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Nuclear Perils in a New Era

Bringing Perspective to the
Nuclear Choices Facing Russia
and the United States



Steven E. Miller and Alexey Arbatov

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Introduction

Prominent voices in both Russia and the United States warn that the danger of nuclear war is again growing. Their concern stems from a complex and accelerating set of developments. Technological advances are calling into question the assumptions that once underpinned the concept of strategic stability between nuclear adversaries. Conventional weapons capable of missions previously reserved to nuclear weapons are blurring the lines between conventional and nuclear war. Cyber and other facets of space warfare are opening whole new frontiers of nuclear risk. The effort to defend against some aspects of the nuclear peril by building missile defense systems in Russia, the United States, China, and India may stir a nuclear arms race dynamic pitting ever-improving offensive weapons against evermore ambitious defensive systems. While Russia and the United States press forward with the modernization of all aspects of their nuclear forces, they are joined by China, India, and Pakistan as they fashion their own triad of nuclear forces on land, in the air, and at sea, creating a matrix of competing nuclear relationships far more complex than the two-sided competition during the Cold War. And all of this is happening at a time of seriously deteriorated relations between Russia and the United States, accompanied by the crumbling of the strategic nuclear arms control regime constructed over the last half century.

Thus, leaders and the policy-making community in both countries are making decisions about the nuclear forces they wish to have, the missions they plan to assign them, and what, if anything, arms control can contribute to national security in an increasingly fraught and daunting environment. Decision-making in this environment requires a broad perspective—one alert to what the long experience of U.S. and Russian efforts to manage nuclear weapons has entailed, the lessons it holds, and the challenges that it underscores. In this publication, two authors—one Russian, the other American—review that history and use it to illuminate the gravity of the decisions currently facing policy-makers in their two countries. Although comparable in their scope and level of concern, the two essays were independently written, and earlier versions were published under different auspices. Alexey Arbatov’s article, “Mad Momentum Redux? The Rise and Fall of Nuclear Arms Control,” first appeared in the June-July 2019 issue of *Survival*. Steven E. Miller’s essay, “The Rise and Decline of Global Nuclear Order?” was included in an occasional paper published as part of the

American Academy of Arts and Sciences' project "Meeting the Challenges of the New Nuclear Age."

We believe that together these essays provide the background and context vital to the choices that the leadership in our two countries will make as they seek to enhance each nation's national security in a rapidly changing, complex, and potentially perilous nuclear environment.

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The Rise and Decline of Global Nuclear Order?

Steven E. Miller

The first half century of the nuclear age witnessed the gradual construction of a global nuclear order designed to mitigate nuclear dangers, inhibit arms racing, and prevent the spread of nuclear weapons to additional states. Spurred by the experiences, the dangers, the crises, the near misses, and the frightening risks on display in the early years of the Cold War, sustained efforts were made, in McGeorge Bundy's vivid phrase, "to cap the volcano."¹ The time had arrived, Bundy wrote in 1969, for the two great nuclear superpowers "to limit their extravagant contest in strategic weapons," a contest that had "led the two greatest powers of our generation into an arms race totally unprecedented in size and danger." In the subsequent twenty-five years after Bundy's appeal, an increasingly elaborate and institutionalized arms control process produced, with many ups and downs, a detailed web of constraints on the nuclear behavior of the superpowers. The articulated goal was to stabilize the superpower nuclear balance by reinforcing mutual deterrence. The vast nuclear arsenals of the superpowers, however, were not the only source of nuclear danger. In a world in which the number of states armed with nuclear weapons was slowly growing and many additional states had interest in acquiring such weapons or the technology to produce them, there was reason, as Albert Wohlstetter warned in 1961, to be "concerned with the enormous instabilities and dangers of a world with many nuclear powers."² Such a world—"life in a nuclear armed crowd"—Wohlstetter wrote in a later famous study, was widely believed to be "vastly more dangerous than today's world."³ The desire to prevent this

1. McGeorge Bundy, "To Cap the Volcano," *Foreign Affairs* (October 1969).

2. Albert Wohlstetter, "Nuclear Sharing: NATO and the N+1 Problem," *Foreign Affairs* (April 1961).

3. Albert Wohlstetter et al., *Moving Toward Life in a Nuclear Armed Crowd?* Report to the U.S. Arms Control and Disarmament Agency, ACDA/PAB 263, December 4, 1975, 143. Writing in 1975, Wohlstetter and colleagues anticipated that by 1985, some forty states would possess the technical wherewithal to acquire nuclear weapons.

unattractive world led to the negotiation of the Nuclear Nonproliferation Treaty (NPT), which entered into force in 1970, and to the subsequent development of an associated regime intended to create legal and technical barriers to the spread of nuclear weapons. Thus, in reaction to the major perceived dangers of the nuclear age, there emerged what Lawrence Freedman calls the “twin pillars” of the global nuclear order: mutual stability in the major nuclear rivalry and nonproliferation to inhibit or prevent the spread of nuclear weapons to additional states.⁴

By the end of the Cold War, mutual deterrence and strategic arms control had been deeply embedded in the relationship between the United States and the Soviet Union, and most states in the international system had, by joining the NPT, undertaken a legally binding pledge not to acquire nuclear weapons. The collapse of the Cold War structure and the end of reflexive hostility between Moscow and Washington seemed to suggest that a much more cooperative international security system might be possible and that a golden age of ambitious arms control might beckon.⁵ To be sure, there were still worries about nuclear dangers and still debates about the effectiveness of the NPT system, but in general there was optimism about what President George H. W. Bush labelled “the new world order.” “The winds of change are with us now,” Bush concluded confidently in his moving and triumphant State of the Union Address in January 1991.⁶ A safer world, in which nuclear dangers would be contained by cooperative management, seemed to be at hand—or at least possible.

Nearly three decades later, it is evident that such hopes for a benign nuclear order have been dramatically disappointed. Harmony and cooperation among the major powers have not been preserved, a golden age of arms control and disarmament has not arrived, and the nonproliferation norm has not been universally respected. Instead, Russia’s relations with the United States and the West have grown difficult and sometimes toxic. China’s rise has added a significant complication to the nuclear calculations of Washington and Moscow. Several new nuclear-armed states have emerged, creating complicated and unprecedented regional nuclear dynamics, while

4. See Lawrence Freedman, “The Interplay Between the International System and the Global Nuclear Order,” in Steven E. Miller, Robert Legvold, and Lawrence Freedman, *Meeting the Challenges of the New Nuclear Age: Nuclear Weapons in a Changing Global Order* (Cambridge, Mass.: American Academy of Arts and Sciences, 2019), 62–75.

5. See, for example, Janne E. Nolan, ed., *Global Engagement: Cooperation and Security in the 21st Century* (Washington, D.C.: Brookings Institution, 1994). This was one product of a collaboration between the Brookings Institution, Harvard University, and Stanford University to explore what forms of security cooperation could be possible in the new international environment.

6. “Address Before a Joint Session of Congress on the State of the Union,” January 29, 1991.

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protracted crises over the nuclear ambitions of Iran and North Korea have called into question the effectiveness of the NPT regime. Important pieces of the arms control framework inherited from the Cold War era have been rejected or jettisoned while others are undermined and jeopardized by contentious compliance disputes—and at present there appears to be little serious interest in reviving the arms control process, either bilaterally or multilaterally. Meanwhile technological advances in surveillance and accuracy have the potential to erode the survivability of deployed nuclear forces and thereby undermine the deterrence stability that has been one of the pillars of the global nuclear order. Compared to the high hopes of 1991, the current state of the global nuclear order is shockingly worrisome: political relations are frayed, stability is jeopardized, and arms control has deteriorated. The potential implications are enormous. As Gregory Koblenz argues in his recent analysis of the evolving nuclear scene, the United States could find itself “trapped in a new nuclear order that is less stable, less predictable, and less susceptible to American influence.”⁷

How did we arrive at this point and what are the forces that are shaping the negative evolution of the global nuclear order? In what follows, I provide broad-brush sketches of three phases of the nuclear age, sketches that demonstrate movement from an unregulated and highly competitive environment to one that gradually becomes highly regulated and collaboratively (sometimes cooperatively) managed. What has come to dominate the story is the striking turn in the narrative arc in recent years toward a less regulated and more contentious third phase in the history of the global nuclear order. Old concerns (such as missile defense) have resurfaced while new problems (such as multilateral deterrence) have arisen. It is not entirely clear yet where we are headed but there should be no doubt that fundamentally important questions should be on the agenda. Are we going to be living in a nuclear world that is more laden with friction, more multilateral, less stable, less constrained by negotiated agreement, and possibly populated with additional nuclear-armed actors? Will some of the undesirable

7. Gregory D. Koblenz, *Strategic Stability in the Second Nuclear Age* (New York: Council on Foreign Relations, November 2014), 32.

characteristics of the early years of the nuclear age re-emerge? If so, what can be done to address the emerging nuclear dangers? If we are headed into or are already living in a new nuclear age, how can it be managed safely and prudently? A brief examination of the history of the nuclear order provides the context for and demonstrates the significance of these questions.

Unmanaged Competition, 1945–1970: Racing to Oblivion?

In the beginning, there was not order but unmitigated competition. For the first quarter of a century of the nuclear age, nuclear forces evolved in an unregulated environment. Serious dialogue between the great Cold War protagonists was virtually nonexistent. States were unconstrained by arms control agreements. There were few norms or tacitly agreed codes of conduct. To the extent that order existed at all, it emerged from the uncoordinated unilateral steps and choices of states acting on the basis of their own perceived self-interest. For the two Cold War superpowers, the result was a world of intense arms racing and recurrent nuclear crises. Driven by fear, by the opacity of the existing military balance, by uncertainty about the plans and motives of the other side, and by concern about the adequacy of deterrent postures, the two nuclear superpowers rapidly expanded and modernized their nuclear forces.

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The formative nuclear strategists of this era quickly came to the conclusion that nuclear weapons were best understood as instruments of deterrence. Remarkably, Bernard Brodie articulated the core logic almost immediately after World War II in an essay initially drafted late in 1945. Because no gain would be worth suffering a devastating nuclear attack, Brodie argued, aggressors would refrain from nuclear attack if threatened with retaliation in kind. Hence the great imperative of the nuclear age: “The first and most vital step in any American security program for the age of atomic bombs is to take measures to guarantee ourselves in case of attack

the possibility of retaliation in kind.”⁸ Inexorable logic suggested that if other nuclear powers heeded the imperative to possess nuclear retaliatory capabilities, a condition of mutual deterrence (later codified in American doctrine as mutual assured destruction, or MAD) would exist. If nuclear rivals had confidence in the adequacy and survivability of their respective retaliatory capabilities, the nuclear balance would be stable, meaning neither side would have incentives to use nuclear weapons first. In this way, a kind of nuclear order would emerge as the Cold War evolved, so long as the United States and the Soviet Union satisfied the requirements of deterrence—as both strenuously sought to do. As Lawrence Freedman observes, “The logic of the nuclear stalemate was to neutralize the effects of the arsenals. There was no premium in initiating nuclear war. Each arsenal cancelled out the other.”⁹

With hindsight, we know that the resulting order—the logic of nuclear stalemate—sufficed to prevent the use of nuclear weapons despite years of dramatic political contention and military conflict (notably Korea and Vietnam).

