear weapons at the end of the Cold War but has retained air- and sea-delivered systems as described in Chapter 4: Research Design. Nuclear weapons on the battlefield have three advantages. First, one weapon can have an outsized effect on enemy forces because of its great power. Second, countries often develop nuclear weapons with a wide range of yields that can be tailored to the needs of a particular target. Finally, battlefield use has less effect on civilians than strategic attacks on cities or nuclear forces.

There are several disadvantages. The first is that nuclear weapons will affect friendly forces as well as adversaries. That means that friendly forces must be warned before a strike and, if possible, pulled back. However, the adversary might pick up on this warning and make its own preparations.

Second, although troops in the open are very vulnerable, dug-in troops are relatively well protected, and troops inside armored vehicles are extremely well protected. For example, a 10 kt burst air

burst will inflict 50 percent casualties on troops in the open to 2 km, on dug-in troops to 1 km, and on troops in armored vehicles to just 0.5 km. The corollary to this is that to produce a significant battlefield advantage, an attacker needs to use a lot of nuclear weapons. Opening a 30 km gap in a front defended by dug-in troops (a gap wide enough to prevent easy plugging by reserves and reinforcements) requires fifteen 10 kt weapons or five 100 kt weapons.[272]

The final disadvantage is casualties inflicted on civilians. Although military forces are trained and equipped to deal with nuclear attacks, civilians are not and will suffer much higher casualties than military forces. Table C-1 shows estimated civilian casualties for nuclear detonations on Taiwan. Even if cities are not targeted, civilian casualties would be high. A 10 kt weapon detonated in a rural area would produce 4,800 casualties (cell highlighted). Fifteen 10 kt weapons would produce 72,000 casualties. Five 100 kt weapons would produce 113,000 casualties.

### Table C-1: Estimated Civilian Casualties for Nuclear Detonations on Taiwan

| | | Air Burst | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **PD (in km²)** | **1 kt** | **3 kt** | **10 kt** | **30 kt** | **100 kt** | **300 kt** | **1 MT** | **3 MT** |
| **Large City:** Taipei | 9,000 | 31177 | 64778 | 144,509 | 301,039 | 675,242 | 1,394,598 | 3,136,388 | 6,501,012 |
| **Medium City:** Keelung, Taoyuan | 2,500 | 8,660 | 8,868 | 40,142 | 83,622 | 187,567 | 387,388 | 871,219 | 1,805,837 |
| **Small City:** Taichung, Penghu, Tainan, Kaoshun | 1,000 | 3,464 | 7,198 | 16,057 | 33,449 | 75,027 | 154,955 | 348,488 | 722,335 |
| Rural | 300 | 1,039 | 2,159 | **4,817** | 10,035 | 22,508 | 46,487 | 104,546 | 216,700 |
| Mountain | 100 | 346 | 720 | 1,606 | 3,345 | 7,503 | 15,496 | 34,849 | 16,451 |

Note: PD = Population density in people per square kilometer.
Source: CSIS calculations based on nuclear lethality radii from Alex Wellerstein, "NukeMap," NukeMap, https://nuclearsecrecy.com/nukemap/. Taiwan population density based on "Population Density in Taiwan in 2023," Statista, https://www.statista.com/statistics/1317802/taiwan-population-density-by-region/; and census data published on websites of Taiwan's provincial and special municipal governments.

**Ships at Sea:** During the Cold War, both the United States and the Soviet Union deployed antiship and antisubmarine nuclear weapons. This thinking, and the weapons to implement it, faded away after the Cold War since conventional weapons were adequate for the naval threats that remained. The rise of China as a great power with nuclear weapons has renewed interest.

A key employment consideration is how near nuclear weapons must land to damage ships. Table C-2 shows these effects by weapon yield. The key insight from the table is how close a nuclear detonation must be to a ship to cause significant damage.

### Table C-2: Effects on Ships by Nuclear Weapons Yield

| | **10 kt** | **30 kt** | **100 kt** | **300 kt** | **1,000 kt** |
|---|---|---|---|---|---|
| Lethal radius | 250 m | 400 m | 600 m | 850 m | 1,300 m |
| Incapacitating damage | 500 m | 800 m | 1,200 m | 1,700 m | 2,600 m |

Note: Lethal radius = sinking or in a sinking condition. Incapacitating damage = unable to continue missions without extensive repairs.
Source: Crossroads test and DTRA supplied data.

Because neither side has terminal guidance for nuclear weapons and uses GPS or inertial guidance instead, a large shot pattern with many weapons is needed to cover all possible locations. Table C-3 combines the distance estimates from Table 2 with kill chain assumptions to show how many nuclear weapons would be needed. The resulting numbers are very large, from 22 to 178.

