

Nuclear credibility in theory and in practice

What 81 years of nuclear crises reveal about
arsenal size, posture, and deterrence

| Melanie W. Sisson

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Executive summary

Over its more than 80-year history as a nuclear power, the United States has sought to convince adversaries that it can wage, will wage, and will win a nuclear war. It has sought to convey the credibility of these threats through different combinations of the types, sizes, and locations of its nuclear weapons. No nation has yet exploded a nuclear weapon on the territory, people, or allies of the United States. That nonuse, however, has remained constant even as U.S. nuclear strategy has varied, making it impossible to conclude that strategy, rather than other factors, did the causal work. Nuclear attack, however, is not the only empirically observable event that can provide information about U.S. nuclear credibility: the United States has made and has been the recipient of nuclear threats, both implicit and explicit. These are moments of acute nuclear danger; each incident has the potential to turn into nuclear disaster. Responsible policy, therefore, will seek to minimize how often such crises arise.

This study examines whether and how different U.S. nuclear strategies are associated with few nuclear crises, or with many. It uses an original dataset of 36 U.S.-involved nuclear crises between 1945 and 2026—instances in which the United States or a nuclear-armed adversary made an explicit or implicit nuclear threat—and tests whether their frequency is associated with the features of U.S. nuclear strategy and the broader military and political context.

The single most robust finding is that nuclear crises were less frequent when the United States and its nuclear adversary approached rough parity in nuclear capability and markedly more frequent when one side held a substantial advantage. The policy levers the U.S. national security establishment has spent eight decades pulling in the name of credibility—doctrinal refinements, arsenal size, the forward deployment of nuclear forces—show no consistent, independent association with how often nuclear crises occurred.

These findings speak directly to live policy debates. Some officials and analysts warn that the United States faces a potential “credibility deficit”: that U.S. nuclear strategy today is inadequate to hold at risk enough Russian and Chinese targets to deter both simultaneously, and so it must prepare to expand its arsenal’s size, variety, and posture to close the gap. The historical record instead suggests that a Chinese arsenal organized around a secure second-strike capability is unlikely to increase the frequency of nuclear crises and might reduce it. Historically, it is an assured second-strike capability—not nuclear advantage—that has been stabilizing. Seeking to widen the U.S. lead over China, or to match a combined Russia-China target set, would therefore be to implement an enormously costly solution to a problem that the United States does not have.

The findings also have implications for arms control. If parity is associated with stability—if the condition most associated with fewer crises is mutual assured retaliation and not U.S. superiority—then the relevant policy question is not whether, but rather at what level, to seek parity. The historical patterns offer no evidence that larger arsenals on both sides are more stabilizing than smaller ones; what appears to matter is the balance, not the count. This should make small stockpiles far more appealing than large ones: negotiated reductions that preserve mutual second-strike capability while shrinking the overall nuclear inventory save taxpayer dollars without sacrificing security.

In search of nuclear credibility

Nuclear bombs are the most powerful weapons humans have yet invented, and the most destructive instruments over which they can claim to exercise control. Nuclear weapons alone can simultaneously destroy everything humans have ever built, contaminate the entirety of the Earth’s natural environment, and cause human

extinction. History contains two demonstrations of these effects; the U.S. nuclear bombings of Hiroshima and Nagasaki remain horrifying for the devastation they caused, and terrifying because the scale of that devastation is minor compared to what the world's nuclear arsenals now make possible.

The extent of human suffering in Hiroshima and Nagasaki convinced many of the scientists who built the bombs, and the policymakers who directed their use, that no reasonable person could regard nuclear weapons as anything other than a last resort. They are, in other words, weapons for use only in extremis: when the population for which a policymaker holds ultimate responsibility faces imminent political subjugation or physical destruction—and perhaps not even then. This essential conclusion, however, arrived at by those most intimate with the creation and detonation of nuclear weapons, is nearly absent from the roughly 80-year history of official U.S. nuclear strategy.

That history is instead a record of how analysts, policymakers, and military officials have attempted to convince potential U.S. adversaries of precisely the opposite. For eight decades, the United States has sought to convince all nuclear-armed adversaries that the United States can wage nuclear war; that it will wage nuclear war; and that it will win nuclear war. An adversary so convinced, the logic goes, would not dare attempt an attack against the United States, or any other state to which it has extended its atomic protection.

This understanding of deterrence is intellectually comforting. It is consistent with widely accepted views about how humans make decisions, weighing costs against benefits to arrive at a rational choice. The difficulty, however, is that rational choices depend on judgments about the predicted probabilities of different outcomes. In nuclear deterrence, the predicted probabilities of interest have to do with how likely an actor is to follow through on its nuclear threats. Each strategy of nuclear deterrence is therefore

an essential element of the effort to convince adversaries that U.S. threats and promises are credible. For the United States, this has produced variations on a theme: different strategists have expressed their different theories of what nuclear credibility requires through different combinations of the types, sizes, and locations of U.S. nuclear weapons.

The focus on these policy levers descends directly from the approach to thinking about credibility that has dominated U.S. nuclear strategy since the 1950s. It is an approach in which abundant possession of warheads and the means through which to deliver them are meant to display the ability to inflict intolerable damage. Variety in composition, location, and targeting is intended to demonstrate the will to inflict such damage.

The United States has implemented nine different strategies to operationalize this logic—and no nation has yet exploded a nuclear weapon on the territory, people, or allies of the United States. Nuclear nonuse has been constant. Although it is tempting to attribute this success to U.S. nuclear strategy, there is no empirically sound way to do so. The pairing of a constant outcome with variation in how the United States has sought to achieve it, in other words, precludes any supportable conclusions about whether strategy was doing the causal work—or whether nonuse reflected other factors.

Nuclear attack, however, is not the only empirically observable nuclear event that might provide information about credibility. The United States has made and has been the recipient of nuclear threats, both implicit and explicit. As described by Richard K. Betts in “Nuclear Blackmail and Nuclear Balance,” such instances “are twilight regions ... Crises evoke the question of whether the threats lying behind the goal of deterrence might be called to the test.”¹ They are, in other words, evidence of nuclear danger, discrete moments in which abstract theories of nuclear credibility become grave matters of nuclear practice.

For every nuclear crisis, the most vital outcome is that it not result in a nuclear detonation. Other outcomes might also be valuable to the United States, but these upsides are not comparable in scale to the possible nuclear downside—and there is reason to think that U.S. presidents are quite sensitive to the possible nuclear downside.² There is mounting evidence, moreover, that efforts to use nuclear capability to coercively achieve policy outcomes are high stakes bets that do not reliably pay off.³ And although some nuclear crises are perceived at the time, or after, to be highly fraught, to teeter especially close to the nuclear edge, the real-time reality is that all crises have the potential to walk right up to that line—and to cross it. Responsible U.S. nuclear policy will therefore seek to avoid crises, not to court them.

Nuclear crises do not arise unbidden, and they are not preordained. Nuclear danger rises and falls with the choices leaders make based on what they believe and know to be true. Reducing nuclear danger therefore requires altering the former by improving the latter. One means through which to do so is to examine whether and how the different policies that have determined what nuclear arsenal the country needs, and what it needs to do with it, are associated with fewer or more nuclear crises.

The analysis that follows examines that record. It finds that the relationship of crisis frequency with the three theories of credibility that have dominated U.S. nuclear thinking, and the nine strategies—combinations of nuclear posture and doctrinal logic—that have implemented them, is inconsistent and largely explained by other factors. What is robustly associated with crisis frequency is the balance of nuclear capability between the United States and its nuclear-armed adversary. When the United States held a substantial nuclear advantage, crises were more frequent, and the United States was more often the threatening side. When the United States and its adversary approached rough parity, crises occurred less often, regardless of whether the underlying arsenals were large or small.

These findings are supportive of a foundational claim of deterrence theory: that a mutual secure second-strike capability is stabilizing. They also are directly relevant to contemporary debate. If parity between the United States and a nuclear adversary is associated with fewer crises in the historical record, then the assertion that growth in China's nuclear arsenal, alone or alongside Russia's, will increase nuclear danger requires reexamination. The data cannot adjudicate that question by themselves. They do, however, offer a compelling reason to consider that a U.S. policy oriented toward accepting parity, rather than racing against it, might reduce nuclear danger and produce serious engagement among nuclear powers on arsenal reduction. The available evidence suggests that the United States might be just as safe, and perhaps safer, with fewer nuclear weapons as with more.

Credibility in theory

One of the central, irresolvable dilemmas of international politics is that states can make threats and promises, but nothing can make states follow through on them. The condition of anarchy leaves states to say what they wish, and to do what they wish, with no systemic mechanism to force compliance with pledges made or contracts signed.⁴ In the pursuit of their various national interests, however, states often find it necessary to try to coerce other actors, and to make threats and promises that are persuasive enough to convince them to do, or not to do, particular things. The conundrum is how to be persuasive, and what means states can use to convince others that their threats and promises are to be believed. How, that is, can they make their commitments credible?

Failing to convey credibility can have serious and sometimes severe consequences for states. Threats and promises that are disbelieved, after all, have no power to shape others' behaviors.⁵ The difficulty is that credibility is not a directly observable intersubjective phenomenon.⁶ It is instead the product of human perception and judgment. This helps explain why credibility

is often used interchangeably with terms like “reputation,” “assurance,” and “trust.”⁷ This makes credibility an inherently probabilistic phenomenon. Policymakers cannot be sure of what causes their threats and promises to be credible; all they can do is use tools that they think will increase the likelihood that other actors will perceive them as such.

In the first decade of the nuclear age, concerns with credibility were not primary in the development of U.S. deterrence strategy. The focus was instead on retaining U.S. quantitative advantage over the Soviet Union for as long as possible.⁸ It was in the late 1950s that the concept fully emerged and began to play an important role in the development of U.S. nuclear strategy. The Soviet use of a rocket to launch the Sputnik satellite into space in October 1957 preceded by a matter of weeks the presentation to President Dwight D. Eisenhower of a report titled “Deterrence and Survival in the Nuclear Age.”⁹ This was the Gaither Report, produced by an expert panel convened with the task of forming “a broad-brush opinion of the relative value of various active and passive measures to protect the civil population in case of nuclear attack.”¹⁰ As noted in the report, once in process, the mandate was expanded: “While fulfilling its assignment, the Panel was also asked to study the deterrent value of our retaliatory forces ... The Panel has therefore examined active and passive defense measures from two standpoints: their contribution to deterrence; and their protection to the civil population if war should come by accident or design.”¹¹

The panel’s “broad-brush” conclusions for deterrence—which the report never directly defined—were not heartening. It found that the United States could not shield its civilian population from the effects of nuclear attack at all, much less enough so to convince the Soviet Union that a strike would not achieve its goals.¹² This meant that protection against nuclear attack depended primarily “upon the deterrence provided” by the nation’s own nuclear capabilities.

Although the development of a missile arsenal was underway, the majority of U.S. nuclear capabilities were still vested in air assets—B-52 and B-47 bombers, large planes that sat, exposed, on a small number of airfields. Taken together, these features of American defenses meant that the U.S. population and the nuclear weapons meant to protect it were both highly vulnerable. The implication was that if the Soviets were to launch a surprise first strike, not only could it destroy large portions of American society, but it could also effectively disarm the United States. This was a considerable problem, given that U.S. deterrence strategy at the time was “massive retaliation”: the threat to meet Soviet nuclear attack on the United States, and any attack on Europe, with nuclear strikes in return.