With hindsight, we know that the resulting order—the logic of nuclear stalemate—sufficed to prevent the use of nuclear weapons despite years of dramatic political contention and military conflict (notably Korea and Vietnam). But it was also an order marked by stresses, dangers, and disadvantages. Nuclear weapons were never used but the arms competition between the nuclear superpowers was extremely intense and the confrontations between them seemed, both at the time and in retrospect, to be perilous.

Powerful arms race dynamics propelled the Soviet-American nuclear competition. At least five reinforcing forces were in play. First, the overwhelming importance of preserving second strike capabilities against current and future threats created incentives for expansion and redundancy; a large and diverse nuclear arsenal provided insurance against the risk of being victimized by a successful first strike and allayed strategic concerns

8. Bernard Brodie, “Implications for Military Policy,” in Bernard Brodie, ed., *The Absolute Weapon: Atomic Power and World Order* (New Haven: Yale Institute of International Studies, February 15, 1946), 62. Brodie concluded this paragraph with one of the most famous passages in the history of U.S. nuclear thought: “Thus far the chief purpose of our military establishment has been to win wars. From now on its chief purpose must be to avert them. It can have almost no other useful purpose.”

9. Freedman, “The Interplay Between the International System and the Global Nuclear Order,” 65.

that the other side's expanding and improving forces might pose a credible threat to one's own deterrent force. Second, each side was keen to ensure its own second-strike capability but was not willing to accept without resistance the retaliatory forces of the other side. Rather, both Moscow and Washington embraced operational nuclear doctrines—under the rubric of counterforce and damage limitation—that targeted the nuclear forces of the other side. Hence, the enormous growth in the size of the arsenals represented an expansion of the number of targets, requiring larger forces to ensure that all targets could be covered—a self-reinforcing cycle. The obvious intense contradiction between the imperative to possess a survivable deterrent force and the powerful instinct to target the deterrent forces of the other side not only drove up numbers but produced recurrent concerns about vulnerability and instability.¹⁰

Third, these potent doctrinal impulses produced strong interaction effects as the nuclear plans and behavior of the Cold War protagonists influenced one another—what came to be known as the action-reaction phenomenon.¹¹ But in an atmosphere of hostility, distrust, and uncertainty about future plans, there was a tendency to worry about the worst-case, to prepare to match what the opponent might do next, to fear that the future threat could turn out to be larger and more effective than expected. Prudent policy-makers, it was believed, would feel the need to be ready for the worst-case scenario, resulting in what might be more accurately described as an action-overreaction dynamic. As George Rathjens wrote in 1969, “the action-reaction phenomenon, with the reaction often premature and/or exaggerated, has clearly been a major stimulant of the strategic arms race.” The pattern of overreaction, Rathjens observed, produces “an arms race with no apparent limits other than economic ones, each round being more

10. See, for example, David Alan Rosenberg's classic study, “The Origins of Overkill: Nuclear Weapons and American Strategy, 1945–1960,” *International Security* 7 (4) (Spring 1983): 3–71. Recent literature documents and emphasizes resistance to mutual deterrence, questions the stability of the nuclear relationship, and highlights the persistent self-interested embrace of strategic competition. See, in particular, Brendan Rittenhouse Green, *The Revolution that Failed: Nuclear Competition, Arms Control, and the Cold War* (Cambridge: Cambridge University Press, 2020); and Keir A. Lieber and Daryl G. Press, *The Myth of the Nuclear Revolution: Power Politics in the Atomic Age* (Ithaca, NY: Cornell University Press, 2020). The deep commitment to large-scale counterforce targeting in U.S. strategic planning is described in Fred Kaplan, *The Bomb: Presidents, Generals, and the Secret History of Nuclear War* (New York: Simon & Schuster, 2020).

11. See, in particular, the influential analysis in George Rathjens, “The Dynamics of the Arms Race,” *Scientific American* 220 (4) (April 1969): 15–25, reprinted in Herbert York, ed., *Arms Control; Readings from Scientific American* (San Francisco: WH Freeman & Co., 1973), 177–187.

expensive than the last.”¹² The unknown future cast a powerful shadow as fears of an ever larger and ever more sophisticated and effective nuclear arsenal in the hands of the other side shaped the perceptions and decisions of nuclear policy-makers; the long timelines associated with the procurement of major systems meant that today’s choices were inevitably framed in the context of an unknown future threat.

Fourth, one particular form of the action-reaction model, the offense-defense arms race, was thought to be operating powerfully. For deterrence to work, nuclear forces needed not only to be able to survive an attack in some number, but the surviving forces needed to be able to penetrate the enemy’s defenses—otherwise the necessary retaliation in kind is questionable and may not be sufficient to deter.¹³ Even an imperfect first strike could significantly degrade an arsenal and might reduce the surviving retaliatory force to such an extent that it makes the problem of defense against retaliation much more tractable. At the time, missile defenses were still limited and not highly effective, but no one knew what advances might be made in the future. A breakthrough could undermine deterrence and give one side a strategic advantage. The answer to the potential threat of future effective defenses was, once again, an expansion of offensive forces. If the offensive force was large enough, it would always be possible to exhaust a missile defense system no matter how effective it might be. Moreover, in this era (as at present) it was considerably cheaper to acquire additional offensive forces than to deploy missile defense interceptors. “In a competition with a determined and resourceful adversary,” Rathjens explained in response to impending U.S. decisions in the late 1960s about deploying missile defense, “the advantage in an offense-defense duel would still lie with the offense.” Nevertheless, the urge to defend is very strong and the choice to remain defenseless is often unacceptable in domestic political terms even if sensible in strategic terms. Hence, both the United States and the Soviet Union were working on missile defense systems and their

12. Rathjens, in *Arms Control*, 181–182. Critics, however, argued that the action-reaction model overstated the interactive sources of arms race behavior and undervalued the internal political, bureaucratic, economic, and technological drivers of arms racing. See, notably, Colin S. Gray, “The Arms Race Phenomenon,” *World Politics* 24 (1) (October 1971): 39–79. The most emphatic rejections of the interactive model argued that the arms race was a myth, both because “US and Soviet strategic weapons programs were largely independent of each other” and because the United States simply did not race, but instead leveled off its forces even as the Soviet arsenal continued to grow. See, for example, Richard Perle, “The Arms Race Myth, Again,” *The Washington Post*, March 3, 2008.

13. Albert Wohlstetter’s legendary warning about the instability of nuclear balance rested on the argument that deterrent forces needed to be able both to survive an attack and then penetrate enemy defenses, and neither attribute could be taken for granted. See Wohlstetter, “The Delicate Balance of Terror,” *Foreign Affairs* (January 1959).

planning for nuclear forces had to take into account possible defensive deployments in the future. The notion of an offense-defense arms race envisioned a future in which ever larger and better missile defense systems would be offset by ever larger and more sophisticated offensive arsenals—with the expansion of offensive forces driven by the imperative of deterrence. This would produce an upward spiral in the nuclear competition without eliminating the nuclear threat. As Rathjens concludes, “it appears virtually certain that at the end of all this effort and all this spending neither nation will have significantly advanced its own security.”¹⁴

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Finally, at least in the United States nuclear policy-making was driven in part by a politically motivated fear of falling behind and being (or looking) inferior. In strategic terms, exact numbers might not be significant and possession of a secure second-strike capability should make additional forces unnecessary or superfluous. However, there was concern about the international optics of having smaller forces; friends and foes might perceive the United States to be the weaker power, with negative consequences for Washington’s ability to operate in the world.¹⁵ Similarly, in the American domestic political context, the Soviet achievement of numerical advantages by the 1970s was disturbing and for elected officials there was little to be gained by supporting alleged inferiority. Codifying those Soviet advantages in arms control agreements was particularly controversial and provoked intense criticism. Writing decades after the debates about ratifying the SALT I agreements, for example, Henry Kissinger is still visibly frustrated by the “amazing tale” of the claim that in the SALT negotiations the Nixon administration had “conceded an inequality.” Kissinger explains that “inequality was one of those code words that create their own reality,” a reality that undermined support for the Nixon-Kissinger arms

14. Rathjens, in *Arms Control*, 177–178.

15. Illustrating the (contested) argument that nuclear superiority matters, in large part by affecting the resolve of contending parties, is Matthew Kroenig, “Nuclear Superiority and the Balance of Resolve: Explaining Nuclear Crisis Outcomes,” *International Organization* 67 (1) (January 2013): 141–171.

control policy and produced the impression, as Kissinger himself puts it, “that what the Administration was defending was a ‘missile gap’ disadvantageous to the United States.”¹⁶ In short, internal political considerations joined strategic calculations in promoting vigorous competition in the nuclear relationship.

A further confounding factor was the possibility that nuclear weapons might spread to additional countries. From the earliest days of the nuclear age, it was understood that other states might choose to pursue and deploy nuclear arsenals, resulting in what Brodie, in 1946, described as “multilateral possession of the bomb.”¹⁷ This was an option available to any state that possessed or could develop or acquire the technical and financial resources necessary for a nuclear program. While the United States and the Soviet Union were primarily preoccupied with each other, it was recognized that in the not-too-distant future there could be a number of nuclear-armed states. By 1960, Washington feared that there might be as many as twenty-five nuclear weapon states within five to fifteen years—a prediction that John Kennedy noted during his presidential campaign and that President Kennedy later highlighted in a memorable press conference in March of 1963.¹⁸ Here, then, was another large and worrisome uncertainty: the U.S.-Soviet rivalry might become embedded in a multilateral nuclear order that could involve many (large and small, stable and less stable, responsible and irresponsible) actors, regional nuclear balances, multidirectional fears of attack, and concerns about the stability of a complicated overall system of nuclear interactions. Both Moscow and Washington feared and opposed this outcome, a deeply held shared interest that produced considerable cooperation between them on nonproliferation even in the darker days of the Cold War.¹⁹ But policy-makers and nuclear planners on both sides had no choice but to consider the implications of life in Wohlsetter’s

16. Henry A. Kissinger, *Diplomacy* (New York: Simon and Schuster, 1994), 749.

17. Brodie, “Implications for Military Policy,” 61.

18. During the presidential debate on October 13, 1960, for example, Kennedy said, “There are indications, because of new inventions, that ten, fifteen, or twenty nations will have a nuclear capacity—including Red China—by the end of the presidential office in 1964. This is extremely serious.” See Commission on Presidential Debates, “October 13, 1960, Debate Transcript,” available at <http://www.debates.org/index.php?page=october-13-1960-debate-transcript>. I am grateful to Chris Chyba for drawing this quote to my attention. For Kennedy’s March 1963 statement and more broadly for an overview of concerns about future proliferation, see Peter R. Lavoy, “Predicting Nuclear Proliferation: A Declassified Documentary Record,” *Strategic Insights* III (1) (January 2004).

19. See, for example, William Potter and Sarah Bidgood, eds., *Once and Future Partners: The United States, Russia, and Nuclear Non-Proliferation* (London: IISS, 2018), which examines cases in which the United States and the Soviet Union were able to cooperate in efforts to prevent proliferation.

“nuclear-armed crowd.” This was another unsettling feature of the nuclear order in the first quarter century of the nuclear age.