### Table C-3: Number of Nuclear Weapons Needed to Be Certain of Destroying Ships at Sea

| | **Time from Observation to Missile Arrival at Targeted Point ("Kill Chain")** | |
|---|---|---|
| | *30 minutes* | *60 minutes* |
| 1 km lethal radius | SSPK = 0.011<br>89 warheads to cover | SSPK = 0.006<br>178 warheads to cover |
| 2 km lethal radius | SSPK = 0.045<br>22 warheads to cover | SSPK = 0.022<br>45 warheads to cover |

Note: SSPK = single shot kill probability. Lethal radius depended on the type of ship and the yield of the nuclear weapon. In general, weapons with 100 kt yields had a 1 km lethal radius, and those of 300 kt had a 2 km lethal radius, though the radius also depended on ship type. Calculations assume: (1) target ships are traveling at 25 nautical miles per hour, plus or minus 5 knots; (2) ships are zigzagging with alternating starboard and port turns of 25 degrees, plus or minus 5 degrees; and (3) 30 or 60 minutes of elapsed time from the last observed location of the target and the missile's arrival at the targeted area (including analysis, communications, command, launch preparation, and flight time). At 30 minutes, the number of warheads required would range from 22 to 89, at 60 minutes from 45 to 178.
Source: MIT calculations.

**Airfields:** Chapter 3 describes airfields as an attractive target. Table C-4 shows the reason: Even relatively small nuclear detonations are devastating for unprotected aircraft on the ground. For example, a 10 kt detonation (column highlighted) will destroy nearly all aircraft, even at large air bases where aircraft can spread out.[273]

Table C-4: Nuclear Effects Against Aircraft on Airbases (Percentage of Aircraft Destroyed)

**Small Airbase**

| | *3 KT* | *10 KT* | *30 KT* | *100 KT* | *300 KT* | *1000 KT* |
|---|---|---|---|---|---|---|
| Light A/C | 90% | 100% | 100% | 100% | 100% | 100% |
| Heavy A/C | 100% | 100% | 100% | 100% | 100% | 100% |
| HAS | 55% | 90% | 95% | 100% | 100% | 100% |

**Medium Airbase**

| | *3 KT* | *10 KT* | *30 KT* | *100 KT* | *300 KT* | *1000 KT* |
|---|---|---|---|---|---|---|
| Light A/C | 80% | 100% | 100% | 100% | 100% | 100% |
| Heavy A/C | 95% | 100% | 100% | 100% | 100% | 100% |
| HAS | 40% | 75% | 85% | 95% | 100% | 100% |

**Large Airbase**

| | *3 KT* | *10 KT* | *30 KT* | *100 KT* | *300 KT* | *1000 KT* |
|---|---|---|---|---|---|---|
| Light A/C | 60% | 90% | 100% | 100% | 100% | 100% |
| Heavy A/C | 90% | 100% | 100% | 100% | 100% | 100% |
| HAS | 25% | 55% | 70% | 85% | 100% | 100% |

Note: Assumed burst mode: Anti-infrastructure. HAS = hardened aircraft shelter. Light A/C = light aircraft-like fighters. Heavy A/C = heavy aircraft-like multiengine bombers and tankers.
Source: Provided by DTRA RD based on calculations from its MINES model.

# Appendix D

## *Glossary*

**Assured Retaliation Focus:** A postulated future Chinese nuclear force that has focused on enhancing its ability to endure counterforce attacks.

**China:** The People's Republic of China

**Conflagration:** A general exchange of countervalue attacks.

**Counterforce:** An attack against the nuclear forces of an adversary. It is assumed to be made with nuclear weapons, unless a "conventional counterforce" attack is specified.

**Countervalue:** An attack with nuclear weapons against the cities of an adversary. In this report, this includes attacks against economic and military targets whereby the direct effects of nuclear weapons would affect metropolitan areas.

**Damage-limiting strike:** A counterforce attack that will limit but not eliminate the nuclear retaliatory capability of an adversary.

**Disarming strike:** A counterforce attack that is expected to eliminate the adversary's nuclear retaliatory capability.

**Escalation:** A change in nuclear posture or the use of nuclear weapons.

**High-yield:** For this game, nuclear weapons of 300 kilotons.

**Infrastructure targeting:** A more sophisticated formulation of countervalue targeting that proposes to target an adversary's infrastructure, ranging from remote sites causing few civilians deaths to society-destroying target sets. For the purposes of this report, it is subsumed into countervalue targeting.

**Low-yield:** There is no generally accepted definition.[274] For this game, nuclear weapons of 30 kt. Note that the bombs dropped on Hiroshima and Nagasaki were of ~15 kt and ~20 kt, respectively.

**Low-yield enabled:** Refers to a postulated future Chinese nuclear force that has focused on becoming more like the United States, particularly in the acquisition of low-yield nuclear weapons. This posture still gives China a secure second strike, although that second strike is not as potent as in the alternate posture.