The more scholarly literature on nuclear deterrence that emerged during those same years was faster to grapple with the implications of nuclear weapons’ sheer destructive power for the nation’s overall defense strategy.¹³ Harvard University lecturer Henry Kissinger captured this difference nicely in his 455-page “Nuclear Weapons and Foreign Policy,” published in 1957:

“The notion that the decision between peace or war depends on the ability to inflict a greater level of damage than the enemy, demonstrates the traditionalism of our military thinking. True, when the power of individual weapons was relatively small, the side which could deliver the greater weight of offensive effort would generally win ... But the strategic transformation caused by nuclear weapons derives from the fact that the notion of ‘relative damage’ may have become meaningless when applied to all-out war. For even the side which has mounted the stronger offensive may have to absorb a level of damage which drains its national substance. With modern weapons, even an inferior retaliatory capacity may deter, not because it can inflict disproportionate damage, but because it can inflict unacceptable losses.”¹⁴

The researchers engaged in developing nuclear strategy were also more inclined to think conceptually about the interactive dynamics of the atomic age and to address their implications beyond the already obvious pressures for arms-racing. Thus, where the practitioner-oriented Gaither Report left the concept of credibility to lurk as subtext, a set of university books and articles, and a collection of research reports produced by the RAND Corporation, began to pull it forward into full view. In 1954, William Kaufmann described credibility as both ephemeral and concrete, something that can be in the “air” around deterrent threats—largely, he seemed to argue, in the form of public opinion—but that also depended upon the visibility of the “capability to act.”¹⁵ Credibility was a central preoccupation for Kissinger in “Nuclear Weapons and Foreign Policy” (1957); he considered it part of the “psychological aspect” of deterrence.¹⁶ Albert Wohlstetter used the word “credibility” in his enormously influential 1958 piece, “The Delicate Balance of Terror,” though only once.¹⁷ Bernard Brodie allowed it its own section as “The Problem of Credibility” in his 1959 article entitled “The Anatomy of Deterrence,” and it was in regular use by Herman Kahn in his 1960 meditation, “On Thermonuclear War.” Some of these thinkers, however, did not even attempt to define credibility directly, and those that did offered representations that were more descriptive than definitive, featuring such words as “will,” “conviction,” “rationality,” “certainty,” “plausibility,” “reputation,” “consistency,” “reliability,” “resolve,” “reluctance,” “doubt,” “assurance,” “belief,” and “faith.”¹⁸

Ten years after Eisenhower’s 1957 receipt of the Gaither Report, then-Secretary of Defense Robert McNamara encapsulated two decades’ worth of intellectual ferment on the nuclear age in a speech delivered to the annual gathering of United Press International Editors and Publishers in San Francisco. In an effort to clarify the foundations of the Kennedy administration’s nuclear strategy, McNamara offered what he called “precise definitions.”¹⁹ He defined first strike as an attack that produces the “elimination of the attacked nation’s retaliatory second-strike

forces,” and deterrence of nuclear aggression therefore the strategy of confronting an adversary with “the certainty of suicide ... not merely to his military forces, but to his society as a whole.”²⁰ He captured ideas about the necessity of maintaining a retaliatory force under the rhetorical umbrella of “assured destruction,” which he established as the “ability to inflict unacceptable damage ... during the course of a strategic nuclear exchange, even after absorbing a surprise first strike.” And for credibility, he gathered up various descriptions into this summation: “a potential aggressor must believe that our assured-destruction capability is in fact actual, and that our will to use it in retaliation to an attack is in fact unwavering.”²¹

The theory of credibility as material capability

Because the Gaither Report concluded that protecting U.S. cities and industry from nuclear attack was unrealistic, most of the subsequent work done on credibility in nuclear deterrence focused instead on making U.S. nuclear capability “actual” and robust. Convinced of the imperative of demonstrating the ability to retaliate, policy-makers sought not just to remedy the immediate vulnerability of U.S. nuclear assets, but also to insure against such vulnerability well into the future.

The solution was to make U.S. nuclear forces plentiful enough, dispersed enough, defended enough, and hidden enough to degrade Soviet confidence in their ability to deliver a decisive first strike. The United States built thousands of weapons delivery systems and even more warheads to put on them. It scattered its long-range strategic aircraft around the country. It built ballistic missiles capable of striking the Soviet Union from road-mobile launchers, from heavily fortified silos buried deep underground, and from a fleet of quieted, endurance submarines. All of these weapons were sewn together into the Single Integrated Operational Plan (SIOP), which dictated which weapons would be launched against which targets in the event of a

Soviet attack—nuclear or conventional. The SIOP, completed in December 1960 and implemented in mid-1961, was designed to destroy Russia, China, and the Eastern European nations as functional societies.

By 1966, the U.S. Department of Defense under McNamara was satisfied that it had achieved secure second-strike—that is, the ability to absorb a first nuclear strike and still strike back in return. By 1969, in fact, the U.S. “capability in being” was “higher than the levels judged adequate by the Secretary of Defense and the President. ... The United States had an assured capability to destroy nearly 50 percent of the Soviet population and nearly 80 percent of its industrial capacity in a retaliatory attack—much higher than the 20 percent and 50 percent levels, respectively, used for planning purposes.”²² The United States had achieved making its arsenal “actual” enough that policymakers were comfortable that its capabilities were credible.

This still left the problem of how to demonstrate that the American will to use its arsenal was “unwavering.” Here, the difficulties were more intractable. While the Gaither Report was concerned that the strategy of massive retaliation did not reflect material reality, others objected that it wouldn’t work. Former Army General Maxwell D. Taylor and many of the university and RAND researchers working on matters of nuclear strategy argued that the Soviets would surely question a threat to respond with all-out nuclear attack to anything other than a nuclear first strike on the United States. Such a response, after all, would be to commit national suicide—the Soviets would certainly send a volley of nuclear weapons in return.²³ All U.S. nuclear strategies after massive retaliation are expressions of different theories about how to resolve this dilemma. None of them, however, looked beyond conventional and nuclear “destructive capabilities,” for the means through which to do so.

The theory of credibility as communication

The nuclear establishment’s fixation on material capabilities is perhaps unsurprising, but it was not preordained. To the contrary, Thomas C. Schelling became arguably the most influential strategist of the early nuclear age by treating credibility not as the product of the accumulation and alignment of assets but as the outcome of the effects of behavior on perception—as the human response, in other words, to signals received and interpreted.

Schelling introduced this idea in “The Strategy of Conflict: Prospectus for a Reorientation of Game Theory.”²⁴ The purpose of the prospectus—by which Schelling meant a “new way of thinking”—was to adapt the practice of game theory, a field of study that had gained traction among economists during the 1940s, to the nuclear age.

Game theory is obsessed with solutions. More specifically, it is obsessed with winning solutions, whether winning means not doing worse than the status quo, accruing gains in absolute terms, accruing gains relative to an opponent, or decisively defeating that opponent. Game theory proposes that these winning solutions are discoverable through the elaboration of chains of logical if-then reasoning. It quantifies what decisionmakers value; it maps, as a decision tree, the courses of action available to each actor, given the courses of action chosen by the other; and it represents how likely each outcome is to occur, given the possible combinations of those choices.

Conventional war, in game theoretic terms, was a game of “pure conflict”: its winning solution was zero-sum, where one side’s victory was the other side’s defeat. Schelling’s argument was that this model did not apply to nuclear war; the destructive power of the weapons meant there was no pure, winning solution to be had among nuclear-armed adversaries. In nuclear war, rather, neither side could expect to emerge victorious. This rendered their interactions a “game” in

which, “though the element of conflict provides the dramatic interest, mutual dependence is part of the logical structure and demands some kind of collaboration or mutual accommodation ... even if only in the avoidance of mutual disaster.”²⁵

Schelling’s goal, therefore, was to render game theory—this arcane tool of analysis—capable of speaking to all areas of action where “conflict is mixed with mutual dependence.” He argued that this combination applied not only to nuclear strategy but to all sorts of matters with stakes high and low, interactions elevated and mundane: “the non-zero-sum games involved in wars and threats of war, strikes, negotiations, criminal deterrence, class war, race war, price war, and blackmail; maneuvering in a bureaucracy or a social hierarchy or in a traffic jam; and the coercion of one’s own children.”²⁶

In such games, the tradeoffs between one’s own gains and the other side’s losses, and vice versa, are not directly related. There are, rather, a variety of outcomes that convey net benefits differently, favoring one side or the other. These mixed games therefore involve bargaining, by which is meant the mutual search for an outcome that can only be achieved through coordination, even in the context of a conflictual relationship. In such games, coordination can be sought explicitly, through direct communication, or implicitly, through observable actions, or what Schelling called “maneuvers.”

Neither approach is uncomplicated. Actors in a conflictual interaction have incentives to misrepresent their motives, capabilities, and intentions if they believe doing so will produce a better deal.²⁷

How an actor receives and interprets communication, moreover, is perceptual, subjective to the recipient—not to the sender. There is no guarantee that what the communicator means to say will be what the recipient hears; irrespective of modality—said, read, or seen—messages can be misconstrued, misunderstood, or overlooked entirely.

These, Schelling argued, were the defining features of the mixed-motive games with which state leaders must contend in interactions that could lead to nuclear war or escalate one already underway. Under such conditions, leaders must develop a shared understanding of which actions will produce outcomes both sides can tolerate. For Schelling, credibility therefore depended upon persuasive communication: revealing “information about a player’s value system or about the choices available to him” or moves that “commit him to certain actions.”²⁸ Nuclear strategy, in this view, is the means by which states “play” the mixed-motive, non-zero-sum bargaining game of avoiding nuclear catastrophe. The manner and timing of communication matter as much as the material capabilities themselves.

Schelling proceeded to develop his application of game theory to modern conflict in “Arms and Influence.”²⁹ Here, he made the case that because nuclear weapons could not be used in a strategy of pure conflict, states would need to use them in strategies of coercion. They would need, that is, to figure out how to use nuclear weapons to threaten, but not to harm, in ways persuasive enough to compel the adversary to behave in a particular way, or to convince them not to. Nuclear weapons, for Schelling, were only useful as an especially loud form of communication—where the importance of any disputed interest was revealed through acceptance of the risk of nuclear catastrophe. These ideas resonated deeply among nuclear theorists, but they proved less influential among practitioners—the officials and officers who built, managed, and operated the U.S. nuclear establishment.

Credibility in practice

The immediate aftermath of World War II was a period of enormous strategic adjustment. On the European continent, policymakers in Washington, DC were contending with their allies’ reconstruction, America’s demobilization, and the Soviet Union’s massive conventional presence. So too were U.S. policymakers attempting to make sense of their new atomic monopoly, seeking

answers about how long it might last and struggling with the contradiction between their desire to make use of it and, as remarked by President Harry Truman upon being reminded that he had “an atomic bomb up your sleeve,” his uncertainty “that it can ever be used.”³⁰ Indeed, the few American attempts to use their nuclear monopoly as an asset in negotiating the terms of postwar Europe failed quickly and unequivocally.³¹

This early recognition, even in the heightened atmosphere of growing U.S.-Soviet tensions, that the threat of nuclear punishment was morally bankrupt, persuasively hollow, or both, colored deliberations about where these weapons fit in American defense strategy. Truman and his administration puzzled over whether to treat nuclear weapons as occupying a special category apart from regular, conventional weapons, or whether such treatment reflected a layperson’s artificiality more than it did a military reality.