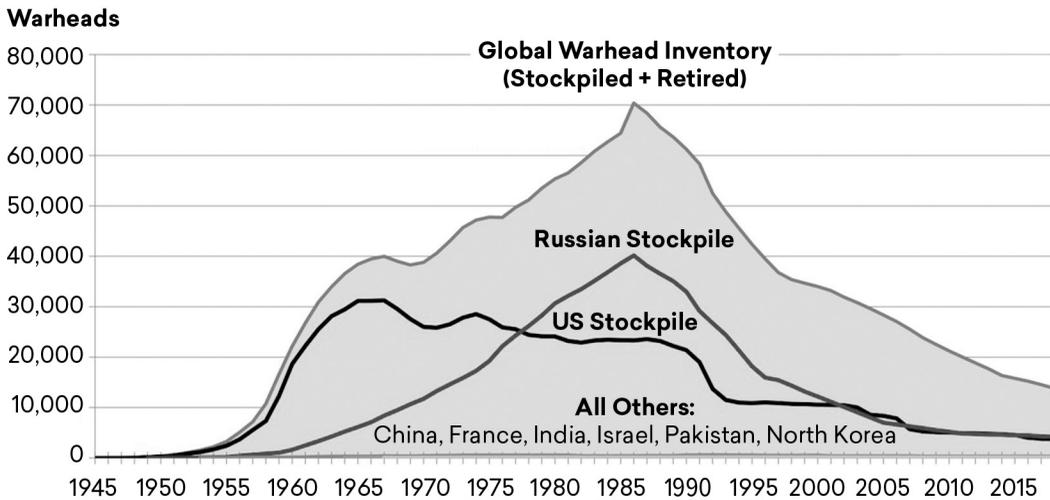
The operation of this set of powerful forces had three broad effects. First, there was a prodigious accumulation of weapons—to a level that today seems irrational. One small nuclear weapon devastated Hiroshima, but the superpowers eventually deployed tens of thousands of weapons, nearly all of them many times more powerful than the bombs dropped in 1945. By the time this gluttonous acquisition of nuclear weapons peaked in 1986, there were more than seventy thousand nuclear weapons deployed by the superpowers—more than thirty thousand in the American arsenal and nearly forty thousand in the Soviet arsenal.²⁰ This extraordinary amassing of weapons represented an unimaginable aggregation of destructive power—leading to concerns that any substantial nuclear exchange between the Soviet Union and the United States could seriously damage the global ecosystem by producing a “nuclear winter” as enormous quantities of dust and debris in the atmosphere blocked the sun and produced a cooling of the planet.²¹ Advocates of arms control believed that this immense buildup increased dangers and wasted resources while producing no net improvement in security. An intense quantitative arms race was one of the hallmarks of the unregulated phase of the nuclear age. And the momentum of this build-up continued well into the 1980s.

Second, the scramble for advantage and the fear of disadvantage led to the nuclearization of nearly everything. Long-range bombers and ballistic missiles were, of course, the mainstays of the strategic nuclear competition. But by the 1960s, nuclear weapons were being deployed throughout the U.S. and Soviet militaries in every armed service and on nearly every conceivable means of conveyance. Gravity bombs were provided for tactical aircraft. Shorter-range missiles and cruise missiles were armed with nuclear weapons. Nuclear air defense interceptors and nuclear torpedoes were deployed. In addition, an array of so-called battlefield nuclear weapons was developed, including nuclear artillery shells, nuclear land mines, and man-portable nuclear weapons. The M28/M29 Davey Crockett, for example, was a recoilless rifle, handled by a three-man crew, that fired a W54 warhead weighing 51 pounds in a projectile that was 11 inches in diameter and 31 inches in length; between 1961 and 1971, the Davey Crockett was

20. The data used here, including the table, are drawn from Hans M. Kristensen and Robert S. Norris, “Status of World Nuclear Forces” (Washington, D.C.: Federation of American Scientists, June 2018).

21. See, most famously, the analysis undertaken by a group of leading climate scientists: R. P. Turco, O. B. Toon, T. P. Ackerman, J. B. Pollack, and Carl Sagan, “Nuclear Winter: Global Consequences of Multiple Nuclear Explosions,” *Science* 222 (4630) (December 23, 1983): 1283–1292.

Estimated Global Nuclear Warhead Inventories, 1945–2018



Source: Hans M. Kristensen and Robert S. Norris, “Status of World Nuclear Forces” (Washington, D.C.: Federation of American Scientists, June 2018).

deployed in both Germany and South Korea.²² At the peak of this nuclearization in the 1970s, the United States possessed some 7,600 tactical nuclear weapons, of which 7,300 were deployed with U.S. forces in Europe.²³ Every domain of warfare—ground forces, naval deployments, tactical air—became part of the nuclear equation. Along with the pervasive deployment of nuclear weapons came elaborate doctrinal explorations about how the various levels of nuclear capability were related to one another in ladders of escalation and whether it might be possible to engage in varieties of limited nuclear war without escalating to all-out nuclear exchanges.²⁴ The unrestrained competition widened the horizons of the nuclear debate and brought more menacing scenarios and possibilities into view.

22. Facts on the Davey Crockett system can be found in Matthew Seelinger, “The M28/M29 Davey Crockett Nuclear Weapon System,” Army History Center, National Museum of the United States Army, September 20, 2016, at www.armyhistory.org.

23. For discussion and data, see Hans M. Kristensen, *Non-Strategic Nuclear Weapons*, Special Report No. 3 (Washington, D.C.: Federation of American Scientists, May 2012). Statistics on numbers of tactical weapons can be found on p. 18.

24. In a landmark study from the mid-1960s, Herman Kahn identified and analyzed a remarkable number of “rungs” on the “escalation ladder.” See Herman Kahn, *On Escalation: Metaphors and Scenarios* (New York: Praeger, 1965). Henry Kissinger first became prominent and controversial by advocating a doctrine of limited nuclear war as an alternative to Eisenhower’s massive retaliation policy. See Henry Kissinger, *Nuclear Weapons and Foreign Policy* (New York: Council on Foreign Relations, 1957).

Third, the vast accumulation and wide distribution of weapons were accompanied by rapid innovation and a fast pace of nuclear modernization. At the outset of the era, medium-range bombers were the primary delivery system, but were soon supplanted by intercontinental bombers. Starting in 1951, the United States invested in more than two thousand B-47 medium range bombers, but in 1955 the long-range B-52 was introduced and by 1963 more than seven hundred B-52 bombers had been acquired. The Soviet Union was simultaneously charging into the missile age. The Soviet launch of an orbiting satellite in October 1957 demonstrated Moscow's progress and produced in the United State the shocked belief that it was lagging behind in the missile field—producing deep fears of a missile gap. The U.S. missile program was galvanized and early in his administration President Kennedy decided to deploy a thousand intercontinental ballistic missiles (ICBMs), dubbed Minuteman. In parallel, starting in 1961, ballistic missiles were deployed at sea on submarines. By the late 1960s, programs were underway to put multiple warheads on missiles and to upgrade their guidance systems to improve accuracy.

While the heated quantitative arms race produced enormous numbers, the intense qualitative race generated endless anxiety and repeated scares about possible instability in the nuclear balance.

The large and redundant strategic forces that emerged on both sides provided grounds for thinking that second-strike forces would survive any attack and deterrence would therefore be effective. The pace of innovation and modernization, however, was worrisome and disruptive, and gave rise to fears that large and dangerous vulnerabilities might emerge or exist or that asymmetric capabilities might give significant or even decisive advantage to one side. Reliance on medium-range bombers meant utilizing air bases within range of the Soviet Union that were vulnerable to attack. Long-range bombers were potentially vulnerable to short-notice attacks by ICBMs. Even missiles in hardened silos were vulnerable if attacking missiles could strike accurately enough. Command and control arrangements for nuclear forces could become vulnerable to crippling “decapitation attacks.” Rapid modernization brought all these concerns into view, producing a perennial debate about the survivability and adequacy of deterrent forces and a pattern of lurching from one vulnerability crisis to the next. By the mid-point of the Cold War, the United States was in the midst of a

serious scare over the possible vulnerability of its ICBM force.²⁵ While the heated quantitative arms race produced enormous numbers, the intense qualitative race generated endless anxiety and repeated scares about possible instability in the nuclear balance.

Nuclear order in the first twenty-five years of the nuclear age took the form of unregulated competition in which the only significant constraints were budgetary and technological and in which the primary moderating force was the mutual deterrence that arose out of each side's unilateral efforts to neutralize the nuclear forces of the other.

The compulsion to compete quantitatively and qualitatively produced what came to be labelled arms race instability. This was an unfortunate circumstance: costly, potentially dangerous, and producing questionable gains in security while raising fears of instability. But an even larger concern arose from the repeated diplomatic confrontations between the nuclear antagonists, which raised the risk of military escalation and brought the possibility of nuclear use into view. In one collision after the next—the Korean War, Quemoy and Matsu, Berlin—nuclear weapons cast a worrisome shadow. What is generally regarded as the moment of maximum danger—namely, the Cuban Missile Crisis—came in October 1962. The incredibly intense standoff between Moscow and Washington over the Soviet Union's deployment of missiles in Cuba brought the world to the brink of nuclear war—or so it was believed—and subsequent revelations exposed dangers not fully understood at the time. This frightening near-miss highlighted the peril of nuclear crises. “Events were slipping out of their control,” commented Robert McNamara in one of his countless exhortations about the lessons of the 1962 crisis, “and it was just luck that they finally acted before they lost control, and before East and West were involved in nuclear war that would have led to destruction of nations. It was that close.”²⁶

Two large concerns were reinforced by the Cuban Missile Crisis. One was the importance of managing crises carefully and effectively; “crisis management” became almost a field unto itself—abetted by the claim that disaster had been avoided in 1962 because President Kennedy and his team had handled the affair so deftly. The other, more fundamental, concern had to

25. See, for example, Albert Carnesale and Charles Glaser, “ICBM Vulnerability: The Cures are Worse than the Disease,” *International Security* 7 (1) (Summer 1982): 70–85.

26. <https://nsarchive2.gwu.edu/coldwar/interviews/episode-11/mcnamara2.html>.

do with the problem of crisis instability—the fear that in a crisis there might exist particular temptations to strike if striking first with nuclear weapons would confer advantage, especially if each side feared that the other might strike first. Thomas Schelling warned in 1960 that even a small incentive to strike first could be magnified by this dynamic, which he called the reciprocal fear of surprise attack: “Fear that the other may be about to strike in the mistaken belief that we are about to strike gives us a motive for striking, and so justifies the other’s motive.”²⁷ This was another argument for robust deterrence: the answer to crisis instability was survivable nuclear forces that would guarantee that a surprise attack would be met with unacceptable retaliation. After Cuba, the power of this analysis was fully understood.

A school of thought emerged that suggested that the costs and dangers of the existing nuclear order could be contained and reduced if negotiated constraints could be achieved.