**Operational nuclear use:** An attack with nuclear weapons against the conventional forces of an adversary.

**Retaliation:** A nuclear attack launched in response to nuclear first use.

**Secure second strike:** The ability of a country's nuclear forces to endure an adversary's counterforce first strike (so that the adversary's attack is only damage-limiting and not disarming).

# About the Authors

**Mark Cancian** (Colonel, USMCR, ret.) is a senior adviser with the Defense and Security Department at the Center for Strategic and International Studies (CSIS) in Washington, D.C. He joined CSIS in April 2015 from the Office of Management and Budget, where he spent more than seven years as chief of the Force Structure and Investment Division. Previously, he worked on force structure and acquisition issues in the Office of the Secretary of Defense and ran research and executive programs at Harvard University's Kennedy School of Government. In the military, Colonel Cancian spent over three decades in the U.S. Marine Corps, active and reserve, serving as an infantry, artillery, and civil affairs officer and on overseas tours in Vietnam, Desert Storm, and Iraq (twice). Since 2000, he has been an adjunct faculty member at the Johns Hopkins School of Advanced International Studies, where he teaches a course on the connection between policy and analysis. A prolific author, he has published over a dozen CSIS research reports and 40 articles on military operations, acquisition, budgets, and strategy and has received numerous writing awards. He graduated with high honors (magna cum laude) from Harvard College and with highest honors (Baker Scholar) from Harvard Business School.

**Matthew Cancian** is an associate professor at the Naval War College, specializing in conducting wargames. He earned a PhD in political science from MIT, where he concentrated in security studies and comparative politics. His thesis was about the motivations of combatants and the effects of training, based on a survey of 2,301 Kurdish fighters (Peshmerga) during their war against the Islamic State. Before attending MIT, he earned a master of arts in law and diplomacy from the Fletcher School and a bachelor of arts in history from the University of Virginia. Between those educational experiences, he served as a U.S. Marine Corps captain, deploying to Sangin, Afghanistan, as a forward observer in 2011 in support of Operation Enduring Freedom.

**Eric Heginbotham** is a principal research scientist at the MIT Center for International Studies and a specialist in Asian security issues. Before joining MIT, he was a senior political scientist at the RAND Corporation, where he was the lead author of *China's Evolving Nuclear Deterrent* and *The U.S.-China Military Scorecard*. He participated in five iterations of DTRA's Track 1.5 U.S.-China Strategic Dialogue and iterations of the Track 1.5 U.S.-Australia Indo-Pacific Deterrence Dialogue. He is the coauthor (with George Gilboy) of *Chinese and Indian Strategic Behavior: Growing Power and Alarm* (Cambridge University Press, 2012) and is an editor of *China Steps Out: Beijing's Major Power Engagement with the Developing World* (Routledge, 2018). Before that, he was a senior fellow of Asian studies at the Council on Foreign Relations. After graduating from Swarthmore College, Heginbotham earned his PhD in political science from MIT. He is fluent in Chinese and Japanese and was a captain in the U.S. Army Reserve.

# Endnotes

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122 Lawrence Freedman, *The Evolution of Nuclear Strategy*, 3rd ed. (London: Palgrave Macmillan, 2003), 101–111.

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126 Defense Intelligence Agency, *Nuclear Challenges: The Growing Capabilities of Strategic Competitors and Regional Rivals* (Washington, DC: Defense Intelligence Agency, August 2024), 17, https://www.dia.mil/Portals/110/Images/News/Military_Powers_Publications/Nuclear-Challenges-2024.pdf.

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128 Weaver, "The Role of Nuclear Weapons in a Taiwan Crisis," 12.

129 Kroenig, *Deliberate Nuclear Use*, 15.

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131 Metrick, Sheers, and Pettyjohn, *Over the Brink*, 7.

132 Jacob Stokes, *Atomic Strait: How China's Nuclear Buildup Shapes Security Dynamics with Taiwan and the United States* (Washington, DC: CNAS, February 2023), https://www.cnas.org/publications/reports/atomic-strait-how-chinas-nuclear-buildup-shapes-security-dynamics-with-taiwan-and-the-united-states.

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134 Department of Defense, *2023 Military and Security Developments involving the People's Republic of China* (Washington, DC: DOD, October 2023), 111–112, https://media.defense.gov/2023/Oct/19/2003323409/-1/-1/1/2023-MILITARY-AND-SECURITY-DEVELOPMENTS-INVOLVING-THE-PEOPLES-REPUBLIC-OF-CHINA.PDF.