However unresolved he was on these heady matters, Truman and his advisers understood that the nuclear monopoly put America on the more desirable side of what former U.S. National Security Advisor McGeorge Bundy described as the “deep imbalance of feeling between having it and having it to fear”—as concise a statement as has ever been made about the purpose of nuclear strategy.³²

Truman was also quite certain of the practical need to ensure civilian control over how the nation’s nuclear arsenal would be managed domestically and how it would be integrated into international diplomacy. His direct engagement in congressional wrangling on these matters ultimately produced the Atomic Energy Act of 1946. This placed nuclear weapons under civilian custodial control through the Atomic Energy Commission and authorized the president to direct their transfer to the armed forces. National Security Council guidance adopted in 1948 established that the decision to employ nuclear weapons rested with the president. The formal pre-delegation of launch authority to military commanders under specific contingencies was an Eisenhower-era development, fully formalized only in late 1959.

The military did not receive short shrift, however. The Pentagon was granted a substantial role in nuclear deliberations—including, quite importantly, on the matter of how many weapons the nation would produce—and was instructed to devise plans for the possibility of future nuclear employment. Policymakers were uncertain about the country’s ability to threaten and to use nuclear weapons, yet they authorized the military to plan for their use. The result was that the U.S. government did not develop a nuclear strategy, but a warfighting strategy that included nuclear weapons. Indeed, the first document concerning how the United States would involve its nuclear arsenal in defending its national security was a target list.³³

Even after the initial shock of the nuclear era had been absorbed, the intermingling of nuclear credibility with war planning and war fighting would persist. American strategy has never resolved that nuclear weapons are instruments of annihilation whose only credible function is as an insurance policy.

McNamara’s 1967 distillation of credibility as convincing a potential aggressor that U.S. capability is actual and its will unwavering is an accurate accounting of most of what researchers theorizing about the strategic implications of nuclear weapons had written to that point. It also comports nicely with most people’s intuitive understanding of what credibility means. It is not enough, however, for policymakers to understand that a potential aggressor must be convinced that U.S. capability is actual and its will unwavering; their work is to determine how to do the convincing—a responsibility they discharge through nuclear strategy.

Consequently, every nuclear strategy necessarily rests on a theory—a structure of assumptions and logical implications—about what will convince. About, that is, what is required to establish credibility. U.S. policymakers and military practitioners have not always articulated their theories of credibility explicitly, and it is possible that many have not been and are not

now cognizant of the assumptions underlying their strategic choices. But that does not mean the theories are not there; to the contrary, three distinct theories of credibility are discernable in the 81-year history of U.S. nuclear strategy.³⁴

The first theory, more the product of timing and necessity than of deep theorizing or conviction, held that possession was sufficient: that having the weapons, especially having many of them, was demonstration enough. The second was the outcome of a growing recognition that this was not always so: that quantity detached from interests was unpersuasive, and that credibility therefore required modulation and proportionality of threats made to match the severity of the offense suffered. The third, and most enduring, is that credibility and rationality are the same thing: that the task of nuclear strategy is to calibrate threats precisely enough that the adversary, calculating costs against benefits on both sides, concludes that America's threats are to be believed.

Credibility as quantity: Monopoly, transition, and massive retaliation

The American monopoly on nuclear destruction was shorter than some had predicted and that many preferred. The Soviet Union detonated its first weapon in August 1949.

In 1948, the Department of State produced a series of careful studies on "the Soviet threat."³⁵ This collection of reports, the NSC 20 series (1-4), was drafted under the stewardship of George C. Kennan, the first director of the Policy Planning Staff. They became the analytical foundation of U.S. Cold War military, economic, and diplomatic policy. The reports were unsentimental in their view that the Soviet Union's communist ideology could not coexist peacefully with America's liberal democracy. Combined with assessments of the Soviet Union's realized and latent economic and military power, this led to a U.S. national security strategy centered on resisting Soviet territorial or ideological expansion and demonstrating the superior material

outcomes of the American way of life. The NSC 20/1-4 papers, in other words, provided the analytical basis for the strategy of containment.

Kennan and his successor at policy planning, Paul H. Nitze, agreed entirely about the need to contain Soviet influence and dissuade Soviet aggression. They disagreed, however, about how to pursue these objectives in practice. Kennan readily acknowledged that military fortitude was necessary but considered it to be only one of many fortitudes that the burgeoning contest would require. Nitze, by comparison, gave special weight to military might, convinced that it was "an ultimate guarantee of national security and an indispensable backdrop to the conduct of the policy of containment."³⁶

This disagreement about just how much to prioritize military power extended into the nuclear domain. Kennan and Nitze both understood that the objective was to deter a Soviet first strike. Kennan was by no means skeptical of the dangers of Soviet ideology and military capability, not least atomic capability. But he did not consider these features a direct reflection of Soviet intentions or singularly deterministic of them. Nitze, on the other hand, as his seminal policy planning document NSC-68 made clear, believed the Soviets were not just aggressive but aggressive to the point of having a first-strike mentality. For him, this meant that when the Soviet Union "calculates that it has a sufficient atomic capability to make a surprise attack on us, nullifying our atomic superiority and creating a military situation decisively in its favor, the Kremlin might be tempted to strike swiftly and with stealth."³⁷ He saw recourse in a "further increase in the number and power of our atomic weapons," inclusive of the hydrogen bomb.

Nitze's insistence on the imperative of nuclear quantity, however, derived more from his beliefs about the Soviet mindset than from any theory of credibility per se. It was not, that is, that he believed the Kremlin would perceive an increase in the number of U.S. nuclear weapons, on its own, as an increase in U.S. resolve to use them.

To the contrary, Nitze believed it necessary for the United States to bolster its conventional capabilities, specifically to guard against a situation in which the Soviets believed they could confront the United States with small, piecemeal aggressions that posed the dilemma of choosing between “reacting totally” or “not reacting at all.”³⁸

Eisenhower inherited Nitze’s NSC-68, and his concern with being positioned to respond to minor Soviet incursions either totally or not at all. Indeed, the Eisenhower administration’s “Basic National Security Policy,” NSC 162/2, noted that “increasing Soviet atomic capability may tend to diminish the deterrent effect of U.S. atomic power against peripheral Soviet aggression. ... as general war becomes more devastating for both sides the threat to resort to it becomes less available as a sanction against local aggression.”³⁹ U.S. vulnerability to atomic retaliation, that is, weakened its deterrent threats against anything other than a first strike on the United States itself.

Recognition of this dynamic, however, did not penetrate into NSC 162/2’s design for U.S. nuclear posture. This was instead driven by Eisenhower’s desire to address the Soviet conventional threat without putting the United States on a path to fiscal insolvency. For Eisenhower, the math was clear: “We knew that the Soviets maintained something in the neighborhood of 175 divisions active in Europe at all times. The United States had twenty divisions, only five of which were in Europe ... only by the interposition of our nuclear weapons could we promptly stop a major Communist aggression in that area.”⁴⁰

Eisenhower’s secretary of state, John Foster Dulles, was charged with the administration’s first attempt to explain publicly that the U.S. strategy for defending Europe against conventional attack was to threaten the Soviet Union with nuclear attack. In the doing, Dulles stated that “Local defenses must be reinforced by the further deterrent of massive retaliatory power.

... Otherwise, for example, a potential aggressor, who is glutted with manpower, might be tempted to attack in confidence that resistance would be confined to manpower. He might be tempted to attack in places where his superiority was decisive. The way to deter aggression is for the free community to be willing and able to respond vigorously at places and with means of its own choosing.”⁴¹ This phrasing caused the whole of the administration’s nuclear thinking thereafter to be captured under the umbrella of the doctrine of massive retaliation.

This simplistic framing, however, belies the extent to which Eisenhower and the growing community of strategic thinkers inside and outside the administration were satisfied that the fact of U.S. nuclear superiority was sufficient demonstration of nuclear credibility. There was, in other words, even at the time, real suspicion among analysts, policymakers, and especially allies, that massive retaliation would not be sufficient to create certainty in the enemy’s mind that a threat would be carried out. The Europeans, who understood quite well that they were the proving ground, worried not only that the Soviets would be unconvinced, but that they would be correct—that the United States would not, actually, respond as threatened. They channeled this insecurity into demands for visible evidence of U.S. commitment, which essentially determined where Eisenhower was, and was not, able to cut conventional forces to fund the nuclear stockpile. It was the Army at home and in the Pacific that shrank; U.S. force structure across the Atlantic remained steady.

The connection between U.S. conventional presence and nuclear credibility was perhaps intuitively understandable, but it was far from being fully theorized—much less established as having any causal effect on adversary behavior. Conceptual development came later. At the time, the decision was made more from inertia and political necessity than from any theory of credible extended deterrence per se.

Meanwhile, Strategic Air Command remained the driver of decisions about how many nuclear weapons the nation would need, and those decisions continued to be motivated by a target-list logic, wherein credibility was tacitly assumed to derive from the arsenal's ability to hold thousands of Soviet installations at risk.⁴² Thus, despite the low-boil of concern that the relationship between target-counting and credibility was tenuous, the buildup continued.

By the time Eisenhower left office in 1961, his administration had authorized development of what would grow into a force of roughly 1,000 intercontinental ballistic missile (ICBM) silos. It had also fielded the first of an eventual 41 ballistic missile submarines, maintained a fleet of more than 1,500 strategic aircraft, and amassed upward of 18,000 nuclear warheads with which to arm them. And so, for a time, U.S. analysts and policymakers held their breath and hoped that nuclear quantity and nuclear credibility were effectively the same thing.

TABLE 1

Strategies implementing the theory of credibility as quantity

Strategy	Years	Description
Monopoly	1945-1949	Deterrence rested on the uncontested threat of atomic retaliation against Soviet conventional aggression.
Transition	1950-1952	A brief doctrinal interregnum following the Soviet atomic test in 1949, during which U.S. planners reassessed the credibility of deterrence in a nascent two-power nuclear environment.
Massive retaliation	1953-1960	Doctrine that threatened overwhelming nuclear response to any Soviet provocation, prioritizing nuclear forces over expensive conventional armies.

Credibility as proportionality: Flexible response

Eisenhower handed the incoming John F. Kennedy administration a nuclear triad of land, sea, and air capabilities, backed by a massive warhead stockpile. These forces were organized under a Pentagon war plan that was intentionally rigid and entirely unforgiving. The SIOP, if implemented, was designed to pick up and move “many thousands of megatons” of nuclear explosive energy and deliver it on targets in the Soviet Union, Eastern Europe, and China. The

intent was to immediately eliminate the enemy’s “war-making capability”—broadly understood to include installations in or near cities.⁴³

Like Eisenhower, however, Kennedy too was dissatisfied with the idea that the United States—indeed that any nuclear power—should find itself in a position to have the choice of either making “a humiliating retreat or a nuclear war.”⁴⁴ This conviction was deeply at odds with the doctrine of massive retaliation and with the SIOP that he had inherited. The new administration therefore made it early business to address both.