In sum, nuclear order in the first twenty-five years of the nuclear age took the form of unregulated competition in which the only significant constraints were budgetary and technological and in which the primary moderating force was the mutual deterrence that arose out of each side’s unilateral efforts to neutralize the nuclear forces of the other. This was a nuclear order that, as it evolved, came to be marked by massive numbers of nuclear weapons, pervasive nuclearization of military forces and doctrines, and recurrent dangerous and sometimes frightening crises. Gradually, however, a school of thought emerged that suggested that the costs and dangers of the existing nuclear order could be contained and reduced if negotiated constraints could be achieved.

Managed Rivalry, 1970–2000: Building an Architecture of Restraint

It would be incorrect to suggest that there was a magical transformation of the nuclear order, after which all was well. On the contrary, the superpower rivalry remained intense, nuclear forces remained substantial, efforts to escape the implications of mutual deterrence endured, bruising diplomatic confrontations continued, domestic controversies over nuclear policy and arms control were common, and worries about nuclear proliferation

27. Thomas C. Schelling, “The Reciprocal Fear of Surprise Attack,” in Thomas C. Schelling, *The Strategy of Conflict* (Cambridge, Mass.: Harvard University Press, 1980), 207.

persisted. After the unfettered competition of the first quarter century following World War II, though, the next several decades were an era of arms control. Starting in the late 1950s, a group of strategists began to analyze and advocate for arms control, suggesting that negotiated constraints were both feasible and desirable.²⁸ The aim, as then-Director of the International Institute for Strategic Studies (IISS) Alistair Buchan summarized, was “the stabilizing of mutual deterrence by taking both unilateral and multi-lateral action and at the same time attempting to identify and control the most dangerous features of the arms race”²⁹ Ideas and policy concerns that had been discussed for years came to fruition in the 1960s. Prompted in part by the Chinese nuclear test in October 1964, negotiations commenced in 1965 under the auspices of the United Nations for a treaty to inhibit the spread of nuclear weapons. In the same period, efforts to launch U.S.-Soviet arms control discussions were disrupted for a time, in particular by the Soviet intervention in Czechoslovakia in 1968, but the strategic arms control talks finally began in November 1969, initiating a process that would continue, with minor interruptions, more or less continuously for four decades. The processes for enhancing Lawrence Freedman’s twin pillars—nonproliferation and strategic stability—were in place.

The evolution of the nuclear order was neither smooth nor harmonious. Though the United States and the Soviet Union shared an interest in preventing nuclear proliferation and in avoiding an unwanted nuclear war, their relations were contentious and marked by distrust until very late in the Cold War period. Arms control remained controversial and outspoken skeptics criticized both the broad process and the content of specific agreements.³⁰ Nevertheless, over several decades, stretching from the late 1960s

28. The spearhead of this effort was an arms control study group at the American Academy of Arts and Sciences, which resulted in a study known as the bible of arms control. See Donald G. Brennan, ed., *Arms Control, Disarmament, and National Security* (New York: George Braziller, 1961). Also influenced by the American Academy project was Thomas C. Schelling and Morton Halperin, *Strategy and Arms Control* (New York: Twentieth Century Fund, 1961). The other arms control classic to appear in 1961 was Hedley Bull, *The Control of the Arms Race: Disarmament and Arms Control in the Missile Age* (New York: Praeger, 1961).

29. Alistair Buchan, “Foreign Comment,” in Brennan, ed., *Arms Control, Disarmament, and National Security*, 443.

30. For an excellent concise summary of the critique of arms control, which argues that the benefits were meager or nonexistent and the counterproductive effects were costly and destabilizing, see Richard N. Perle, “Good Guys, Bad Guys, and Arms Control,” in Ian Anthony and Daniel Rotfeld, eds., *A Future Arms Control Agenda* (Oxford: Oxford University Press, 2001), 43–51. For fuller examples of the anti-arms control genre, see Bruce D. Berkowitz, *Calculated Risks: A Century of Arms Control, Why it Has Failed, and How it Can Be Made to Work* (New York: Simon & Schuster, 1987); and Colin S. Gray, *House of Cards: Why Arms Control Must Fail* (Ithaca, NY: Cornell University Press, 1992).

to the late 1990s, there was the gradual construction of elaborate treaty regimes that addressed both concerns about nuclear proliferation in the multilateral arena and about nuclear rivalry in the bilateral Soviet-American arena. As Richard Haas has written in characterizing this nuclear era, “reason and caution increasingly gained the upper hand.”³¹

The tales associated with building the web of connections and constraints are long and filled with telling details, but the essential architecture of restraint rested on four main building blocks.

Preventing the Spread of Nuclear Weapons: The Nonproliferation Treaty and Regime

Somewhat miraculously, it proved possible to negotiate a legally binding multilateral treaty that acknowledged and accepted the five nuclear weapon states that existed at the time but prohibited all other signatories from building or otherwise acquiring nuclear weapons. Across time, also perhaps somewhat miraculously, nearly every state in the international system (191 member states) signed the treaty; every state that does not possess nuclear weapons (with the single exception of South Sudan) has signed a legal instrument in which they accept a binding obligation to remain non-nuclear. The Nuclear Nonproliferation Treaty entered into force in 1970 and became the legal foundation for an evolving regime of technology controls and mandated inspections of nuclear facilities aimed both at preventing the spread of weapons-related nuclear technology and at discouraging the use of civilian nuclear facilities for illicit weapons-related purposes. Adaptions in the regime often came after some undesirable development or challenge to the system. After the 1974 Indian nuclear test, for example, a Nuclear Suppliers Group (NSG) was established to harmonize export controls on sensitive nuclear technologies and to deny weapons-related technologies to potentially worrisome recipients. Similarly, after the discovery of Iraq’s illicit nuclear weapons program in 1990, the International Atomic Energy Agency (IAEA) developed a new set of information requirements and inspection measures, enumerated in a document called the Additional Protocol, that enhanced the IAEA’s access to information and its powers of inspection. In the nearly five decades since its inception, there has been considerable evolution in the NPT regime. From the beginning, there were doubts about its sufficiency and effectiveness.³² Doubts

31. Richard N. Haas, “Foreword,” in Koblenz, *Strategic Stability in the Second Nuclear Age*, vii.

32. See, famously, Albert Wohlstetter, “Spreading the Bomb without Quite Breaking the Rules,” *Foreign Policy* (25) (Winter 1976–1977), which articulates the complaint that the NPT regime allows states to come close to acquiring the bomb without violating any of its provisions.

remain even today, and the regime has been seriously tested by protracted crises involving Iran and North Korea—showing that where proliferation problems exist, they are very disruptive and troublesome and not easily addressed. Nevertheless, the unregulated order in which it was feared that nuclear weapons might spread to many states has been replaced by a nearly universal treaty that prohibits the acquisition of nuclear weapons and by an associated regime for managing and limiting the spread and use of weapons-related nuclear technology. In the 1950s and 1960s, few would have imagined that the eventual puzzle would be why there are so few nuclear-armed states nor would they have expected the emergence of a widespread norm against the acquisition of nuclear weapons.³³ The assumption that a steadily growing number of states would acquire nuclear weapons was supplanted by the belief that most states would not do so. This was a profound change in the global nuclear order.

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Severe Constraints on Missile Defenses: The ABM Treaty

Nascent missile defense programs in the United States and the Soviet Union had been both engines of the arms race and potentially destabilizing factors in the strategic equation between the superpowers, since they could contribute to first-strike options. In the early stages of the strategic arms control process, the most significant result was the 1972 ABM Treaty, of unlimited duration, that limited the two sides to two strategically insignificant missile defense sites.³⁴ Interest in and explorations of missile defense persisted (most prominently with Reagan's Strategic Defense Initiative program in the 1980s), but operational deployments were severely restricted by a permanent treaty. A 1974 protocol to the ABM Treaty reduced the number of permitted sites to one, and in 1975 the United States abandoned missile defense deployments altogether (though research and development

33. See, for example, William Potter, "The NPT & the Sources of Nuclear Restraint," *Dædalus* (Winter 2010), which seeks to explain why there are so few nuclear weapon states and argues for the impact of the nonproliferation norm.

34. The very complicated path that led to this result is detailed in James Cameron, *The Double Game: The Demise of America's First Missile Defense System and the Rise of Strategic Arms Limitation* (Oxford: Oxford University Press, 2017).

continued). Regarded as the essential foundation of strategic arms control, the ABM Treaty directly confronted offense-defense interactions as an influence on nuclear decision-making by eliminating missile defenses from the equation for the foreseeable future. This was a vast and moderating change in the character of the global nuclear order.

Limiting and Reducing Offensive Nuclear Forces: SALT, START, and Beyond

Missile defenses were only one of the factors that gave momentum to the accumulation of offensive nuclear forces. Fears of vulnerability, worries about inferiority, desires for counterforce options, and the drive for innovation and modernization were also in play. Uncertainty was a major influence: who knew how large and capable an opponent's force might be in the future, especially when current planning had to anticipate capabilities that might exist years ahead? Starting with the Strategic Arms Limitations Talks (SALT) in November 1969 and continuing through the New START agreement of April 2010, Washington and Moscow engaged in a long series of negotiations aimed at limiting strategic offensive forces.³⁵ These negotiations were typically slow and difficult. The agreements were sometimes disappointing and were frequently controversial. The process sometimes broke down or failed; ratification of the SALT II agreement, for example, was prevented by the Soviet invasion of Afghanistan in 1979.

But the aggregate impact of this process was the imposition of an evolving set of increasingly significant constraints on the size and character of nuclear forces, accompanied by a verification process that reduced the opacity of the competition. The first such agreement, the Interim Agreement on Offensive Forces of 1972, established a freeze on the number of launchers—the volcano was capped and the upward spiral in the number of delivery systems was stopped, permanently as it turned out. It is commonly presumed that arms control codified rather than caused the leveling off of the Soviet-American nuclear competition, but it is also plausible that deployments could have grown even larger in the absence of limits on offensive and defensive forces. Since 1972, however, strategic nuclear arsenals have been governed by agreed limits and hence the future size of the opposing force could be known precisely with some confidence so long as the arms control framework was expected to remain intact. The Soviet

35. For an overview of this history, see Matthew J. Ambrose, *The Control Agenda: A History of the Strategic Arms Limitation Talks* (Ithaca, NY: Cornell University Press, 2018); and James H. Lebovic, *Flawed Logics: Strategic Nuclear Arms Control from Truman to Obama* (Baltimore, Md.: Johns Hopkins University Press, 2013).

Union and the United States agreed to observe the limits of the 1979 SALT II agreement even though it was never ratified. Starting in the 1980s, strategic arms control focused on reducing numbers and constraining modernization—even though the Reagan administration was skeptical of arms control and started out with a confrontational policy toward the Soviet Union. With the signature of the START I agreement of 1991 after nearly a decade of negotiation, significant reductions had been agreed upon, limits on modernization had been achieved, extensive verification measures had been accepted, and the strategic nuclear relationship was governed by a detailed treaty, including countless pages of definitions, annexes, protocols, and agreed-upon understandings. This was a remarkable change from the reality that existed in the first twenty-five years of the nuclear age.

The aim of this protracted exercise in arms control was not only to contain the arms competition between the two superpowers—that is, the promotion of arms race stability. It was also intended to inhibit the emergence of destabilizing capabilities—thus contributing to crisis stability.