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136 Clay Wilson, *High Altitude Electromagnetic Pulse (HEMP) and High Power Microwave (HPM) Devices: Threat Assessments*, CRS Report No. RL32544 (Washington, DC: Congressional Research Service, July 2008), 6–8, https://sgp.fas.org/crs/natsec/RL32544.pdf; and Edward Savage et al., "The Early-Time (E1) High-Altitude Electromagnetic Pulse (HEMP) and Its Impact on the U.S. Power Grid," Metatech Corporation, January 2010, https://securethegrid.com/wp-content/uploads/2017/09/2010-Metatech-HEMP-Impact-on-US-Power-Grid.pdf.

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138 The treaty is formally known as the Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water. See https://2009-2017.state.gov/t/avc/trty/199116.htm.

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141 Wilson, *High Altitude Electromagnetic Pulse (HEMP) and High Power Microwave (HPM) Devices*, 5–6.

142 Stacie Pettyjohn, Becca Wasser, and Chris Dougherty, *Dangerous Straits: Wargaming a Future Conflict with Taiwan* (Washington, DC: Center for New American Security, 2022), https://s3.amazonaws.com/files.cnas.org/CNAS+Report-Dangerous+Straits-Defense-Jun+2022-FINAL-print.pdf.

143 Freedman, *The Evolution of Nuclear Strategy*, 276.

144 See, for example, Ivo H. Daalder, *The Nature and Practice of Flexible Response: NATO Strategy and Theater Nuclear Forces Since 1967* (New York: Columbia University Press, 1991); and ibid.

145 Brad Roberts, *Extended Deterrence and Strategic Stability in Northeast Asia* (Tokyo: National Institute for Defense Studies, 2013), https://www.nids.mod.go.jp/english/publication/visiting/pdf/01.pdf.

146 Choe Sang-Hun, "In a First, South Korea Declares Nuclear Weapons a Policy Option," *New York Times*, January 12, 2023, https://www.nytimes.com/2023/01/12/world/asia/south-korea-nuclear-weapons.html; Mitch Shin, "The Great Debate Over South Korea Developing Nuclear Weapons is Back," *The Diplomat*, May 16, 2024, https://thediplomat.com/2024/05/the-great-debate-over-south-korea-developing-nuclear-weapons-is-back/; Iku Tsujihiro, "Exploring Tactical Nuclear Possibilities in Japan," CSIS, May 15, 2024, https://nuclearnetwork.csis.org/exploring-tactical-nuclear-possibilities-in-japan/; Eric Heginbotham and Richard J. Samuels, "Vulnerable US Alliances in Northeast Asia: The Nuclear Implications," *Washington Quarterly* 44, no. 1 (March 23, 2021): 157-175, https://doi.org/10.1080/0163660X.2021.1894709.

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148 Kroenig, *Deliberate Nuclear Use*, 9–10

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150 William Safire, *Safire's Political Dictionary* (Oxford: Oxford University Press, 2008), 49–50.

151 Thomas Schelling, *Arms and Influence* (New Haven, CT: Yale University Press, 1966).

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158 J. Michael Legge, *Theater Nuclear Weapons and the NATO Strategy of Flexible Response* (Santa Monica, CA: RAND Corporation, January 1983), 27, https://www.rand.org/pubs/reports/R2964.html.

159 Vojtech Mastny, Petr Luňák, and William E. Odom, *Taking Lyon on the Ninth Day? The 1964 Warsaw Pact Plan for a Nuclear War in Europe and Related Documents* (Washington, DC, and Zurich: Center for Security Studies at ETH Zürich, 2000), https://www.files.ethz.ch/isn/108642/warplan_dossier.pdf.

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161 Kroenig, *Deliberate Nuclear Use*, 16.

162 Schelling, *Arms and Influence*, 2.

163 Jervis, *The Meaning of the Nuclear Revolution*, 42.

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208 Kristensen and Korda, "Nuclear Notebook," 71; and Amy F. Woolf, *U.S. Strategic Nuclear Forces: Background, Developments, and Issues* (Washington, DC: Congressional Research Services, December 2021), 43, https://crsreports.congress.gov/product/details?prodcode=RL33640.

209 NNSA, *W80-4 Life Extension Program* (Washington, DC: NNSA, November 2023), https://www.energy.gov/sites/default/files/2023-11/W80-4_1123.pdf.

210 The LRSO Selected Acquisition Report indicates initial production will begin in 2027, so no systems would be available in 2028. See DOD, *Long Range Stand Off (LRSO): Selected Acquisition Report (SAR)* (Washington, DC: DOD, April 2022), https://www.esd.whs.mil/Portals/54/Documents/FOID/Reading%20Room/Selected_Acquisition_Reports/FY_2021_SARS/22-F-0762_LRSO_SAR_2021.pdf.

211 This is the limit placed by the New START treaty, though some counting rules make a definitive count using only government-released sources impossible. For example, the treaty counts bombers as one deployed warhead. See "New START Treaty," U.S. Department of State, accessed November 12, 2024, https://www.state.gov/new-start/.