In a March, 1961, "Special Message to the Congress on the Defense Budget," Kennedy affirmed the necessity of retaining the ability to retaliate to a first strike—indeed, it was his secretary of defense that would eventually give bilateral second-strike capability the moniker of assured destruction—but made clear his intent to depart from the remainder of massive retaliation in language and in doctrine.⁴⁵ The nation must remain prepared "to take whatever action with whatever weapons are appropriate" in the event of "a major aggression that could not be repulsed by conventional forces." But, when confronted with acts of limited aggression, those that "do not justify and must not lead to a general nuclear attack," the United States must have an ability "to confine our response to non-nuclear weapons."⁴⁶

The Kennedy defense program was therefore to rebalance the nation's conventional and nuclear force structure such that it was "both flexible and determined ... selective, swift and effective," supportive of "deliberate choices in weapons and strategy ... usable in a manner permitting deliberation and discrimination as to timing, scope and targets."⁴⁷ Under the Kennedy and then the Johnson administrations, this strategy for the national defense became known as "flexible response."

The new doctrine's emphasis on creating options changed the declaratory policy and force structure of the U.S. military—nuclear and conventional. The Kennedy administration made explicit its intent to shift nuclear targeting to prioritize striking the enemy's military forces, not its cities. It deployed thousands of theater-capable warheads to Europe and reduced the nation's bomber fleet from more than 1,300 in the early 1960s to less than 700 by 1965.⁴⁸ Conventionally, the Kennedy and successor Johnson administrations' secretary of defense, Robert McNamara, oversaw an overhaul of the size and readiness of the military services. He added air wings to the Air Force and bulked up its munitions stocks, focused the Navy on surface combatants and attack submarines, and invested in strategic air- and sealift.

McNamara's new program especially augmented the Army's quantity and improved its operational quality: it grew from 11 combat-ready divisions to a theater-designed composite force of "several types of divisions that would provide a broad range of capabilities for different kinds of combat."⁴⁹ These changes reflected McNamara's insistence that the president's ability to respond intelligently in a crisis depended upon having a U.S. military that was capable of responding rapidly and effectively to the diverse and manifold forms Soviet aggression might take.

Flexible response reflected Kennedy's and McNamara's belief that massive retaliation was unworkable in practice and untenable in concept. In practice, for any contingency short of direct attack, no president would ever want to be forced to pick between national concession or global cataclysm. In concept, no leader should ever be considered likely, if it came down to it, to choose the latter over the former.

Flexible response was meant to resolve both dilemmas. It was designed to offer policymakers options for conventional and nuclear use that were more proportionate to a range of potential offenses, rather than the reflexive and indiscriminate destruction of military and urban targets. The intent was to arrive at more reasonable alternatives that, by merit of being more reasonable, would make the Soviets less likely to transgress in the first place. The credibility of the threat of nuclear use, in other words, was a product of the ability to wield it proportionally, not spasmodically.

For all of McNamara's rebuilding of the U.S. military, however, analysts and historians have since demonstrated that the Department of Defense did not, in fact, reshape its nuclear war plans to be less massively retaliatory and more flexible and responsive.⁵⁰ That would instead happen at the direction of President Richard Nixon, as the strategy of Limited Nuclear Options (LNO).

TABLE 2

Strategies implementing the theory of credibility as proportionality

Strategy	Years	Description
Flexible response	1961-1973	Doctrine replacing massive retaliation with a graduated menu of conventional and nuclear options, intended to make deterrent threats more credible at lower levels of conflict.

Credibility as rationality: Limited nuclear options, countervailing strategy, last resort, reduced role, and multipolar deterrence

By the time Nixon entered office, nuclear strategy had become a recognizable discipline, with theory and practice becoming increasingly intertwined. It had progressed from grappling with the implications of nuclear weapons for warfare and international politics to discovering secure second-strike as the essential element of nuclear deterrence. It then turned to wrestling with the question of what makes a nuclear threat credible—not only in abstract theory, but in the concrete calculations of the adversary it is meant to influence.

Flexible response and LNO were applied theory, the manifestation of belief that nuclear weapons were not just instruments of annihilation but could be useful tools of international politics. This case was being made most vigorously by researchers engaged in applying game theory to nuclear strategy.

The core proposition of game theory is that decisionmakers are rational actors. They are aware of what they desire, and of what they disdain, and therefore can calculate the probabilities and magnitudes of the costs and benefits associated with a given action. The hidden conceit of game theory is the assumption that credibility and rationality are the same thing. If an act is rational,

it can be believed; if it is not rational, there is no reason to believe anyone would carry it out—and therefore no reason to fear that they will.

This was the main critique of massive retaliation: U.S. vulnerability to Soviet weapons meant the doctrine was obviously misaligned with the costs the country would have to bear in its implementation, most especially if applied “except in the face of provocations as extreme as Pearl Harbor.”⁵¹ Threatening annihilation to fend off anything less than existential danger, that is, was patently irrational and therefore impossible to believe. The conclusion was that for the U.S. nuclear arsenal to deter, the strategy guiding its use must prioritize proportionality. The president needed options commensurate to the provocation—costly enough to deter, but not so catastrophic as to be irrational to execute.

This, in turn, meant that proportional options had to be worked out and signaled to the adversary in advance. The United States needed an entire architecture of contingency plans that demonstrated the availability of executable, proportional responses to a range of possible provocations. Game theory created the intellectual scaffolding. LNO used it to construct an ornate edifice of war plans, converting potential conflicts of interest, large and small, into decision trees that dictated which weapons the United States would need to have and where to put them. The sizes and locations of U.S. nuclear assets would reveal to the adversary what the United States was holding at

risk, allowing opposing decisionmakers to assess whether particular threats were rational and therefore credible.

This meant, in theory, that each side could calibrate its own moves to keep wars from escalating beyond limited nuclear exchanges to all-out nuclear war. Advocates of LNO also argued that the introduction of flexibility into American nuclear planning meant that “growth in Soviet nuclear forces did not foreshadow a decline in the utility of American nuclear forces.”⁵²

In implementation, LNO included revising the SIOP to give the president options short of massive strike—regional strikes, selective strikes against military targets, and discretion over whether and which cities to strike. It drove advances in nuclear command and control and contributed to the development of highly accurate reentry vehicles and the large, multiple independently targetable reentry vehicle MX intercontinental ballistic missile (ICBM). It intensified the importance of forward-based nuclear forces in Europe and Asia—locations that enabled precise and timely strikes—and changed the yield composition of the U.S. nuclear arsenal, accelerating the retirement of older high-yield theater weapons and their replacement with lower-yield, higher-accuracy systems better suited to limited and discriminate strikes.

Subsequent presidential administrations made adjustments in execution, but the LNO’s essentializing of credibility as rationality has been a persistent feature of U.S. nuclear strategy ever since.⁵³ The Cold War imposed continuity of adversary for Presidents Jimmy Carter, Ronald Reagan and George H.W. Bush, and so their nuclear policies were all variations on a theme.

The Carter administration’s countervailing strategy focused on aligning nuclear options to convince the Soviets that the United States would deny it any benefits of aggression at all levels and during all phases of a fight: “It is necessary to have nuclear (as well as conventional) forces such that ... any adversary would

recognize that no plausible outcome would represent a victory ... we must be capable of fighting successfully so that the adversary would not achieve his war aims and would suffer costs that are unacceptable, or in any event greater than his gains.”⁵⁴ It therefore took what LNO had started, and directed the Department of Defense to push strategy further down the decision tree of nuclear warfighting logic, developing plans for multiphase, or protracted, nuclear war. This generated posture and targeting arrangements that held Soviet leadership, military assets, and postwar recovery capacity at risk, in addition to cities—though even here, the options were not especially less expansive or more discriminate.⁵⁵

The Reagan administration took Carter’s long war premise but disagreed that U.S. credibility could be achieved through a force structure and posture designed to demonstrate to the Soviets that they wouldn’t benefit from a nuclear war of any duration. For Reagan, credibility instead required demonstrating that the United States would win. Transforming the objective of U.S. nuclear policy from thwarting Moscow to defeating it was a change in form but not in function: it still required a vast menu of graduated response options, but achieving those options at a scale sufficient to guarantee victory had significant expansionary effects on the size, composition, and cost of the U.S. military generally, and U.S. nuclear capability specifically.

As introduced in the Annual Report to Congress, submitted to Congress by Secretary of Defense Caspar Weinberger in February 1982, the Reagan administration had concluded that composing a winning force would require steep investments in new nuclear capabilities—enough to allow the military to execute a full range of operations across all three legs of the triad. Its early defense budgets included plans for a new strategic bomber, the B-1B Lancer; development and initial procurement of nine MX ICBMs (a portion of the planned procurement and basing of 100); and a 600-ship fleet that would include the first-strike-capable submarine-launched Trident II D-5.⁵⁶ This offensive firepower, moreover, was to be

matched with the Strategic Defense Initiative in 1983, imagined to be a defensive shield that would render Soviet nuclear missiles “impotent and obsolete.”⁵⁷

Reagan’s successor, George H.W. Bush, retained the basic contours of the defense buildup that preceded his term.⁵⁸ As the Cold War began to wane, however, Bush and his counterpart in Moscow, General Secretary of the Communist Party of the Soviet Union Mikhail Gorbachev, substantially reduced the numbers of warheads their countries deployed.⁵⁹ This did not reflect an intellectual movement away from the precepts of credibility as rationality that LNO had introduced.⁶⁰ The reduction in tensions, and then the collapse of the Soviet Union itself, rather, simply removed a number of contingencies that had informed U.S. posture. It was these changed conditions that enabled Bush to recast the U.S. nuclear arsenal not as a flexible warfighting tool but as one of last resort, for use only in extreme circumstances.

The combination of changes in size, scenario planning, and continuity in LNO’s underlying theory of credibility continued into and through the post-Cold War years. The Clinton Nuclear Posture Review (NPR) of 1994 largely ratified the force structure and doctrinal framework it inherited, making incremental adjustments rather than undertaking a fundamental reconceptualization.⁶¹ Cold War targeting logic survived mostly intact, extended to new adversaries but not truly revised. Quantity diminished—through the Strategic Arms Reduction Treaty (START) I and then the commitments made at the 1997 summit in Helsinki between Clinton and Russian President Boris Yeltsin toward further START reductions—but the theory of credibility that justified the remaining arsenal and force structure did not change. The Clinton period saw the first systematic effort to apply LNO’s logic to regional adversaries: Iraq, Iran, North Korea, and eventually Libya were added to the target set. This extended the credibility-as-rationality framework to states that had not been party to the deterrent relationship the theory had been built to manage.

The George W. Bush administration introduced more substantial changes to what U.S. nuclear strategy would do, but not to the theory behind how and why it was presumed to work. Bush’s 2001 NPR moved the United States away from the Cold War’s bilateral framework and replaced it with a capabilities-based approach that focused on what potential adversaries could do—conventionally, and with chemical, biological, and nuclear weapons—rather than on who they were.⁶² It institutionalized this approach through what it called a “new triad,” which integrated conventional precision strike and missile defense with nuclear forces. The goal was to expand the range of proportionate options available to the president. This formulation retained the credibility-as-rationality logic while multiplying the scenarios to which it was meant to apply, adding conventional and counterproliferation dimensions to a framework that had been built for a large nuclear adversary with a second-strike capability.