The aim of this protracted exercise in arms control was not only to contain the arms competition between the two superpowers—that is, the promotion of arms race stability. It was also intended to inhibit the emergence of destabilizing capabilities—thus contributing to crisis stability. To be sure, neither side ever really abandoned the quest for advantage or the pursuit of usable nuclear options, but the imperative to ensure the adequacy of deterrence was fundamental. Arms control was viewed as an instrument that could strengthen deterrence and prevent threats to the deterrence system from arising. As Henry Kissinger has written, “The diplomacy of arms control concentrated on limiting the composition and operating characteristics of strategic forces to reduce the incentive for surprise attack to a minimum.”³⁶

Arms Control as Management Process

Despite recurrent acrimony in U.S.-Soviet relations and occasional interruptions in negotiations, arms control talks became a form of institutionalized dialogue on nuclear issues. As Matthew Ambrose comments about SALT, for example,

36. Henry A. Kissinger, *Diplomacy* (New York: Simon and Schuster, 1994), 715.

Negotiations grew so routine that they became divorced from whatever agreement they sought to achieve next and were instead seen as a continuous process. In this process, senior policymakers on each side formulated a policy and presented and discussed these positions at formal diplomatic exchanges. These exchanges were punctuated by intermittent summit meetings by heads of state or cabinet officials. As this cycle repeated itself, policymakers primarily thought of their task as tending to the more abstract “SALT process.”³⁷

These regularized interactions became, in effect, a mechanism for the joint management of the nuclear balance. The completely uncoordinated exertions of the 1950s and 1960s were eventually replaced by the practice of regular consultation, producing periodic agreed-upon limitations on nuclear forces. Rivalry still existed and nuclear dangers did not disappear, but the era of unbridled nuclear competition and galloping acquisition of nuclear forces was brought to an end.

Post-Cold War Promise and Progress

Arms control had proven resilient enough to weather setbacks and low moments, even during the Cold War. With the end of the Cold War, there arrived a moment of extraordinary hopefulness. Instead of intense antagonism, there was now “strategic partnership” between Moscow and Washington. As the Cold War waned and then disappeared into history, what emerged was a remarkable decade-plus of arms control. This phase commenced with the dramatic Reagan-Gorbachev summit at Reykjavik in 1986, at which the two presidents discussed both the elimination of all nuclear weapons and the banning of ballistic missiles.³⁸ Though the two sides were unable to reach agreement on these unprecedentedly sweeping measures, Reykjavik represented a symbolic breakthrough to a much more ambitious era of arms control. Soon after came the 1987 Intermediate Nuclear Forces (INF) agreement that eliminated an entire class of missile. This was the beginning of a retreat from the nuclearization of everything that had been witnessed in the early decades of the nuclear age. It was followed in September 1991 by an unprecedented set of reciprocal unilateral initiatives undertaken by Presidents Bush and Gorbachev (prompted in part by the

37. Ambrose, *The Control Agenda*, introduction.

38. Reagan’s team, at least, reacted with alarm at these deliberations, which posed a mortal threat to existing Cold War nuclear structures. See, for example, the scathing account in Kenneth Adelman, *The Great Universal Embrace: Arms Summity—A Skeptic’s Account* (New York: Simon and Shuster, 1989), 19–88. At the time of the summit, Adelman was head of the U.S. Arms Control and Disarmament Agency (ACDA).

Reykjavik represented a symbolic breakthrough to a much more ambitious era of arms control.

August 1991 coup attempt against Gorbachev that raised concerns about control of nuclear weapons) that committed the two sides to eliminate, withdraw from service, or significantly reduce most categories of tactical nuclear weapons; particularly notable was the focus on removing tactical nuclear weapons from ground and conventional naval forces.³⁹ The intent and effect of these initiatives was to “radically reduce” holdings of deployed tactical nuclear weapons.⁴⁰ In December 1991, the United States initiated the Cooperative Threat Reduction program (also known as Nunn-Lugar) that involved intimate cooperation with and investment of U.S. taxpayer dollars in the Russian nuclear weapons establishment; it sought to secure facilities and weapons-usable nuclear materials to allay concerns that Russian nuclear assets might leak into illicit nuclear markets during the turbulent period after the collapse of the Soviet Union. This program was not without its difficulties and frictions, but it involved a degree of intimate nuclear collaboration that would previously have been unthinkable. In short order, the possibilities for arms control seemed to expand and the nuclear relationship was transformed by one unprecedented move after another.

In parallel, significant steps were taken in strategic arms control. After a difficult decade of on-again, off-again negotiations, the START I agreement was signed on July 31, 1991. Much the most complex of these agreements and containing elaborate verification provisions, START I called for significant reductions in the number of deployed strategic delivery systems and associated nuclear weapons. Soon thereafter, on January 3, 1993, yet another agreement—START II—was reached; it represented a further elaboration of the increasingly extensive network of negotiated constraints governing nuclear capabilities by introducing an important qualitative constraint: the banning of multiple warhead (MIRVed) missiles, which were regarded as potentially destabilizing because they expanded attack capabilities while also representing attractive targets for the other side.

This phase of hope and progress reached a crescendo in the mid-1990s, highlighted by one historic event and one dramatic vision. The historic

39. For a concise summary of the details, see “The Presidential Nuclear Initiatives (PNIs) on Tactical Nuclear Weapons at a Glance” (Washington, D.C.: Arms Control Association, July 2017), available at www.armscontrol.org.

40. Nikolai Sokov and William Potter, “The Presidential Nuclear Initiatives, 1991–1992: An Assessment of Past Performance and Future Relevance,” Policy Brief No. 21 (Tokyo, Japan: Toda Peace Institute, October 2018), 2.

event was the indefinite extension of the NPT in 1995. The treaty was coming to the end of its initial twenty-five-year duration and the 1995 NPT Review and Extension Conference would determine whether the treaty was terminated or extended, and if extended, whether for a fixed term or indefinitely. There was no guarantee that the alchemy that had permitted the negotiation of the treaty in the late 1960s would exist in 1995 and there was plenty of indication (not least at earlier NPT review conferences) of dissatisfaction with the treaty. Hence, there was great concern in the period leading up to the 1995 conference that the outcome could well be disappointing. George Bunn, one of the leading nonproliferation experts, warned, for example, that “The obstacles to securing a lengthy extension are truly formidable...”⁴¹ The United States, for its part, mounted a major diplomatic effort to gain support for a protracted renewal of the NPT, motivated by the realization that among NPT members “many are resisting an indefinite extension.”⁴² At the 1995 conference itself a number of alternatives were put forward, including renewal for a single fixed period, rolling renewal for fixed periods, and renewal made conditional on greater and more tangible progress toward nuclear disarmament by the states possessing nuclear weapons. In the end, however, on May 11, 1995, the conference agreed on the indefinite extension of the NPT, thus putting the legal foundation of the nonproliferation regime on sound permanent footing.⁴³ This was seen as a major victory: the demise of the NPT had been avoided and instead the NPT regime entered “a new era.”⁴⁴ There were still nonproliferation problems on the agenda, of course, and efforts to improve the regime continued, but with the indefinite extension of the NPT the nonproliferation pillar seemed well-entrenched. Moreover, the deliberations over the NPT gave impetus to the negotiations on nuclear testing, with non-nuclear weapon state members of the NPT pressing the nuclear-armed states to take tangible steps toward disarmament, as called for in Article VI of the NPT. The Comprehensive Test Ban Treaty (CTBT) was signed in September of 1996.

41. George Bunn, “The NPT and Options for its Extension in 1995,” *The Nonproliferation Review* (Winter 1994): 58.

42. David Ottaway and Steve Coll, “A Hard Sell for Treaty Renewal,” *The Washington Post*, April 14, 1995, which provides a concise account of the pro-NPT campaign led by U.S. Ambassador Tom Graham.

43. For a thorough account of the issues and controversies at the 1995 Review and Extension Conference, see Rebecca Johnson, “Indefinite Extension of the Nonproliferation Treaty: Risks and Reckonings,” *ACRONYM Report No. 7*, The ACRONYM Institute, September 1995.

44. The phrase is used in Tariq Rauf and Rebecca Johnson, “After the NPT’s Indefinite Extension: The Future of the Global Nonproliferation Regime,” *The Nonproliferation Review* (Fall 1995): 28.

The Clinton-Yeltsin framework envisioned not only further substantial reductions in nuclear forces, but also, for the first time, a direct focus on warheads and nuclear materials.

The landmark step in nonproliferation was soon followed by the emergence of a dramatic vision of progress in strategic arms control. At their summit in Helsinki in March of 1997, Presidents Clinton and Yeltsin agreed on a framework for the upcoming START III negotiations that went well beyond earlier agreements.⁴⁵ The Clinton-Yeltsin framework envisioned not only further substantial reductions in nuclear forces, but also, for the first time, a direct focus on warheads and nuclear materials (in contrast to earlier agreements that focused overwhelmingly on delivery systems). The negotiation was (again, for the first time) to address tactical as well as strategic nuclear weapons, and to cover delivery systems (such as sea launched cruise missiles) that had been excluded from earlier agreements. There was an emphasis on trying to achieve the irreversibility of reductions by creating a cooperative and transparent program for the dismantlement of warheads withdrawn from service and to secure and manage the nuclear materials extricated from dismantled warheads. Clinton and Yeltsin established the goal of creating a nuclear arms control regime of permanent duration. The parameters for negotiation agreed by the two presidents at the Helsinki summit aimed at nothing short of a comprehensive, cooperative, highly transparent, permanent, treaty-based regime for managing the nuclear relationship between the United States and Russia.⁴⁶ If the Reagan-Gorbachev summit at Reykjavik was, in terms of ambition, the pinnacle of Cold War arms control, the Clinton-Yeltsin summit at Helsinki was the high-water mark of post-Cold War arms control. An agreement based on the Helsinki parameters would be unprecedentedly ambitious and transformative.

In sum, a fertile dozen years, spanning the end of the Cold War and the emergence of the post-Cold War era, stretching from Reykjavik 1986 to Helsinki 1997, witnessed an impressive advance of arms control in multiple contexts. The negotiations were often contentious, forward movement was often hard-won, interests still collided, rivalries and antagonisms between

45. The Helsinki framework is spelled out in “Joint Statement of Parameters on Future Reductions in Nuclear Forces,” March 1997, available at armscontrol.org.

46. The elements of a comprehensive regime are sketched more fully in Steven E. Miller, “A Comprehensive Approach to Nuclear Arms Control,” in *Arms Control and Disarmament: A New Conceptual Approach*, DDA Occasional Paper, No. 4 (New York: UN Department of Disarmament Affairs, September 2000), 16–33.

states continued, agreements invariably attracted criticism and opposition, and policy battles were fought and sometimes lost. This is not a smooth story of steady and uninterrupted progress. Nevertheless, in aggregate, by the late 1990s, much had been achieved: an extensive, treaty-based regulatory infrastructure governed the nuclear affairs of the planet, and momentum in the direction of greater cooperation and additional constraints seemed in evidence.