212 NNSA definitions from "Transparency in the U.S. Nuclear Weapons Stockpile": "The nuclear stockpile includes both active and inactive warheads. Active warheads include strategic and non-strategic weapons maintained in an operational, ready-for-use configuration, warheads that must be ready for possible deployment within a short timeframe, and logistics spares. They have tritium bottles and other Limited Life Components installed. Inactive warheads are maintained at a depot in a non-operational status and have their tritium bottles removed. A retired warhead is removed from its delivery platform, is not functional, and is not considered part of the nuclear stockpile. A dismantled warhead is a warhead reduced to its component parts."

213 Kristensen and Korda, "Nuclear Notebook," 4.

214 Office of the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs, "Nuclear Weapons" in *The Nuclear Matters Handbook 2020 Revised* (Washington, DC: Office of the Secretary of Defense, 2020), 31–49, https://www.acq.osd.mil/ncbdp/nm/NMHB2020rev/chapters/chapter4.html.

215 The B-21 production schedule is still classified. The U.S. Air Force fact sheet says that the B-21 will be operational in the "mid-2020s." See "B-21 Raider," U.S. Air Force, https://www.af.mil/About-Us/Fact-Sheets/Display/Article/2682973/b-21-raider/. A Northrop Grumman fact sheet says that the initial aircraft are in production, and press reports state that the first six aircraft are in production. However, the aircraft is still in flight testing. See "B-21 Raider Frequently Asked Questions," Northrop Grumman, accessed November 12, 2024, https://www.northropgrumman.com/what-we-do/air/b-21-raider/b-21-faqs. The assumption for the wargame was that there would not be enough operational B-21s in 2028 to form even a half squadron.

216 Michael Marrow, "F-35A Officially Certified to Carry Nuclear Bomb," Breaking Defense, March 8, 2024, https://breakingdefense.com/2024/03/exclusive-f-35a-officially-certified-to-carry-nuclear-bomb/.

217 Stacie Pettyjohn, Becca Wasser, and Chris Dougherty, *Dangerous Straits: Wargaming a Future Conflict with Taiwan* (Washington, DC: CNAS, 2022), https://s3.amazonaws.com/files.cnas.org/CNAS+Report-Dangerous+Straits-Defense-Jun+2022-FINAL-print.pdf.

218 Pettyjohn and Dennis, *Avoiding the Brink*.

219 Metrick, Sheers, and Pettyjohn, *Over the Brink*.

220 Shullman, Culver, Liao, and Wong, *Adapting US Strategy*.

221 Weaver, "The Role of Nuclear Weapons in a Taiwan Crisis," 12.

222 For more on the authors' view of the epistemology of wargames, see Chapter 2 in Cancian, Cancian, and Heginbotham, *First Battle of the Next War*.

223 On the general futility of estimating the likelihood of nuclear use, see Amy J. Nelson and Alexander H. Montgomery, "How Not to Estimate the Likelihood of Nuclear War," Brookings Institute, October 19, 2022, https://www.brookings.edu/articles/how-not-to-estimate-the-likelihood-of-nuclear-war/.

224 The United States, for example, considered using nuclear weapons during the Korean and Vietnam Wars. See Daniel Calingaert, "Nuclear Weapons and the Korean War," *Journal of Strategic Studies* 11, no. 2 (1988): 177–202, https://doi.org/10.1080/01402398808437337; and Robert Jervis et al., "Nuclear Weapons, Coercive Diplomacy, and the Vietnam War: Perspectives on Nixon's Nuclear Specter," *Journal of Cold War Studies* 19, no. 4 (2017): 192–210, https://doi.org/10.1162/jcws_c_00770.

225 Cancian, Cancian, and Heginbotham, *First Battle of the Next War*.

226 For examples of historical attempts to gain such an advantage against one element of an adversary's nuclear forces, see Long and Green, "Stalking the Secure Second Strike."

227 Ben R. Rich and Leo Janos, *Skunk Works: A Personal Memoir of My Years at Lockheed* (Boston: Little Brown, 1994). See especially Chapter 2, "Swatting at Mosquitos." The aircraft became operational in 1984, and DOD acknowledged its existence in 1988.

228 As in all social science endeavors, hypotheses can be supported or not; they cannot be proved or disproved. The degree of confidence in the support should be based on the rigor and methodology of the project. Although 15 game iterations may not be enough to make conclusive judgments about all these complex issues, as discussed in the Chapter 4, this project's background research and iterated play strengthen the level of confidence in its findings. Some hypotheses are more rigorously or extensively examined than others.

229 Roberts, *The Case for U.S. Nuclear Weapons*, 170.

230 Lieber and Press, *Myth of the Nuclear Revolution*, 117. The authors argue that China's poor conventional matchup against the United States and the high costs of defeat might pressure China to nuclear escalation.