Bush’s withdrawal from the Anti-Ballistic Missile Treaty in 2002 was the operational expression of this logic: if credibility required that adversaries face U.S. retaliation without confidence in their own, then limiting missile defense was a constraint to be shed rather than a stabilizing commitment to be honored. The Moscow Treaty of 2002 continued the trajectory of warhead reduction, but the force structure changes that accompanied it, including the preservation of a large “hedge” of non-deployed warheads and the development of lower-yield capabilities, signaled that reduction in numbers was not to be confused with a change in how the arsenal might be used.

President Barack Obama came to office with a stated interest in positioning the U.S. nuclear arsenal more cleanly as the nation’s deterrent against nuclear attack. His administration pledged not to pursue new warhead designs, aligned declaratory policy more closely with U.S. obligations under the Nuclear Non-Proliferation Treaty (NPT), and sought to narrow the circumstances under which nuclear weapons would be used.⁶³ His 2010 NPR did not fully realize those

objectives: It declined to adopt a “sole purpose” declaration and preserved most of the existing targeting architecture. Nevertheless, it represented the clearest public articulation in decades of the view that nuclear weapons should serve primarily as a deterrent against nuclear attack rather than as instruments of warfighting across a range of contingencies.⁶⁴

The New START Treaty signed in 2010 codified further reductions in deployed strategic warheads and delivery vehicles, and the bilateral arms control architecture that had structured U.S.-Russia nuclear relations since the early 1970s remained in place. But it was also under Obama that the country embarked upon the most expensive nuclear modernization program in its history: a 30-year, trillion-dollar commitment to recapitalizing every leg of the triad, a policy proponents described as helping to “ensure that the U.S. nuclear force remains usable—which is the foundation of a credible deterrent.”⁶⁵ In practice, therefore, “last resort” was more aspirational than actual, with the core logic of flexible response and LNO still very much intact.⁶⁶

President Donald Trump’s 2018 NPR was informed by his 2017 National Security Strategy, which focused on the return of great power competition. For the NPR, this translated into a requirement for multipolar deterrence—a posture designed to contend with the Russian and Chinese nuclear arsenals.

Trump therefore expanded the conditions under which the negative security assurance—the formal pledge by a nuclear-armed state not to use or threaten to use nuclear force against a non-nuclear-weapon state—for NPT-compliant states might not apply. He also introduced a new low-yield capability—the W76-2, a modification of the existing W76 warhead—narrowing the scope of Obama’s commitment to reduce the role of nuclear weapons in U.S. strategy.⁶⁷

The administration further restored the sea-launched cruise missile program, expanded the conditions under which nuclear use might

be considered, and treated nuclear warfighting flexibility as a direct contribution to deterrence credibility. President Joe Biden left Trump’s NPR largely intact, with a softening of rhetorical tone and a hardening of the strategic position against China—formally elevating China to a nuclear challenge commensurate with Russia, an acknowledgment that the United States now faces, for the first time, two peer-level nuclear adversaries simultaneously.⁶⁸

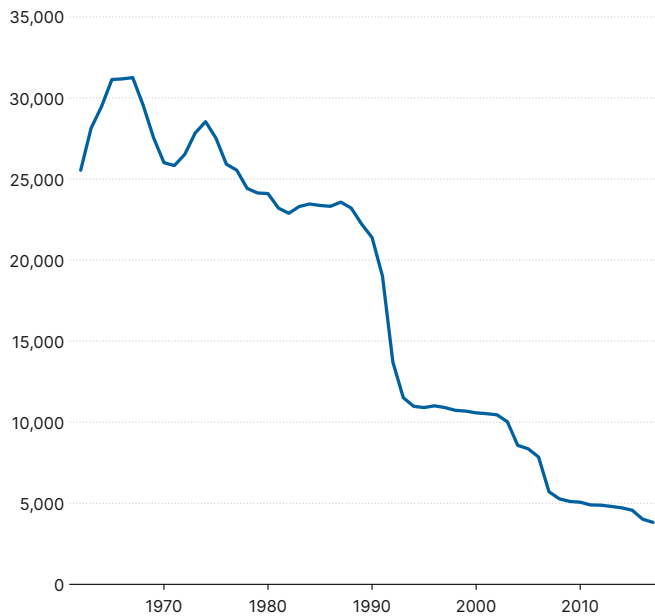
Neither the transition to the post-Cold War geopolitical environment nor the changes within it catalyzed a reconsideration of the foundational assumption underlying U.S. nuclear strategy: that credibility depends upon matching graduated responses to adversary actions in ways designed to manipulate rational cost-benefit calculations. Credibility as rationality, in other words, remained the governing theory; what changed across the post-Cold War administrations was the set of adversaries U.S. nuclear credibility was expected to discipline, and the growing conviction that the arsenal available to do so was no longer large or flexible enough.

Between 1945 and the end of the Cold War in 1990, the United States “manufactured more than 70,000 nuclear bombs and warheads ... produced 745.3 metric tons of highly enriched uranium 103.5 metric tons of plutonium” and “116 different delivery systems” to equip its nuclear strategies.⁶⁹ Comprehensive and longitudinal government data on the composition of the U.S. arsenal—numbers of warheads by yield—are not publicly available. Although enterprising researchers have produced creditable approximations, none covers the full duration of the period 1945-2026. It is nonetheless clear that the arsenal has decreased in quantity over time. The reductions reflect force-structure changes driven by budgets and system obsolescence, as well as a series of U.S.-Soviet/Russian arms control agreements and reciprocal initiatives. The average yield of the arsenal’s warheads has also declined over time, consistent with the series of post-1960 strategies intended to make nuclear weapons “usable” (Figure 1).

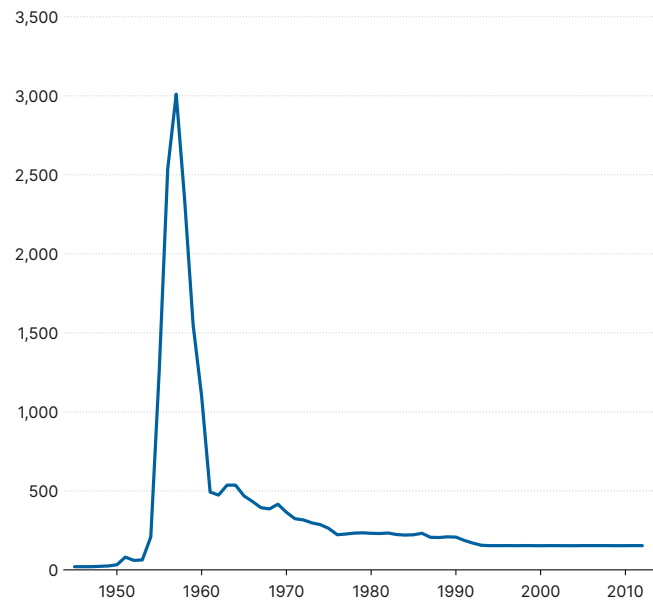
FIGURE 1

The downward trend in quantity and average yield of the U.S. nuclear arsenal over time⁷⁰

U.S. nuclear weapons stockpile, FY1962-2017



Average U.S. warhead yield (kt), 1945-2012



To produce, maintain, and deploy these weapons, the nation first spent roughly \$21.6 billion in constant 1996 dollars for the Manhattan Project's weaponization of minds, materials, and machines. The vagaries of government accounting thereafter prevent full specification of the moneys outlaid in the decades since—though an authoritative study released in 1998 places the number at roughly \$5 trillion through 1996.⁷¹ The Congressional Budget Office projects that carrying out plans “to operate, sustain, and modernize current nuclear forces and purchase new forces would cost a total of \$946 billion over the 2025-2034 period, or an average of about \$95 billion a year.”⁷² This accounting excludes costs associated with legacy cleanup from past production and testing, and expenditures assigned to missile defense and non-proliferation.

Even absent a granular tabulation, it is clear that the United States has made, and is continuing to make, substantial investments in its nuclear strategies. Most of these investments have been premised on the theory that warhead quantity and variety, delivery-system flexibility, and response options calibrated to possible provocations protect the United States against nuclear danger. It is, therefore, worth asking whether the empirical record bears this premise out.

TABLE 3

Strategies implementing the theory of credibility as rationality

Strategy	Years	Description
LNO	1974-1979	Sought to develop selective nuclear strike options below the threshold of general war to enhance crisis flexibility.
Countervailing strategy	1980-1990	Strategy of targeting Soviet military assets and leadership to deny the adversary meaningful advantage from initiating nuclear use.
Last resort	1991-2010	Post-Cold War declaratory posture treating nuclear weapons as a deterrent of last resort against existential threats, with reduced operational emphasis on war-fighting scenarios.
Reduced role	2011-2016	Declaratory policy emphasized further reductions in the role of nuclear weapons, pursuing arms control and a smaller arsenal.
Multipolar deterrence	2017-2026	Contemporary posture confronting simultaneous deterrence challenges from Russia, China, and North Korea, requiring modernization of all three legs of the triad and greater attention to regional extended deterrence.

Credibility, empirically

Close historical study of individual nuclear crises can directly assess whether perceptions of U.S. credibility featured in the leadership deliberations about crisis initiation and resolution. Aggregate approaches cannot, and so this analysis makes no claims about the causes of crises or their outcomes.⁷³ It instead rests on a reasonable assumption: that policymakers believe high-credibility strategies will discourage crisis initiation by adversaries while granting the United States greater latitude in choosing to initiate crises itself.

This assumption supports a descriptive question: Are the theories of credibility and the nuclear strategies that successive U.S. administrations used to operationalize them associated with periods of more or fewer nuclear crises? Or are those patterns more closely associated with other features of the belligerents or the international environment?

Between 1945 and 2026, the United States used nine distinct strategies to implement three different theories of nuclear credibility. Over those 82 years, 36 U.S.-involved interstate interactions meet the threshold of a militarized confrontation in which one of the following occurred:

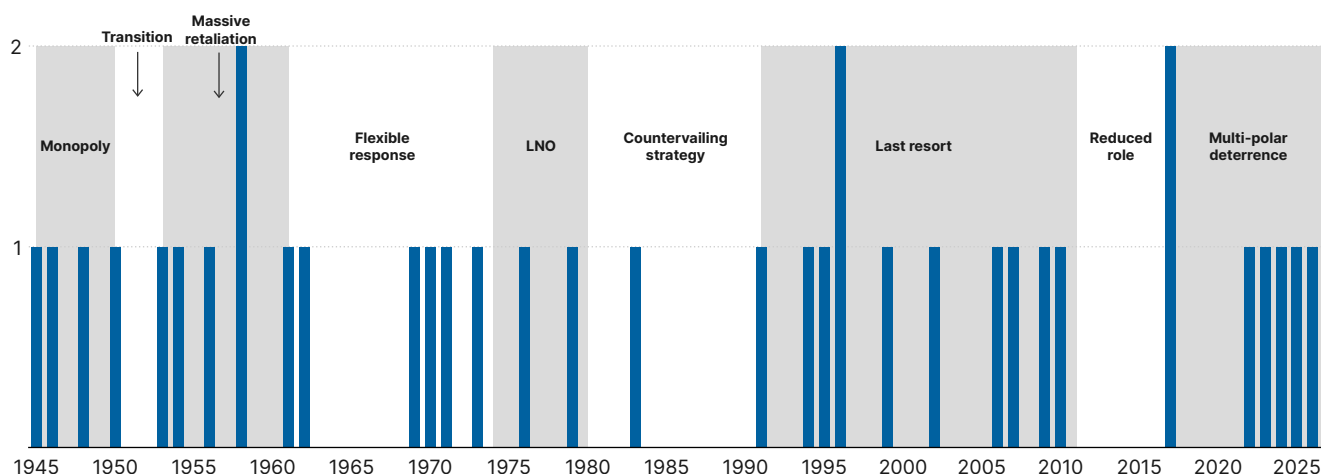
1. A nuclear-armed adversary made an explicit or implicit nuclear threat directed at the United States or a treaty ally. The threat could take the form of a public statement, private diplomatic communication, or deployment of nuclear-armed or nuclear-designated assets to signal resolve.
2. The United States itself made an explicit or implicit nuclear threat. The threat could take the form of a public statement, private diplomatic communication, or deployment of nuclear-armed or nuclear-designated assets to signal resolve.