The Tide Turns, 2000–2018: The Erosion of the Nuclear Order

The picture so far suggests that during the first half century of the nuclear age there was a slow and uneven but broad evolution from intense, unregulated competition to an increasingly regulated, collaboratively managed nuclear environment in which nuclear arsenals were constrained by agreement and the spread of nuclear weapons was inhibited by a negotiated regime rooted in a permanent legally binding treaty. The unregulated phase was marked by the slow but steady increase in the number of nuclear armed states, prodigious accumulations of weapons by the two main protagonists, the spread of nuclear weapons throughout the military organizations of the superpower rivals, recurrent fears of instability undermining deterrence, and frightening and risky diplomatic and military confrontations that raised risks of nuclear use. We do not have to hypothesize about what an unregulated global nuclear order—a world without arms control—might be because the first twenty-five years after the end of World War II gave us a vivid taste of that world.

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The increasingly regulated phase of this history, in contrast, gradually built a global nuclear order in which the NPT had gained almost universal acceptance, the associated regime was being slowly improved, a norm of nonproliferation was thought to exist, and the emergence of the feared nuclear-armed crowd was avoided. In parallel, the superpower arsenals were dramatically reduced in size and many types of tactical weapons were withdrawn from operational deployment, qualitative limits constrained modernization, missile defense deployments were constrained to meaningless

levels by negotiated agreement, nuclear dialogue was sustained and essentially institutionalized, and the nuclear relationship between Washington and Moscow had grown impressively and unprecedentedly cooperative. In the early post-Cold War era, with past antagonisms consigned to history and once unimaginable collaboration now possible, it seemed that the movement in the direction of a heavily regulated and jointly managed nuclear order would continue and deepen.

And then the tide turned. It is even possible to point to a moment when, arguably, events began to shift in a more troubling direction. On May 12, 1998, India conducted a set of nuclear tests that represented the commencement of an open program aimed at developing deployable nuclear weapons.⁴⁷ Within weeks, Pakistan responded with its own nuclear tests. The two big powers in South Asia were now committed to the nuclearization of their troubled and conflict-prone relationship.⁴⁸ Not since China detonated its first nuclear test in October 1964 had the nonproliferation norm been so blatantly disregarded.⁴⁹ Another reversal came the following year: in October 1999, the United States Senate voted down the CTBT and has yet to ratify the agreement to this day. This multilateral instrument, hailed as a breakthrough and seen as a point of significant progress when signed in 1996, cannot enter into force until the United States (along with some others) formally adopts the treaty; hence, the treaty remains in limbo. Whatever momentum was derived from the indefinite extension of the NPT and the signing of the CTBT was soon lost.

These setbacks in nonproliferation were accompanied in 1998 by a dramatic loss of momentum in strategic arms control. With Clinton embroiled in scandal and impeachment proceedings, Russia preoccupied with a severe domestic economic crisis, and relations between Washington and Moscow increasingly complicated by NATO enlargement, Balkan crises, and other frictions, the strategic arms control process fell off the agenda. The START III negotiations were never begun and the ambitious Helsinki framework was never converted into an actual treaty governing Russian and American nuclear forces. The 2000 presidential election in the United States brought to power an administration that regarded the inherited arms control infrastructure as

47. For a contemporaneous account, see John F. Burns, "India Sets Three Nuclear Blasts, Defying a Worldwide Ban; Tests Bring a Sharp Outcry," *The New York Times*, May 12, 1998.

48. For an assessment of the impact of the 1998 tests, see Michael Krepon, "Looking Back: The 1998 Indian and Pakistani Nuclear Tests," *Arms Control Today* (June 2008), available at www.armscontrol.org.

49. Israel's presumed nuclear weapons capability was developed covertly and has never been acknowledged by the Israeli government. South Africa's nuclear weapons were similarly secret and were eventually abandoned. Neither involved the overt pursuit of nuclear weapons.

an “obsolete relic” of the Cold War and was determined to escape the shackles imposed on American policy by arms control treaty obligations. The Bush administration was more inclined to dismantle existing arms control arrangements than to build a more extensive web of negotiated constraints.⁵⁰

Looking back two decades later, the events of 1998 look like the beginning of a long period in which difficulties, setbacks, and worrying trends outweighed occasional gains in terms of the stability and management of the global nuclear order. To be sure, the picture is not totally bleak. Two new strategic arms control agreements—the Strategic Offensive Reductions Treaty (SORT) of 2002 and the New Start Agreement of 2010—were reached with Russia; though modest compared to the ambitions of the late 1990s, these agreements preserved the negotiated nuclear relationship between Moscow and Washington. An unprecedented agreement—the Joint Comprehensive Plan of Action (JCPOA)—was put in place to constrain Iran’s nuclear program and to ease concerns about its possible acquisition of nuclear weapons (only to be renounced in 2018 by President Trump). There have been meaningful augmentations of the NPT regime, including the wide acceptance of the Additional Protocol that strengthens the safeguards system and refinements of international export controls to inhibit the spread of weapons-related nuclear technology. Nevertheless, the global nuclear order today is vastly different and more worrisome than was envisioned two decades ago. A number of trends and developments have combined to alter the trajectory of the nuclear order.

The Return of Great Power Competition

Political relations among the major powers have grown more contentious and potentially more confrontational. Most immediately, relations between the United States and Russia have grown much more toxic and have brought back into view nuclear concerns and dangers reminiscent of the Cold War—though in a very different and more difficult international context.⁵¹ The expectation that “strategic partnership” between the Unit-

50. For a detailed analysis of the change in arms control policy represented by the Bush administration, see Steven E. Miller, “Skepticism Triumphant: The Bush Administration and the Waning of Arms Control,” in Hans J. Giessmann, Roman Kuzniar, and Zdzislaw Lachowski, eds., *International Security in a Time of Change: Threats, Concepts, Institutions* (Baden-Baden: Nomos Verlagsgesellschaft, 2004), 15–40. For a sympathetic account of Bush’s arms control policy that also emphasizes its change of direction, see Christopher A. Ford, “A New Paradigm: Shattering Obsolete Thinking on Arms Control and Nonproliferation,” *Arms Control Today* (November 2008), available at www.armscontrol.org.

51. See, for example, the analysis in Robert Legvold, “The Challenges of a Multipolar Nuclear World in a Shifting International Context,” in Miller, Legvold, and Freedman, *Meeting the Challenges of the New Nuclear Age*, 28–61.

ed States and Russia would permit sustained and unprecedented nuclear cooperation has been thoroughly disappointed. At the same time, China's extraordinary growth in recent decades and its increasing power and assertiveness have dramatically raised the prominence of the relationship between China and the United States. These two states seem destined to be the primary rivals on the international scene in the decades to come and the potential for antagonism and confrontation is real—as evidenced by the bubbling debate in the United States about the likelihood of war with China.⁵² All three of these states are committed to substantial long-term nuclear modernization programs that are sure to influence one another; in the cases of the United States and Russia, they retain doctrinal inclinations that are legacies of the Cold War. The effects of competition and friction among these three can already be seen. The 2018 U.S. *Nuclear Posture Review*, for example, explicitly highlights the rise of great power competition and the growing power and assertiveness of Russia and China as key factors shaping U.S. nuclear policy and as core rationales for Washington's ambitious and extremely expensive nuclear modernization program.⁵³ Nuclear weapons are now prominent in the security policies of these states and indeed, after fading into the background after the end of the Cold War, nuclear weapons have been "relegitimized."⁵⁴ Among the most powerful nuclear-armed actors, the environment is strikingly less benign and less hopeful than was the case in 1991. This is one fundamental factor that is reshaping the global nuclear order.

Proliferation Creates Regional Nuclear Balances

The emergence of three new nuclear-armed states since 1998 has resulted in regional nuclear balances in Northeast Asia and South Asia that simply did not exist previously. The possession of nuclear weapons by a mercurial North Korean regime and the presence of nuclear weapons in the fraught and conflict-prone relations between India and Pakistan have raised a new set of risks, dangers, and potential instabilities. There is no reason to assume that regional nuclear dynamics will have the attributes that have marked the bilateral relationship between the two nuclear superpowers

52. See, for example, Graham T. Allison, *Destined for War: Can America and China Escape Thucydides's Trap?* (New York: Houghton Mifflin Harcourt, 2017).

53. U.S. Department of Defense, *Nuclear Posture Review*, February 2018, pp. 6–7.

54. The phrase is found in Nina Tannenwald, "How Strong is the Nuclear Taboo Today?" *The Washington Quarterly* 43 (3) (Fall 2018): 90.

The rise of China and the arrival of additional nuclear-armed actors has led to the multilateralization of deterrence relationships. Where once a single bilateral nuclear relationship was the primary focus, now a set of triangular relations has become increasingly salient.

and no reason to be confident that more than seven decades of superpower nuclear peace will be easily replicated in regional settings.⁵⁵

Multilateral Nuclear Dynamics

The rise of China and the arrival of additional nuclear-armed actors has led to the multilateralization of deterrence relationships. Where once a single bilateral nuclear relationship was the primary focus, now a set of triangular relations has become increasingly salient. The United States, Russia, and China will obviously be increasingly caught up in a three-way nuclear relationship. This can be seen clearly in the Trump administration's insistence that future strategic arms control depends on the participation of China, despite Beijing's emphatically declared lack of interest in such participation.⁵⁶ China is simultaneously integral to a second triangle involving India and Pakistan—a "trilemma" that has been described as "inherently unstable."⁵⁷ North Korea engages in a complicated nuclear interaction with the United States but also sits in a location where China and Russia are major players. No longer can the nuclear strategy community preoccupy itself largely with the U.S.-Russia nuclear relationship. Difficult questions are becoming unavoidable. Are past concepts and practices appropriate and effective in this new setting? Can arms control work in this multilateral environment? How can this more complex situation be handled safely?

55. On regional nuclear dynamics, see Vipin Narang, *Nuclear Strategy in the Modern Era: Regional Powers and International Conflict* (Princeton: Princeton University Press, 2014). For an imaginative fictionalized exploration of how regional instability could lead to nuclear war, see Jeffrey Lewis, *The 2020 Commission Report on the North Korean Nuclear Attacks Against the United States* (New York: Houghton Mifflin Harcourt, 2018). It is notable that important elements of John Gaddis's famous explanation of "the long peace" between the United States and the Soviet Union do not exist in regional settings. See John Lewis Gaddis, "The Long Peace: Elements of Stability in the Post-War International System," *International Security* 10 (4) (Spring 1986): 99–142.

56. See Robbie Gramer and Jack Detsch, "Trump Fixates on China as Nuclear Arms Pact Nears Expiration," *Foreign Policy*, April 29, 2020; and Robert Farley, "Will Trump's Arms Control Dreams for China Come True? Absolutely Not," *The Diplomat*, June 5, 2020.