231 There is an increasing recognition for the need to study protracted scenarios. For example, see Andrew F. Krepinevich, *Protracted Great-Power War* (Washington, DC: Center for New American Security, 2020), https://www.cnas.org/publications/reports/protracted-great-power-war.

232 The authors did not estimate civilian casualties from nuclear conflict, which in this case clearly would have been horrific. A 2006 study by the Federation of American Scientists estimated that just 60 W88 warheads employed against China's DF-5 silos would kill 11 million people, mostly from radiation. Strikes in Game 6 were far more extensive, involving roughly 20 times the number of weapons. To the extent that they focused on attacking silo-based weapons, casualties per warhead would have been lower, given the remote locations of newer missile silos. However, to the extent that the headquarters for mobile missile brigades, submarine bases, bomber bases, or national command, control, communication, and intelligence (NC3I) were attacked, casualties per warhead would likely have been higher, as these locations tend to be close to heavily populated areas. Hans M. Kristensen, Robert S. Norris, and Matthew G. McKinzie, *Chinese Nuclear Forces and U.S. Nuclear War Planning* (Washington, DC: Federation of American Scientists / Natural Resources Defense Council, November 2006), 185, https://nuke.fas.org/guide/china/Book2006.pdf. For modeling effects against Chinese silos, see Sébastien Philippe and Ivan Stepanov, "Radioactive Fallout and Potential Fatalities from Nuclear Attacks on China's New Missile Silo Fields," *Science and Global Security* 31, no. 1-2 (2023): 3-15, https://doi.org/10.1080/08929882.2023.2215590.

233 The participants in these two iterations were less experienced than those in other games. Experience in wargames or other forms of exposure to the scenario might moderate the response.

234 This reluctance has historical parallels. Robert McNamara reported, "Not only Field Marshal Lord Carver, but Lord Louis Mountbatten and several other of the eight retired Chiefs of the British Defence Staff as well . . . indicate[d] that under no circumstances would they have recommended that NATO initiate the use of nuclear weapons." He further stated his own views: "In long private conversations with successive Presidents—Kennedy and Johnson—I recommended, without qualification, that they never initiate, under any circumstances, the use of nuclear weapons. I believe they accepted my recommendation." Robert S. McNamara, "The Military Role of Nuclear Weapons: Perceptions and Misperceptions," *Foreign Affairs*, September 1, 1983, https://www.foreignaffairs.com/articles/1983-09-01/military-role-nuclear-weapons-perceptions-and-misperceptions.

235 Table 5 seems to suggest that Chinese possession of low-yield nuclear weapons led to better Chinese outcomes (four victories with versus one victory without), even when nuclear weapons were not used. One could hypothesize that possession of low-yield nuclear weapons intimidated the United States into accepting unfavorable settlements. However, no U.S. player remarked on Chinese possession of low-yield weapons in deciding to accept disadvantageous settlements. Therefore, the seemingly better Chinese outcomes appear to be unrelated to Chinese possession of low-yield weapons. More research is needed to establish whether a causal connection exists.

236 Center for Global Security Research, *China's Emergence as a Second Nuclear Peer: Implications for U.S. Nuclear Deterrence Strategy* (Livermore, CA: Lawrence Livermore National Laboratory, 2023), 13, https://cgsr.llnl.gov/content/assets/docs/CGSR_Two_Peer_230314.pdf.

237 Pettyjohn and Dennis observed from their games that, "Whereas Blue players often focused on the quantitative inferiority of even an expanded Chinese nuclear arsenal to that of the United States or Russia, Red players did not believe they needed parity to insulate themselves from American nuclear

coercion and to be empowered to issue nuclear threats or even employ nuclear weapons." Pettyjohn and Dennis, *Avoiding the Brink*, 6.

238 "Extensive" is relative. This represents 30–50 times as much nuclear firepower as was used to end World War II. However, it is a fraction of what might have been used in a NATO-Soviet Union war. For example, one NATO exercise envisioned 335 atomic bombs being used. See "Überholt wie Pfeil und Bogen" [Outdated Like a Bow and Arrow], *Der Spiegel*, July 12, 1955, https://www.spiegel.de/politik/ueberholt-wie-pfeil-und-bogen-a-8282a95e-0002-0001-0000-000031970707.

239 The bunker was assumed to be impervious to conventional attack. Israel reportedly used 80 specialized 2,000-pound bombs to destroy the Hezbollah command center in Beirut. They could fly that many sorties on a single target because they faced no air defenses. That would not be the case for Chinese air attacks on Taiwan. Graham Scarbro, "A Closer Look at Israel's Use of 80 Bunker-Buster JDAMs in Beirut," U.S. Naval Institute, *Proceedings* 150, no. 10, October 2024, https://www.usni.org/magazines/proceedings/2024/october/closer-look-israels-use-80-bunker-buster-jdams-beirut.