To ensure the dataset is capturing instances in which nuclear weapons were deliberately invoked in the confrontation by one or more parties, implicit threats qualify only where contempora-

neous evidence confirms signaling intent. This excludes the incidental presence of nuclear-capable platforms.

FIGURE 2

U.S. nuclear crises per year



The 36 included crises are unevenly distributed across years (Figure 2). This unevenness matters because the years in which no crisis occurred might not all mean the same thing. A year with zero nuclear crises might indicate that no significant conflict of interest emerged; it might indicate that a conflict of interest did emerge, but escalation to a crisis was deterred; or it might indicate that a conflict of interest emerged and was managed through diplomatic, economic, or conventional channels without any nuclear involvement. The data cannot distinguish among these and other possibilities. This is the familiar “non-events” or “dogs that didn’t bark” problem in conflict research: Because averted or deterred crises cannot be observed, realized events can reveal patterns but cannot identify the mechanism that might have produced the zeros.

Patterns in the data can be consistent with a hypothesized causal mechanism, but the same patterns can be consistent with several rival mechanisms that the data cannot adjudicate.

Each crisis, moreover, occurred in a particular context shaped by features that resist measurement—the temperaments and convictions of leaders, the texture of bureaucratic decision-making, the inheritance of prior crises. And the variables that can be measured do not move independently of each other: arsenal size, force posture, doctrinal labels, and the geopolitical environment coevolve, often in close sequence. The most that any analysis of this kind can do, therefore, is cautiously describe associations among realized events and submit those patterns to interpretation. With those constraints stipulated, two results emerge.

Result 1: Balance of nuclear warheads is associated with crisis frequency

The strongest and most robust empirical result is that crises occurred less frequently when the United States and its nuclear adversary had a rough equivalence in numbers of nuclear warheads—where warhead count is used as

an imperfect, but reasonable, proxy for nuclear capability. Crises were more frequent when one side enjoyed a substantial advantage. The relationship is consistent in direction and large in magnitude. A doubling of the adversary-to-U.S. capability ratio is associated with an approximately 22% reduction in expected crises per year. (The ratio is calculated from the number

of nuclear warheads held by the crisis-relevant adversary and the United States in each year.) The relationship survives a model controlling for doctrine, posture, ongoing wars, allied signaling, the conventional military balance, and second-strike survivability (Table 4).

TABLE 4

Nuclear balance and crisis frequency, 1945-2026

Dependent variable: nuclear crises per year. N = 82 years, 36 total crises. Nuclear capability ratio controlled in all models.

Model	Additional controls	Effect per doubling of adversary-to-U.S. nuclear ratio	p-value
Base model	Doctrine era; U.S. forward troops and overseas warheads	-12.5%	0.019
+ Adversary forward deployments	Adds adversary forward troop deployments	-11%	0.168
+ Wartime controls	Adds indicators for U.S. or adversary engaged in ongoing war	-15.6%	0.097
+ Conventional balance	Adds log (adversary-to-U.S. forward troop ratio)	-22.9%	0.021
+ Second-strike survivability ⁷⁴	Adds share of U.S. warheads on submarines (fully specified model)	22.1%	0.017

Note: Results from Poisson regression with autocorrelation-corrected standard errors (Newey–West, lag 3). The nuclear capability ratio is measured as $\log_2(\text{adversary}/\text{U.S. warheads})$ for years in which the adversary held nuclear weapons; a separate indicator variable absorbs years in which the crisis-relevant adversary had no nuclear weapons. Effect expressed as percent change in expected crises per year for each doubling of the adversary-to-U.S. nuclear capability ratio.

When the United States held a nuclear advantage, it was more often the threatening side in the crises that did occur. During periods of rough parity or adversary advantage, the United States issued fewer such threats, and crises overall became less frequent. There is suggestive evidence that this pattern is particular to the United States, though the available data do not allow a definitive assessment of whether adversaries adjusted their own behavior in the same way.

This finding is specifically about the balance of nuclear warheads, not military capability broadly construed. When a measure of the conventional military balance—the ratio of U.S. to adversary forward troops, matched to the crisis-relevant

region—is added to the analysis, it does not exhibit a statistically significant independent association with crisis frequency, and its inclusion does not change the nuclear balance result.⁷⁵

Result 2: Strategy, doctrine, arsenal size, posture, and the wartime environment do not independently affect crisis frequency

The variables that the U.S. national security establishment has spent eight decades manipulating in the name of credibility—the doctrinal adjustments, the size of the arsenal, the location of forward-deployed forces—do not have consistent independent associations with the frequency of crises (Table 5).⁷⁶

TABLE 5

Nuclear posture, doctrine, and crisis frequency, 1945-2026

Dependent variable: nuclear crises per year. N = 82 years, 36 total crises. Nuclear capability ratio controlled throughout.

Factor	What it measures	Effect on crisis frequency	Verdict
Nuclear doctrine			
Proportionality era	Flexible Response (1961-73) vs. earlier Quantity baseline	Not significant	No effect
Rationality era	LNO through Multipolar Deterrence (1974-2026) vs. Quantity baseline		
Arsenal size			
U.S. arsenal size	Total U.S. nuclear warhead inventory	Not significant	No effect
Nuclear forward posture			
U.S. overseas warheads	U.S. nuclear warheads deployed in Europe and Asia	Not significant	No effect
Adversary forward warheads	Adversary nuclear warheads deployed in foreign territory	Not significant	No effect
Wartime environment			
U.S. at war	U.S. engaged in major sustained combat operation	Significant bivariate, not significant fully specified	Not robust
Adversary at war	Adversary engaged in major sustained combat operation	Not significant	No effect

Note: Results from Poisson regression with autocorrelation-corrected standard errors (Newey–West, lag 3). Each row tests whether the listed factor is independently associated with crisis frequency once the nuclear capability ratio and non-nuclear-adversary indicator are held constant.

Crisis frequency varied widely across all periods associated with each of the three practitioner credibility theories and the nine strategies that operationalized them. Years with larger U.S. arsenals did not have systematically more or fewer crises than years with smaller arsenals. The presence or absence of forward-deployed

U.S. forces, whether nuclear or conventional, also had no independent association. Nor did the presence of adversary forward forces. When nuclear capability is accounted for, neither U.S. nor adversary involvement in a major sustained combat operation has a consistent independent association with crisis frequency.⁷⁷

Implications

Some nuclear professionals, policymakers, and foreign policy analysts contend that the United States faces a growing credibility deficit. They worry that an arsenal of more than 1,700 deployed warheads, with nearly 2,000 more available for upload, is insufficient to deter Russia and China simultaneously.⁷⁸ They rely on a targeting logic that counts adversary aim points, compares them to available U.S. weapons, and concludes that the U.S. complement is inadequate to the task.⁷⁹ They argue further that the United States lacks the necessary variety in the yield, type, and locations of its weapons to give policymakers credible response options for nuclear attacks on allies, particularly in Asia.⁸⁰ The prescription that follows from this diagnosis is capability expansion—more warheads, more posture forwardness, and more doctrinal flexibility.

The patterns evident in 82 years of nuclear crises provide no evidence to support the theory of credibility that drives this prescription. The frequency of nuclear danger is not associated with doctrinal refinements, with force structure or posture, with absolute arsenal size, or with U.S. nuclear superiority. The deployment of theater nuclear weapons, the adoption of flexible response and countervailing strategies, and the forward basing of warheads in allied territory are not associated in the data with a consistent, independent reduction in crisis frequency. Their nontrivial fiscal, political, and diplomatic costs were not accompanied by reductions in nuclear danger.

What the data do show is that nuclear crises were less frequent when the United States and its principal nuclear adversary approached rough parity in nuclear capability. What distinguished the quieter periods in the dataset, in other words, was not U.S. positioning to secure escalation dominance at every level of conflict or efforts to establish a wider capability lead; it was the consolidation of mutual deterrence.

These findings have implications for the U.S. policy response to China's nuclear modernization. A China that achieves a robust, secure second-strike capability does not, on the evidence of the historical record, appear likely to increase the frequency of nuclear crises—and might reduce it. This is the opposite of the conventional framing in U.S. nuclear discourse. That framing treats Chinese arsenal growth—which the U.S. government estimates will increase from approximately 200 nuclear warheads in 2016 to as many as 1,000 by 2030—as straightforwardly destabilizing and calls for consideration of a compensating U.S. buildup.

China, of course, is not the Soviet Union. Their differences in the nuclear domain, however, do more to weaken the case for arms buildup than to support it. China entered the nuclear club in the 1960s with a minimal deterrent posture, and its nuclear arsenal has since been organized as a responsive force that is not designed to hit first, but to hit last. Even if China's nuclear buildup does not reflect insecurity about its second-strike capability—even if it is, in fact, an abandonment of nuclear moderation and an embrace of war-fighting flexibility—America's own second-strike capability remains robust. Emerging technologies like artificial intelligence-enabled sensing, computing, analysis, and precision strike raise the specter that nuclear assets will become more vulnerable to enemy targeting. But concerns that assured U.S. second strike is already waning are, at a minimum, premature.⁸¹ Given the survivability of the ballistic missile submarine force, they might also be overstated.⁸² This holds true even if China were ever to coordinate nuclear targeting with Russia.

An attempt at a disarming first-strike on fixed, known locations of U.S. nuclear assets would take at least 1,000 warheads. Such a strike would kill an estimated 3 million to 9 million people over four days.⁸³ Uploading additional warheads to already-in-place delivery vehicles doesn't change this math; it just makes each silo or airbase a more valuable target. Similarly, adding more warheads and mobile vehicles (other than

submarines) to the arsenal doesn't solve the emerging-technologies hider/finder problem; it just gives adversaries more targets to strike and people to kill at the cost of tens of billions of dollars in new weapons production over decades of time. Those resources surely would be better directed elsewhere, for example toward defending U.S. nuclear command and control systems against possible AI-enabled cyber intrusions—which recent scholarship suggests could degrade confidence in the United States' ability to use its arsenal even short of suffering a full disarming attack.⁸⁴

The findings also have implications for arms control. If parity is associated with stability—if the condition most associated with fewer crises is mutual assured retaliation and not U.S. superiority—then the relevant policy question is not whether, but rather at what level, to seek parity.