57. Koblenz, *Strategic Stability in the Second Nuclear Age*, 30.

The Deterioration of Arms Control

While new challenges are arising, the regulatory framework is weakening, to the point that long-time arms control experts have suggested that perhaps the era of negotiated arms control is ending.⁵⁸ “If we think of the end of the cold war as a time of relative peace among the major powers,” wrote experienced arms control negotiator James Goodby in 2001, “we should ask ourselves whether arms control could survive the peace.” His plaintive answer: “Perhaps not.”⁵⁹ Much that has happened in the subsequent years has vindicated his pessimism. “Arms control,” writes Eugene Rumer, “is in trouble.”⁶⁰

One of the first, and most portentous, steps away from arms control was the U.S. withdrawal from the ABM Treaty in 2002. This step eliminated what had been regarded as the essential foundation of strategic arms control and opens up the possibility that the offense-defense dynamics feared in the earlier years of the nuclear age might resurface. Missile defense deployments remain small in scope and limited in effectiveness, so the arms race dynamics should not yet be operating powerfully. Nevertheless, there are already indications that the U.S. missile defense program is having an outsized impact on the calculations of others. On March 1, 2018, for example, Russian President Vladimir Putin gave a speech in which he explicitly identified U.S. missile defense policy as one of the driving factors behind Russia’s nuclear modernization:

Now, on to the most important defense issue. I will speak about the newest systems of Russian strategic weapons that we are creating in response to the unilateral withdrawal of the United States of America from the Anti-Ballistic Missile Treaty and the practical deployment of their missile defense systems both in the US and beyond their national borders. . . . In light of the plans to build a global anti-ballistic missile system, which are still being carried out today, all agreements signed within the framework of New START are now gradually being devaluated, because while the number of carriers and weapons is being reduced, one of the parties, namely, the US,

58. See, in particular, Alexei Arbatov, *An Unnoticed Crisis: The End of History for Nuclear Arms Control?* (Moscow: Carnegie Moscow Center, 2015); and Linton Brooks, “After the End of Bilateral Nuclear Arms Control” (Washington, D.C.: Center for Strategic and International Studies, October 24, 2017), available at nuclearnetwork.csis.org, in which Brooks predicts the imminent collapse of U.S.-Russia nuclear arms control.

59. James E. Goodby, “Major Powers and Arms Control: A US Perspective,” in Anthony and Rotfeld, eds., *A Future Arms Control Agenda*, 68.

60. Eugene Rumer, “A Farewell to Arms Control,” US-Russia Insight (Washington, D.C.: Carnegie Endowment for International Peace, April 17, 2018).

is permitting constant, uncontrolled growth of the number of anti-ballistic missiles, improving their quality, and creating new missile launching areas. If we do not do something, eventually this will result in the complete devaluation of Russia's nuclear potential.⁶¹

Putin proceeded to enumerate an array of nuclear acquisition programs, some quite long term, that he described as intended to neutralize the U.S. missile defense effort. China's concern about U.S. missile defense—especially but not only that deployed in Northeast Asia—is similarly quite visible.⁶² Chinese President Xi Jinping has said, for example, that the U.S. missile defense program is having “a severe negative impact to the global and regional strategic balance, security, and stability.”⁶³ But the problem is not limited to Russian and Chinese concerns about U.S. missile defense;

The potential for a revival of offense-defense interactions clearly exists and it may prove difficult to sustain limits at low levels on offensive forces if substantial missile defense systems are built.

Moscow and Beijing are working to develop their own missile defense capabilities that can discomfit American policy-makers.⁶⁴ The potential for a revival of offense-defense interactions clearly exists and it may prove difficult to sustain limits at low levels on offensive forces if substantial missile defense systems are built: the death of constraints on missile defense could thus undermine future efforts at constraining offensive forces.

The abandonment of the ABM Treaty had another significant consequence. On June 14, 2002—the day after the U.S. withdrawal from the

61. The text of Putin's speech can be found in “Presidential Address to the Federal Assembly,” March 1, 2018, available at <http://en.kremlin.ru/events/president/news/56957>.

62. See, as one example, Wu Riqiang, “China's Anxiety About US Missile Defense: A Solution,” *Survival* 55 (5) (October 2013): 29–52.

63. As quoted in Tong Zhao, *Narrowing the U.S.-China Gap on Missile Defense: How to Help Forestall a Nuclear Arms Race* (Washington, D.C.: Carnegie Endowment for International Peace, 2020), 6.

64. See, illustratively, Chris Riback, “Russia Missile Defense Worries US,” *Roll Call*, October 8, 2018; and Ankit Panda, “China and the United States Worry About Each Other Missile Defense Intentions—So Why Not Talk?” *The Diplomat*, March 4, 2018. For a discussion of the implications of a world of multiple national missile defense deployments, see Charles D. Ferguson and Bruce W. MacDonald, *Nuclear Dynamics in a Multiple Strategic Ballistic Missile Defense World* (Washington, D.C.: Federation of American Scientists, July 2017).

ABM Treaty took effect—Russia withdrew from the START II agreement. Moscow was unwilling to abide by START II restrictions if it was going to have to contend with U.S. missile defenses. The end of START II and its important modernization constraint meant the failure of efforts to eliminate multiple warhead missiles from the strategic calculus of the two largest nuclear-armed powers. The U.S. withdrawal from the ABM Treaty was thus a double blow to the fortunes of arms control. The long-term implications could be immense if the regulatory structure governing offensive forces continues to weaken because this represents a significant step back toward an unregulated nuclear environment.

The elimination of the ABM Treaty may be the most profound change in the arms control scene in the past two decades, but other developments compound the concern that the hard-won regulatory framework created over decades is eroding. The Cooperative Threat Reduction Program, which for two decades had facilitated deep cooperation with Russia's nuclear establishment, was terminated completely in 2012, falling victim to increasingly contentious U.S.-Russian relations.⁶⁵ The INF Agreement has been in serious jeopardy in recent years as a result of a compliance dispute triggered by new Russian systems, and also by growing U.S. interest in deploying INF in the Pacific to offset expanding Chinese capabilities. In October 2018, the Trump administration announced its intention to withdraw from the INF Agreement and on August 2, 2019, the United States formally departed the treaty.⁶⁶ In addition, having disposed of the INF Agreement, the Trump administration turned its attention to the Open Skies Treaty. Originally proposed by President Eisenhower in 1955 and signed by President George H. W. Bush in March 1992, the Open Skies Treaty promoted transparency by permitting overflights of national territory and requiring that the information gathered be shared with all signatories of the agreement. Invoking ever-present complaints about Russian compliance, Secretary of State Mike Pompeo announced in May 2020 that the United States intends to withdraw from the treaty despite the objections of NATO European allies, who continue to see value in the arrangement.⁶⁷

65. See David M. Herszenhorn, "Russia Won't Renew Pact on Weapons with U.S.," *The New York Times*, October 10, 2012.

66. See Shannon Bugos, "U.S. Completes INF Treaty Withdrawal," *Arms Control Today*, September 2019. For background on this decision, see Steven E. Miller, "Ideology Over Interests? Trump's Costly INF Decision," *Bulletin of the Atomic Scientists*, October 26, 2018; and Lara Seligman and Robbie Gramer, "What Does the Demise of the INF Treaty Mean for Nuclear Arms Control," *Foreign Policy*, August 2, 2019.

67. David E. Sanger, "Trump Will Withdraw From Open Skies Arms Control Treaty," *The New York Times*, May 21, 2020. See also Kingston Reif and Shannon Bugos, "U.S. to Withdraw from Open Skies Treaty," *Arms Control Today*, May 2020.

It is plausible that the expiration of New START will represent the end of nearly half a century of strategic arms control.

The formal withdrawal took place on November 22, 2020. Soon thereafter Russia withdrew from the treaty as well, leaving it without its two most important participants. Whether it might be possible to resurrect the treaty is unclear, given uncertainties about Russia's interests and possible difficulties in obtaining ratification from the U.S. Senate, which has developed a pronounced aversion to treaties. For now, it is one more agreement stricken from the books.

Nor is strategic arms control faring well. For some four decades, starting in the late 1960s, it was at the center of efforts to constrain nuclear capabilities and the negotiating process was a centerpiece of relations between Washington and Moscow. However, apart from a fifteen-month period at the beginning of the Obama administration, during which the New START agreement was negotiated, the strategic arms control process has grown largely dormant and the institutionalized regular dialogue on nuclear issues has disappeared. In contrast to painstakingly negotiated earlier treaties, the 2002 Moscow Treaty was a hastily negotiated two-page document whose contents were so meager and poorly drafted that it called into question the significance of the exercise. The only remaining negotiated constraint on U.S. and Russian nuclear forces, New START (2010), is a serious agreement but it too was in jeopardy. New START expired on February 5, 2021, and during the Trump administration there was no move to negotiate a follow-on agreement. New START includes a provision that allows it to be prolonged for an additional five years, but President Trump was reported to have no interest in extending it and left office without doing so.⁶⁸ Had Trump been reelected, it is possible, perhaps even likely, that New START would have been allowed to expire. For the Trump administration, that would have represented another significant move in its substantial demolition of what was left of nuclear arms control—bringing to an end nearly half a century of strategic arms control. With the coming of the Biden administration, however, American policy immediately reversed and as one of his first acts in office, Biden agreed with Moscow to extend New START, preserving the existing legal framework for five years and allowing time for negotiating a new agreement. Though the treaty has survived, no one would suggest that strategic arms control is in good health—there is little remaining of the arms control infrastructure that had been built

68. See, for example, Steven Pifer, "Order from Chaos: Don't Let New START Die" (Washington, D.C.: The Brookings Institution, February 6, 2020).

up over several decades, there is no momentum toward a new agreement, virtually nothing remains of the process that produced past agreements, arms control has been discredited in many eyes, and difficult substantive issues crowd the agenda as technologies change and the world grows more complicated. As Nikolai Sokov and William Potter observe, “The fabric of US-Russian nuclear arms reductions is unraveling.”⁶⁹ The Trump administration has accentuated this trend; it concluded in its *Nuclear Posture Review*, for example, that arms control is inappropriate in current international conditions and that “further progress is difficult to envision.”⁷⁰

U.S.-Russian nuclear arms control may be sputtering, but possibly even more striking is the fact that the world’s seven other nuclear arsenals (several of which are growing steadily) are ungoverned by any effective constraining agreement. Meanwhile, on the nonproliferation front, the emergence of three new nuclear-armed states, each working steadily to expand its nuclear arsenal, has undermined confidence in the robustness of the nonproliferation norm. The protracted and never fully resolved crises involving Iran and North Korea have raised criticism of the effectiveness of the NPT regime. Can proliferation really be held back over the long run, when it seems that determined states—with North Korea being the prime example today—can get nuclear weapons if they really want them? How long can the nonproliferation regime keep possible nuclear aspirations at bay? The record of the nuclear age so far suggests that success is possible, but doubters fear the trend cannot last. “Is Nonproliferation Dying?” asked *The Washington Quarterly* on its cover not long ago.⁷¹

In short, far from building on the arms control inheritance of past decades, the arms control frameworks governing nuclear weapons have been discarded, weakened, or jeopardized. The trend toward more extensive constraints and greater cooperation has been substantially reversed, meaning the future nuclear order may be less regulated and more competitive. How much does this matter? Arms control has never been a panacea and has not precluded either geopolitical rivalry or intensely competitive arming. Indeed, skeptics question the net value of the entire arms control

69. Sokov and Potter, “The Presidential Nuclear Initiatives, 1991–1992,” 1. Also anticipating the end of U.S.-Russian arms control is William Caplan, “Nuclear Stability in a Post-Arms Control World,” *New Perspectives in Foreign Policy*, vol. 1 (Washington, D.C.: Center for Strategic and International Studies, Fall 2017), 18–27; and Ulrich Kuhn, “Nuclear Arms Control Shaken by New Instability” (Washington, D.C.: Carnegie Endowment for International Peace, June 12, 2018).