240 These insights come from the results of the 15 full games. The results of the six ground-only games were identical.

241 There would also have been many civilian casualties from conventional attacks, but the project did not estimate these. Also, there are many uncertainties in estimating civilian casualties from nuclear use. Not the least of these is how many civilians might self-evacuate from the battle area prior to use.

242 See William A. Shurcliff, *Technical Report of Operation Crossroads* (Washington, DC: Defense Atomic Support Agency, 1946), 6, table, https://apps.dtic.mil/sti/citations/AD0367496. The Crossroads nuclear tests showed serious damage to ships at about 900 m, sinking at about 400 m, for a 23 kt weapon.

243 This numbers assumes (1) target ships are traveling at 25 nautical miles per hour, plus or minus 5 knots; (2) ships are zigzagging with alternating starboard and port turns of 25 degrees, plus or minus 5 degrees; and (3) the time from the last observed location of the target and the missile's arrival at the targeted area is 30 minutes (including analysis, communications, command, launch preparation, and flight time). At 60 minutes, the number of warheads required would range from 45 to 178.

244 For these reasons, it is implausible that one Chinese low-yield nuclear weapon could destroy a U.S. carrier as postulated in recent wargames. Metrick, Philip Sheers, and Stacie Pettyjohn, *Over the Brink*, 6.

245 Wellerstein, "Nukemap."

246 A major constraint on loading amphibious ships appears to be port access and vehicle traffic flow, so ships need to spread out. This inference arises from a study on Chinese exercises to use civilian shipping for amphibious operations. J. Michael Dahm, "China Maritime Report No. 25: More Chinese Ferry Tales: China's Use of Civilian Shipping in Military Activities, 2021-2022,"U.S. Naval War College, CMSI China Maritime Reports, no. 25, January 2023, https://digital-commons.usnwc.edu/cmsi-maritime-reports/25.

247 Japan was frequently attacked with conventional weapons. See Cancian, Cancian, and Heginbotham, *First Battle of the Next War*, 112–14.

248 For a full description of Japan's importance in a U.S.-China conflict, see Cancian, Cancian, and Heginbotham, *First Battle of the Next War*, 99, 116–17.

249 The *Nuclear Matters Handbook 2020* defines counterforce as counterforce targeting plans to destroy the military capabilities of an enemy force. Typical counterforce targets include bomber bases, ballistic missile submarine bases, intercontinental ballistic missiles (ICBM) silos, air-defense installations, command and control centers, and weapons of mass destruction storage facilities. Because these types of targets may be hardened, buried, masked, mobile, and defended, the forces required to implement this strategy need to be diverse, numerous, and accurate. (DOD, *Nuclear Matters*, 14) Air

Force Doctrine Document 2-1.5 defines counterforce as "the employment of strategic air and missile forces in an effort to destroy, or render impotent, selected military capabilities of an enemy force under any of the circumstances by which hostilities may be initiated. U.S. Air Force, *Nuclear Operations*, Air Force Doctrine Document 2-1.5 (Maxwell Air Force Base, AL: Air Force Doctrine Center, July 15, 1998), 35, https://www.govinfo.gov/content/pkg/GOVPUB-D301-PURL-LPS96209/pdf/GOVPUB-D301-PURL-LPS96209.pdf.

250 Surprisingly, one China team made a highly risky counterforce strike that led to a successful outcome in Game 6; the China team responded to a U.S. counterforce first strike with a counterforce strike of its own. Although the China team could not hope to destroy the U.S. nuclear arsenal, a counterforce response to counterforce first use communicated a balance of resolve and restraint. This led to a favorable operational outcome for China (PRC Enclave), despite it being in an unfavorable conventional position and suffering an extensive nuclear first strike.

251 Kahn began analyzing nuclear strategy at RAND and later founded the Hudson Institute. He became controversial for his willingness to consider and analyze nuclear warfighting, expressed most forcefully in his 1960 book *Thinking about the Unthinkable* and his 1962 book *On Thermonuclear War*.

252 Nor did China teams discuss the prospects of U.S. counterforce attacks when they were in crisis and deciding between accepting an off-ramp or using nuclear weapons. In those situations, discussions always centered on the conventional battle and its implications for regime survival, not on the enhanced resilience of Chinese nuclear forces following dispersal.

253 McGeorge Bundy, "To Cap the Volcano," *Foreign Affairs*, October 1969, https://www.foreignaffairs.com/russian-federation/cap-volcano.

254 Robert Kennedy, *Thirteen Days in October: A Memoir of the Cuban Missile Crisis* (New York: Norton, 1969), 128.

255 Shullman, Culver, Liao, and Wong, *Adapting US Strategy*, 14.

256 Department of Defense, *Report on the Nuclear Employment strategy of the United States* (Washington, DC: DOD, November 2024), 2, https://media.defense.gov/2024/Nov/15/2003584623/-1/-1/1/REPORT-ON-THE-NUCLEAR-EMPLOYMENT-STRATEGY-OF-THE-UNITED-STATES.PDF.