The historical patterns offer no evidence that larger arsenals on both sides are more stabilizing than smaller ones; what appears to matter is the balance, not the count. This should make small stockpiles far more appealing than large ones: negotiated reductions that preserve mutual second-strike capability while shrinking the overall nuclear inventory save taxpayer dollars without sacrificing security. The present trajectory, which treats arms control as either a relic of a more cooperative era or a constraint on necessary modernization, runs against what the data support.

Nuclear crises are extremely dangerous, inherently unpredictable, and do not reliably deliver the political outcomes policymakers desire. If the goal is reducing their frequency, then the case for structured, verifiable reductions is at least as strong as the case for expansion. China, moreover, might prove more willing to engage in an arms control regime that accepts parity than it is to participate in one that bakes in U.S. nuclear superiority.⁸⁵

What these findings do not resolve is the question of extended deterrence in specific regional contingencies. The data speak to crisis frequency across the full postwar period; they are not designed to evaluate particular deterrent effects in particular theaters. It is possible that the dynamics governing a contemporary Taiwan Strait crisis would differ in ways that aggregate patterns cannot fully capture.

Policymakers are right to take those scenarios seriously. They should resist, however, the expectation that more warheads, more forward basing, and lower-threshold doctrine are the variables that determine whether those crises occur. The realized history of nuclear interactions does not bear that inference out. Historically, stability has followed from both sides possessing assured retaliation—not from one side's attempt to deny that condition to the other, and not from the accumulation of forces beyond what that condition requires.

Appendix

APPENDIX I

Nuclear crises 1945-2026

CID	Year	Crisis name
1	1945	London Council of Foreign Ministers / Atomic Diplomacy
2	1946	Iran/Azerbaijan Crisis
3	1948	Berlin Blockade
4	1950	Korean War
5	1953	Korean War Armistice
6	1954	First Taiwan Strait Crisis
7	1956	Suez Crisis
8	1958	Second Taiwan Strait Crisis
9	1958	Berlin Ultimatum
10	1961	Berlin Crisis / Berlin Wall
11	1962	Cuban Missile Crisis
12	1969	Vietnam / Operation Giant Lance
13	1970	Cienfuegos / Jordan Crisis
14	1971	India-Pakistan War
15	1973	Yom Kippur War / DEFCON III
16	1976	Panmunjom Axe Murder
17	1979	Soviet Invasion of Afghanistan
18	1983	Able Archer 83
19	1991	Gulf War

CID	Year	Crisis name
20	1994	North Korean Nuclear Crisis
21	1995	Taiwan Strait Crisis (Lee visit)
22	1996	Taiwan Strait Crisis
23	1996	Libya Chemical Weapons
24	1999	Kosovo War
25	2002	Second North Korea Nuclear Crisis
26	2006	North Korea Nuclear Test 2006
27	2007	Russia Ballistic Missile Defense Dispute
28	2009	North Korea Nuclear Test 2009
29	2010	Cheonan / Yeonpyeong
30	2017	North Korea ICBM Tests
31	2017	North Korea Fire and Fury
32	2022	Russia-Ukraine Nuclear Threats 2022
33	2023	Russia-Ukraine War 2023
34	2024	Russia-Ukraine / NATO 2024
35	2025	Iran Nuclear Crisis 2025
36	2026	Operation Epic Fury

Data dictionary

Year-level data

Variable	Description
<i>Year</i>	Calendar year of observation, 1945 through 2026.
<i>Crises/Year</i>	Count of U.S. nuclear crisis events in that year.
<i>U.S. Nuclear Strategy</i>	Categorical label for U.S. nuclear doctrine in that year (Monopoly, Transition, Massive Retaliation, Flexible Response, LNO, Countervailing Strategy, Last Resort, Minimal Deterrence, or Multipolar Deterrence).
<i>Theory of Credibility</i>	Three-category coding of the prevailing theory of nuclear credibility (Quantity, Proportionality, or Rationality).
<i>U.S. Arsenal</i>	Total U.S. nuclear warhead inventory in that year.
<i>Correlation of Forces</i>	Ratio of the (crisis-specific) adversary's nuclear arsenal to the U.S. arsenal in that year.
<i>Allied Signaling (1)</i>	Binary indicator equal to 1 if one U.S. ally signaled in that year that it might pursue its own nuclear weapons.
<i>Allied Signaling (2+)</i>	Binary indicator equal to 1 if two or more U.S. allies signaled in that year that they might pursue their own nuclear weapons.
<i>US Troops in Asia/Pacific (k)</i>	Estimated number of U.S. military personnel stationed in the Asia/Pacific region, in thousands. Used as the U.S. troop measure for years where China, the Democratic People's Republic of Korea (DPRK), or the People's Republic of China (PRC) is the crisis adversary.
<i>US Troops in Middle East (k)</i>	Estimated number of U.S. military personnel stationed in the Middle East region, in thousands. Used as the U.S. troop measure for years where Iraq, Libya, or Iran is the crisis adversary.
<i>US troops in Europe (k)</i>	Estimated number of U.S. military personnel stationed in Europe, in thousands.
<i>Troops EU $\geq$ 100k</i>	Binary indicator equal to 1 if U.S. troops in Europe were 100,000 or more in that year.
<i>Troops EU (ordinal)</i>	Three-level ordinal coding of U.S. troops in Europe: High ($\geq$ 200k), Medium (50k-199k), Low ($<$ 50k).
<i>Overseas Warheads</i>	Total U.S. nuclear warheads stationed outside the continental United States (Europe, Asia, and at sea) in that year.
<i>Overseas $\geq$ 1,000</i>	Binary indicator equal to 1 if U.S. overseas warheads numbered 1,000 or more in that year.
<i>Overseas (ordinal)</i>	Three-level ordinal coding of U.S. overseas warheads: High ($\geq$ 3,000), Medium (100-2,999), Low ($<$ 100).

Variable	Description
<i>US Arsenal $\geq 10,000$</i>	Binary indicator equal to 1 if the total U.S. nuclear arsenal was 10,000 or more warheads.
<i>Parity Category</i>	Three-category coding of the capability balance based on the correlation-of-forces ratio: U.S. advantage (<0.5), Rough parity (0.5-1.5), Adversary advantage (>1.5).
<i>Nukes in Europe</i>	Binary indicator equal to 1 if the United States had any nuclear weapons forward-deployed in Europe in that year (1 from 1954 onward).
<i>Nukes in Asia</i>	Binary indicator equal to 1 if the United States had any nuclear weapons forward-deployed in Asia in that year (1 from 1955 through 1991).
<i>Adv Fwd Warheads</i>	Estimated number of nuclear warheads stationed in foreign territory by the crisis-specific adversary in that year. Zero for nonnuclear adversaries (China pre-1964, DPRK, Iraq, Libya, Iran). Soviet/Russian values used for USSR/Russia years.
<i>Adv Fwd $\geq 1,000$</i>	Binary indicator equal to 1 if adversary forward-deployed warheads were 1,000 or more.
<i>Adv Fwd (ordinal)</i>	Three-level ordinal coding of adversary forward warheads: High ($\geq 3,000$), Medium (100-2,999), Low (<100).
<i>Adv Fwd Troops (k)</i>	Total active military personnel of the crisis-specific adversary in that year, in thousands. For Soviet/Russia years: forward-deployed troops in foreign territory. For non-Soviet adversaries (China, DPRK, PRC, Iraq, Libya, Iran): total active military forces.
<i>Adv Fwd Troops $\geq 100k$</i>	Binary indicator equal to 1 if adversary forward-deployed troops were 100,000 or more.
<i>Adv Fwd Troops (ordinal)</i>	Three-level ordinal coding of adversary forward troops: High ($\geq 200k$), Medium (50k-199k), Low ($<50k$).
<i>US At War</i>	Binary indicator equal to 1 if the United States was engaged in a major sustained combat operation in that year.
<i>Adversary At War</i>	Binary indicator equal to 1 if the focal adversary (crisis-specific) was engaged in a major sustained combat operation in that year. Coded for the actual crisis adversary in each year, not defaulted to USSR/Russia.
<i>U.S. Milex (\$B 2020)</i>	U.S. military expenditure in billions of constant 2020 U.S. dollars.
<i>Adv Milex (\$B 2020)</i>	Crisis-specific adversary military expenditure in billions of constant 2020 U.S. dollars.
<i>Conv Ratio (adv/U.S.)</i>	Ratio of adversary military expenditure to U.S. military expenditure for that year.
<i>US SSBN Warheads</i>	Estimated number of U.S. nuclear warheads deployed on ballistic-missile submarines in that year.

Variable	Description
<i>Adv SSBN Warheads</i>	Estimated number of warheads on the crisis-specific adversary's ballistic-missile submarine force in that year (zero for adversaries without SSBNs).
<i>US 2nd-Strike Share</i>	U.S. SSBN warheads divided by the U.S. total arsenal—proxy for U.S. second-strike survivability.
<i>Adv 2nd-Strike Share</i>	Crisis-specific adversary's SSBN warheads divided by that adversary's total arsenal—proxy for adversary second-strike survivability.
<i>Crisis Adversary</i>	The specific state adversary associated with each year's crisis coding.
<i>US/Adv Fwd Troop Ratio</i>	Ratio of U.S. troops in the crisis-relevant region to adversary forward-deployed (or total) troops. Uses U.S. troops in Europe for USSR/Russia years, U.S. troops in Asia/Pacific for China/DPRK/PRC years, and U.S. troops in the Middle East for Iraq/Libya/Iran years.

Crisis-level data

Variable	Description
<i>CID</i>	Sequential crisis identifier (1-40) assigned in chronological order. Four crises (Cienfuegos/Jordan 1970, India-Pakistan War 1971, Yom Kippur War 1973, Taiwan Strait Crisis 1996) appear as two rows each, one per direction of nuclear signaling; these share the same CID and crisis name.
<i>Year</i>	Calendar year in which the crisis occurred, 1945 through 2026.
<i>Direction</i>	Direction of nuclear signaling. "US → Adv" indicates the United States issued or implied a nuclear threat toward the adversary. "Adv → US/Ally" indicates the adversary issued or implied a nuclear threat toward the United States or a U.S. ally.
<i>Adversary</i>	The crisis-specific adversary state or coalition. Values include USSR, Soviet Union, USSR/Russia, Russia, China, China/DPRK, DPRK, Iraq, Libya, and Iran, assigned to match the primary opposing party in each crisis.
<i>Crisis Name</i>	Standard historical name assigned to each crisis event.
<i>Issue / Context</i>	Brief description of the issue at stake or the operational context of the nuclear threat or signaling event.
<i>Explicit Threat</i>	1 if the nuclear threat in that crisis was explicit—a direct, unambiguous statement linking nuclear weapons to a specific contingency. Zero if the threat was implicit—conveyed through posture, deployment, alert, or ambiguous language without a direct nuclear reference.
<i>U.S. Nuclear Strategy</i>	Categorical label for U.S. nuclear doctrine in the crisis year. Values: Monopoly, Transition, Massive Retaliation, Flexible Response, LNO, Countervailing Strategy, Last resort, Multipolar deterrence.