257 During the Cold War, Schelling proposed a similar study oriented on Soviet leadership during a potential nuclear crisis. See Thomas C. Schelling, "The Role of Wargames and Exercises," in *Managing Nuclear Operations*, ed. Ashton B. Carter, John D. Steinbruner, and Charles A. Zraket (Washington, DC: Brookings Institution, 1987), 443–44.

258 Roberts, *The Case for U.S. Nuclear Weapons in the 21st Century*.

259 The United States wanted a prompt prisoner swap. The South Koreans wanted to give North Korean prisoners the option of remaining in the South. David Vergun, "Long Diplomatic Wrangling Finally Led to Korean Armistice 70 Years Ago," U.S. Department of Defense, July 24, 2023, https://www.defense.gov/News/News-Stories/Article/Article/3423473/.

260 Cancian, Cancian, and Heginbotham, *First Battle of the Next War*, 71–72.

261 The authors thus diverge slightly from authors like Kroenig who recommend to axiomatically plan on mainland strikes. Kroenig, *Deliberate Nuclear Use*, 13.

262 For example, the disastrous battles in New York during the American Revolution, the First Battle of Bull Run in the Civil War, and Pearl Harbor and the Philippines in World War II. The classic examination of first battles is Charles E. Heller and William A. Stofft, eds., *America's First Battles, 1776–1965* (Lawrence, KS: University Press of Kansas, 1986). John Shy's essay "First Battles in Retrospect" (pp. 327–52) notes

that first battles are always bloodier than the peacetime military anticipates. In half of the first battles studied, the United States lost; in four cases it went on to victory, and in another it was able to achieve a status quo ante (the War of 1812).

263 Such efforts would include stockpiling of supplies, which would also be helpful to endure a blockade. Taiwan has already taken steps in this direction.

264 Seconding one of Kroenig's recommendations. Kroenig, *Deliberate Nuclear Use*, 17.

265 DOD, *Nuclear Employment Guidance*, p. 2, directs "the integration of non-nuclear capabilities into U.S. nuclear planning where non-nuclear capabilities can support the nuclear deterrence mission."

266 Shullman, Culver, Liao, and Wong had a similar finding in *Adapting US Strategy*. Cancian, Cancian, and Heginbotham's *First Battles of the Next War* describes how critical Japan is for the conventional fight.

267 For example, Shullman, Culver, Liao, and Wong, *Adapting US Strategy*, 12–13. The Strategic Posture Commission raised similar concerns.

268 Kahn argued that most people he discussed the question with believe that nuclear war against the Soviet Union to preserve Western Europe would be acceptable if less than half of the U.S. population would die (*On Thermonuclear War*, p. 30). If that is true today of Americans and their views on Taiwan and Ukraine, then U.S. policy should prepare for that contingency.

269 Most recently, see Lyle J. Morris and Rakesh Sood, *Understanding China's Perceptions and Strategy toward Nuclear Weapons: A Case Study Approach* (New York: Asia Society, 2024), https://asiasociety.org/policy-institute/understanding-chinas-perceptions-and-strategy-toward-nuclear-weapons-case-study-approach. For an earlier study drawing the same conclusion, see Cunningham and Fravel, "Dangerous Confidence?"

270 For a whole volume on this topic, see David Santoro ed., *US-China Mutual Vulnerability: Perspectives on the Debate*, Issues and Insights 22, SR 2 (Honolulu, HI: Pacific Forum International, May 2022), https://pacforum.org/wp-content/uploads/2022/05/Issues-Insights-Vol.-22-SR-2.pdf.

271 Matthew Seelinger, "The M28/M29 Davy Crockett Nuclear Weapon System," The Army Historical Foundation, accessed November 12, 2024, https://armyhistory.org/the-m28m29-davy-crockett-nuclear-weapon-system/; Matthew Seelinger, "MGM-31 Pershing Missile," The Army Historical Foundation, accessed November 12, 2024, https://armyhistory.org/mgm-31-pershing-missile/.

272 Data from Defense Threat Reduction Agency, Research and Development Directorate, *Nuclear Weapons Effects Wargames Flipbook* (Fort Belvoir, VA: DTRA, November 2022), 9,10, 12. Cleared for public release.

273 It is worth noting from the table that hardened shelters (HASs) increase aircraft survivability even under the extreme stress of a nuclear detonation. *The First Battles of the Next* War report recommended building HASs in the context of a conventional conflict (p. 125–127).

274 Amy Woolf, *Nonstrategic Nuclear Weapons*, CRS Report No. RL32572 (Washington, DC: Congressional Research Service, 2022), https://crsreports.congress.gov/product/pdf/RL/RL32572/46.

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