Variable	Description
<i>Theory of Credibility</i>	Three-category coding of the prevailing theory of nuclear credibility in the crisis year. Values: Quantity, Proportionality, Rationality.
<i>U.S. Arsenal</i>	Total U.S. nuclear warhead inventory in the crisis year.
<i>Correlation of Forces</i>	Ratio of the crisis-specific adversary's nuclear arsenal to the U.S. arsenal in the crisis year. Values near zero indicate near-monopoly U.S. advantage; values above 1 indicate adversary advantage.
<i>US Troops in Region (k)</i>	U.S. military personnel stationed in the crisis-relevant region, in thousands. Uses U.S. troops in Europe for USSR/Russia adversary crises, U.S. troops in Asia/Pacific for China/DPRK crises, and U.S. troops in Middle East for Iraq/Libya/Iran crises.
<i>Overseas Warheads</i>	Total U.S. nuclear warheads stationed outside the continental United States (Europe, Asia, and at sea) in the crisis year.
<i>Adv Fwd Warheads</i>	Estimated number of nuclear warheads stationed in foreign territory by the crisis-specific adversary in the crisis year. Zero for nonnuclear adversaries (China pre-1964, DPRK, Iraq, Libya, Iran). Soviet/Russian values used for USSR/Russia crises.
<i>Adv Fwd Troops (k) in Crisis region</i>	Total active military personnel of the crisis-specific adversary, in thousands. For Soviet/Russia crises: forward-deployed troops in foreign territory. For non-Soviet adversaries (China, DPRK, Iraq, Libya, Iran): total active military forces.
<i>US At War</i>	1 if the United States was engaged in a major sustained combat operation in the crisis year; zero otherwise.
<i>Adversary At War</i>	1 if the crisis-specific adversary was engaged in a major sustained combat operation in the crisis year; zero otherwise. Coded for the actual crisis adversary, not defaulted to USSR/Russia.
<i>US Milex (\$B 2020)</i>	U.S. military expenditure in billions of constant 2020 U.S. dollars.
<i>Adv Milex (\$B 2020)</i>	Crisis-specific adversary military expenditure in billions of constant 2020 U.S. dollars.
<i>Conv Ratio (Adv/US)</i>	Ratio of adversary military expenditure to U.S. military expenditure in the crisis year.
<i>US SSBN Warheads</i>	Estimated number of U.S. nuclear warheads deployed on ballistic-missile submarines in the crisis year.
<i>Adv SSBN Warheads</i>	Estimated number of warheads on the crisis-specific adversary's ballistic-missile submarine force in the crisis year. Zero for adversaries without SSBNs.
<i>US 2nd-Strike Share</i>	U.S. SSBN warheads divided by the total U.S. arsenal. Proxy for U.S. second-strike survivability.

Variable	Description
<i>Adv 2nd-Strike Share</i>	Crisis-specific adversary SSBN warheads divided by that adversary's total arsenal. Proxy for adversary second-strike survivability.
<i>Allied Signaling (1)</i>	1 if exactly one U.S. ally signaled in the crisis year that it might pursue its own nuclear weapons; zero otherwise.
<i>Allied Signaling (2+)</i>	1 if two or more U.S. allies signaled in the crisis year that they might pursue their own nuclear weapons; zero otherwise.
<i>Fwd Conv Balance (US/Adv)</i>	Ratio of U.S. troops in the crisis-relevant region to adversary forward-deployed (or total) troops (US Troops in Region / Adv Fwd Troops in Crisis region). Values above 1 indicate U.S. conventional advantage in theater; values below 1 indicate adversary advantage.
<i>non_nuclear_adv</i>	Binary indicator equal to 1 for years in which the crisis-specific adversary had zero nuclear weapons (17 years: monopoly-era USSR 1945-1948, and nonnuclear adversaries China/DPRK 1950-1954, DPRK 1975-1976, Libya 1981, Iraq 1991-1998, DPRK 1994, PRC 1996, Iran 2025-2026). Used in the dummy-variable specification of Result 1 to separate the nonnuclear intercept shift from the nuclear balance gradient.
<i>log2_cap_nuc</i>	$\log_2(\text{adversary/U.S. nuclear arsenal ratio})$ for nuclear-adversary years (Correlation of Forces > 0); coded 0 for nonnuclear-adversary years. Used as the IV of interest in the dummy-variable specification of Result 1 alongside the <i>non_nuclear_adv</i> dummy. Avoids the arbitrary floor-value problem of clipping zero ratios to a small constant.
<i>monopoly_era</i>	Binary indicator equal to 1 for 1945-1948, the period of U.S. nuclear monopoly during which the USSR was the crisis adversary but had zero nuclear weapons. Subset of <i>non_nuclear_adv</i> ; used in the two-dummy robustness specification.
<i>never_nuclear_adv</i>	Binary indicator equal to 1 for years after 1948 in which the crisis-specific adversary had zero nuclear weapons (DPRK, Libya, Iraq, PRC pre-1964, Iran). Subset of <i>non_nuclear_adv</i> ; used in the two-dummy robustness specification.

Methods

The statistical tests used to produce Result 1:

- **Estimator:** Poisson QMLE (GLM, log link)—primary estimator for the count dependent variable (crises per year).
- **Standard errors:** Newey-West HAC (Heteroskedasticity and Autocorrelation Consistent) standard errors, lag 3—applied to all five Poisson models to correct for serial autocorrelation.
- **Significance testing:** Wald z-tests—z-statistics and two-tailed p-values reported for each coefficient.
- **Effect size:** IRR (incidence rate ratio, e^{β})—percent change in expected crises per year for each doubling of the adversary-to-U.S. nuclear capability ratio; 95% confidence intervals on β and on the IRR-derived effect percentage.
- **Model fit:** Log-likelihood (log-L = -58.52 in the fully specified model); AIC (145.04 in the fully specified model)—used to compare fit across the five specifications.
- **Robustness:** Negative binomial specification check—alpha converges to zero, confirming Poisson is the appropriate estimator.

The statistical tests used to produce Result 2:

- **Estimator:** Poisson QMLE (GLM, log link)—applied separately for each of the 15 posture/doctrine variables.
- **Standard errors:** Newey-West HAC standard errors, lag 3—applied identically to all 15 models.
- **Controls held constant in every model:** log2_cap_nuc + non_nuclear_adv + log_fwd_troop—the nuclear balance, non-nuclear adversary dummy, and conventional troop balance are base controls throughout.
- **Significance testing:** Wald z-tests—z-statistics and two-tailed p-values for each test variable coefficient; β and HAC SE reported for both the test variable and log2_cap_nuc in each model.
- **Robustness check:** Nuclear balance coefficient (log2_cap_nuc) reported alongside each test variable—confirms the cap ratio result is stable across all 15 models (significant in 11 of 15).
- **Summary counts:** Test variable significant in one of 15 models (U.S. at war, $p = 0.029$); Cap ratio significant in 11 of 15 models.

Endnotes

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- 12** “Civil defense is not a reinforcement of deterrence; it is not a tool of crisis management; it certainly does not demonstrate will or confer superiority. But neither is it belligerent or provocative. It is what Kennedy called it — insurance, imperfect but relatively cheap — a way of mitigating a possible disaster, not a way of avoiding it or making it acceptable.” McGeorge Bundy, *Danger and Survival*, 355-356.
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- 14** Henry A. Kissinger, *Nuclear Weapons and Foreign Policy* (New York: Harper & Brothers, 1957), 55-56.
- 15** William W. Kaufmann, *The Requirements of Deterrence* (Princeton: Princeton University, 1954), 7-8, <https://catalog.hathitrust.org/Record/000819734>.
- 16** Henry Kissinger, *Nuclear Weapons and Foreign Policy*, 133.
- 17** Albert Wohlstetter, “The Delicate Balance of Terror,” *Foreign Affairs*, January 1959, <https://www.rand.org/pubs/papers/P1472.html>.
- 18** Kahn offered the most direct and lengthy—though still abstract—definition: “Credibility does not involve the question ‘Do we or the Soviets have the capability to hurt the other side on a first strike?’ It is well known that this capability exists and in all likelihood will continue to exist. Credibility depends on being willing to accept the other side’s retaliatory blow. It depends on the harm he can do, not on the harm we can do. It depends as much on air defense and civil defense as on air offense. It depends on will as well as capability. It depends on the provocation and on the state of our mind when the provocation occurs. ... Being able to influence ... Soviet or European behavior depends not only on our will, but also on Soviet and European estimates of our will.” Herman Kahn, *On Thermonuclear War* (Princeton: Princeton University Press, 1960), 32.
- 19** Robert S. McNamara, “Mutual Deterrence” (Address to UPI Editors and Publishers, California, September 18, 1967), <https://www.atomicarchive.com/resources/documents/deterrence/mcnamara-deterrence.html>.
- 20** McNamara famously operationalized “unacceptable damage” as the destruction of approximately 20%-25% of the adversary’s population, and 50%-75% of its industrial capacity. See Malcolm W. Hoag, “Alternative Strategic Force Structure Planning Criteria: Some Implications for Nuclear Guarantees, Proliferation, and Alliance Diplomacy,” (Santa Monica: RAND Corporation, November 1971), 1, <https://www.rand.org/pubs/reports/R0858.html#document-details>.
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- 32 McGeorge Bundy, *Danger and Survival*, 185.
- 33 David Alan Rosenberg, "The origins of overkill: Nuclear weapons and American strategy, 1945-1960," *International Security* 7, no. 4 (1983): 3-71, <https://doi.org/10.2307/2626731>.
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- 36 Ibid., 103.
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- 74** This association is likely an artifact of timing, not an indicator of a substantive relationship.
- 75** When a measure of the conventional military balance—the ratio of adversary to U.S. forward troops, matched to the crisis-relevant region—is added to the analysis, it is correlated with the nuclear capability ratio ($r = -0.61$), reflecting the Cold War pattern in which nuclear build-up and conventional forward presence moved together across time. Once years in which the crisis-relevant adversary had no nuclear weapons are separated via an indicator variable, both the nuclear balance and the conventional balance are independently associated with crisis frequency, and inclusion of the conventional balance strengthens rather than displaces the nuclear balance result. The conventional balance does not, however, have a consistent independent association across all specifications, and the nuclear balance result is robust to its exclusion.
- 76** The proportionality era is not significantly associated with crisis frequency in any specification tested ($\beta = 0.245$, $p = 0.582$ in the base model). The rationality era is statistically indistinguishable from the quantity baseline across all specifications tested.

- 77** The relationship between U.S. engagement in ongoing military operations and crisis frequency is marginally significant in the base model ($\beta = 0.478$, $p = 0.029$) but does not survive across specifications, and the direction of that sensitivity does not favor the significance finding. In a negative-binomial robustness test with the capability ratio and both war indicators as the only predictors, neither U.S.-at-war nor adversary-at-war years show a statistically significant association with crisis frequency, and model fit worsens when war indicators are added. U.S. at war is an exogenous condition rather than a policy lever, and its marginal significance in the base model is most plausibly a reflection of the concentration of Cold War crises in years of active U.S. conventional engagement rather than an independent effect of wartime distraction. The nuclear balance result is unaffected across all specifications tested.
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