70. On Trump administration views of arms control, see Steven E. Miller, “Nuclear Battleground: Debating the US 2018 Nuclear Posture Review,” Policy Brief No. 16 (Tokyo, Japan: Toda Peace Institute, June 2018), 11–13.

71. See *The Washington Quarterly* 36 (2) (Spring 2013).

enterprise. Brendan Green writes, for example, that strategic arms control “achieved little more than force caps at very high numbers” and dismisses Cold War arms control as “a wildly popular show about nothing.”⁷² Recognizing the limits of arms control, however, does not erase the difference between a constrained and an unconstrained nuclear environment, nor does it eliminate the contrast between a future rendered more predictable by regulation and the uncertain and potentially more disturbing futures imaginable in an unfettered environment. The notion that a competition bounded by negotiated rules is preferable to a wide open rivalry has lost much of its political and policy force, as reflected in the demise of most of the arms control architecture built up over decades of arduous negotiation. This is another dramatic change in the character of the nuclear order, and moves us back toward the dangerous world experienced in the first decades of the nuclear age.

Technological Advance Undermining Stability?

Worries that nuclear forces might become vulnerable to an opponent’s first strike have been an abiding feature of the nuclear age, notwithstanding the wide belief during the mature Cold War period that large, redundant, protected, or hidden capabilities were sufficient to produce a stable deterrent relationship.⁷³ But now technologies have emerged or are emerging that have the potential to erode, perhaps substantially, whatever stability may be thought to exist. Advances in surveillance, accuracy, lethality, artificial intelligence, and cyber capabilities could make it much more difficult to have confidence in the survivability of deterrent forces.⁷⁴ The growing

72. Green, *The Revolution that Failed*, 3–4.

73. Recent scholarship, however, suggests that (especially Soviet) forces may have been more vulnerable and deterrence more fragile than was fully appreciated at the time. See, for example, Austin Long and Brendan Rittenhouse Green, “Stalking the Secure Second Strike: Intelligence, Counterforce, and Nuclear Strategy,” *Journal of Strategic Studies* 38 (1–2) (2015): 38–73.

74. For an extensive analysis that offers disturbing conclusions, see Keir A. Lieber and Daryl G. Press, “The New Era of Counterforce: Technological Change and the Future of Nuclear Deterrence,” *International Security* 41 (4) (Spring 2017): 9–49. For a concise analysis of the issue, see “Not So MAD: Why Nuclear Stability is Under Threat,” *The Economist*, January 27, 2018. On the potential for artificial intelligence (AI) to undermine the survivability of deterrent forces by making possible rapid integration and assessment of massive amounts of data from surveillance sensors, see Edward Geist and Andrew J. Lohn, “How Might Artificial Intelligence Affect the Risk of Nuclear War?” RAND Perspectives Paper, 2018. They write, for example, “Even if AI only modestly improves the ability to integrate data about the disposition of enemy missiles, it might substantially undermine a state’s sense of security and undermine crisis stability.”

There can be no doubt that a world of more vulnerable offensive forces, more effective missile defense capable of degrading whatever offensive forces might survive a first strike, more lethal conventional forces capable of use against strategic assets, and larger worries about cyber vulnerabilities will be a more dangerous and less stable world.

transparency of military milieu, for example, could make submarines more vulnerable than in the past, thus undermining a capability that has long been regarded as a survivable guarantor of deterrence. Land-based capabilities (including mobile missiles) may become increasingly vulnerable to attack as improvements in surveillance provide precise real-time targeting information to highly effective attacking forces. Progress across an array of technologies from precision to data processing has increased the potential for making missile defense more effective. Further, technological improvements make it possible to use advanced conventional weapons against strategic targets and nuclear command and control facilities, potentially blurring the line between conventional and nuclear war and possibly creating escalatory risks and pressures in the event of conventional conflict.⁷⁵ An additional layer of potential threat and vulnerability has emerged with the advance of cyber capabilities, which raise the possibility that command and control systems can be attacked and nuclear operations can be disrupted using cyber assets.⁷⁶ How far these technological trends will go and how much they will shake confidence in deterrence is still being debated. Nuclear-armed states will be highly motivated to find countermeasures to preserve their deterrent forces. But there can be no doubt that a world of more vulnerable offensive forces, more effective missile defense capable of degrading whatever offensive forces might survive a first strike, more lethal conventional forces capable of use against strategic assets, and larger worries about cyber vulnerabilities will be a more dangerous and less stable world.

In short, over the past two decades, a confluence of multiple trends has transformed the nuclear landscape—and unfortunately, most of these trends have produced new challenges and worries.

75. For detailed exploration of one such scenario, see James M. Acton, “Escalation Through Entanglement: How the Vulnerability of Command-and-Control Systems Raises the Risks of an Inadvertent Nuclear War,” *International Security* 43 (1) (Summer 2018): 56–99.

76. See, for example, Beyza Unal and Patricia Lewis, *Cybersecurity of Nuclear Weapons Systems: Threats, Vulnerabilities and Consequences* (London: The Royal Institute of International Affairs, January 2018).

Conclusion: New Realities, New Challenges

We live in a new nuclear world—what some are now calling the third nuclear age.⁷⁷ The nuclear order of 1991 no longer exists. The optimistic and hopeful nuclear ambitions and opportunities envisioned in 1991 never became a reality. As we have seen, starting in the late 1990s there has been a significant deterioration of relations among the great powers, an erosion of arms control, violations of the nonproliferation norm, and the emergence and evolution of potentially destabilizing technologies. The broad storyline, stretching across decades, of evolution from a competitive, unregulated nuclear environment to a more cooperative, regulated environment has come to an end. Instead, as Nina Tannenwald has written, “In this emerging nuclear era, key norms that have underpinned the existing nuclear order—most crucially deterrence, non-use and nonproliferation—are under stress. . . . The global nuclear normative order is unraveling.”⁷⁸ It is far from clear where this will all lead but it is certain that the old order no longer exists.

As a result, there is a need for what Thomas Schelling described as “strategy in an era of uncertainty.” Schelling, a Nobel laureate in economics and one of the formative strategic thinkers of the nuclear age, has described the difficulty of the task:

Now we are in a different world, a world so much more complex than the world of the East-West Cold War. It took 12 years to begin to comprehend the “stability” issue after 1945, but once we got it we thought we understood it. Now the world is so much changed, so much more complicated, so multivariate, so unpredictable, involving so many nations and cultures and languages in nuclear relationships, many of them asymmetric, that it is even difficult to know how many meanings there are for “strategic stability,” or how many different kinds of such stability there may be among so many different international relationships, or what “stable deterrence” is supposed to deter in a world of proliferated weapons.⁷⁹

77. See, for example, Michal Smetana, “A Nuclear Posture Review for the Third Nuclear Age,” *The Washington Quarterly* 41 (3) (Fall 2018): 137–157. In the 1990s, it had become common to call the post–Cold War environment the second nuclear age.

78. Tannenwald, “How Strong is the Nuclear Taboo Today?” 90–91.

79. Thomas C. Schelling, “Foreword,” in Elbridge A. Colby and Michael S. Gerson, eds., *Strategic Stability: Contending Interpretations* (Carlisle, Pa.: U.S. Army War College Press, February 2013), vii–viii.

The fundamentally important question is, of course, how can we live safely in such a world? If present trends continue, we may find ourselves living in a future world marked by greater contention among the great powers, more nuclear weapons, more nuclear weapons states, less stability, and less arms control and international regulation of the world's nuclear affairs. What are the implications of living in such a world? What paths might lead in more constructive directions? How can this more complex environment be most prudently and effectively managed?

Understanding what has changed over the three decades since the end of the Cold War, and debating the implications of those changes, is an essential and necessary step in addressing such questions. In front of us are choices about force modernization, arms control, and technological advancement that will help shape the contours of the evolving nuclear order and that will determine the relative safety or danger of the future nuclear environment. Nuclear matters may have slipped out of the limelight they once occupied and large changes may have gradually occurred without attracting adequate notice, but we cannot avoid seeking to navigate safely what Robert Legvold has described as “the mounting challenges and dangers of a new and far different nuclear world.”⁸⁰

80. Legvold, “The Challenges of a Multipolar World in a Shifting International Context,” 28.

Mad Momentum Redux? The Rise and Fall of Nuclear Arms Control¹

Alexey Arbatov

In a September 1967 speech in San Francisco that attracted little notice at the time, Robert McNamara—then U.S. secretary of defense and one of the Cold War’s most formidable strategic thinkers—took note of the primacy of technological progress in determining the state’s policy-making: “There is a kind of mad momentum intrinsic to the development of all new nuclear weaponry. If a weapon system works and works well, there is strong pressure from many directions to procure and deploy the weapon out of all proportion to the prudent level required.”²

True, the enormous destructive power and technical complexity of nuclear arms had made critical political decisions hostage to the weapons’ technical characteristics. Actually with regard to nuclear war, Carl von Clausewitz’s classical postulate—that war is the continuation of politics by other means—might have been recast to say that war is the continuation of the technical characteristics of weapon systems that determine doctrines, operational plans, and the contingencies of their employment. In the same speech, McNamara pointed out that “actions—or even realistically potential actions—on each side . . . trigger reactions on the other side. It is precisely this action-reaction phenomenon that fuels the arms race.”³ He also recognized something that seldom, if ever, had been acknowledged: “If we had more accurate information about planned Soviet strategic forces, we simply would not have needed to build as large a nuclear force as we have today.”⁴

1. An earlier version of this essay was first published in *Survival* 61 (3) (June–July 2019): 7–38. Copyright © The International Institute for Strategic Studies, reprinted by permission of Taylor & Francis Ltd., on behalf of The International Institute for Strategic Studies.

2. Quoted in Robert S. McNamara, *The Essence of Security: Reflections in Office* (New York: Harper & Row, 1968), 166.

3. *Ibid.*, 58–59.

4. *Ibid.*, 58.

Coming from a top American official, these insights signified a revolution in the strategic mentality of the time. A half-century later, they remain relevant. First, McNamara proposed a conceptual breakthrough out of the “mad momentum” of the arms race: “We do not want a nuclear arms race with the Soviet Union, primarily because the action-reaction phenomenon makes it foolish and futile. . . . Both of our nations would benefit from a properly safeguarded agreement first to limit and later to reduce both our offensive and defensive strategic nuclear forces.”⁵ This prompted the start of negotiations on strategic arms between the two nuclear superpowers two years later, which would usher in forty years of diplomatic interaction between the United States and the Soviet Union (later Russia) that produced nine major treaties and agreements on nuclear forces. The quantities and aggregate destructive power of nuclear weapons were steeply reduced, the probability of nuclear war was drastically lowered, and the unprecedented transparency and predictability of nuclear forces that McNamara desired was ensured.

Second, McNamara’s ideas have contemporary relevance because legacy Cold War–era arms control is collapsing, and an uncontrolled nuclear arms race is threatening to return.

Third, the principal nuclear powers’ current generation of leaders, political elites, and military officials has an inadequate understanding of the history of the nuclear arms race and nuclear arms control, and therefore an insufficient appreciation of the dangers of the vicious circle of the arms race and the international crises it provoked. Russian President Vladimir Putin recently expressed the hope that “no new crises of the Cuban type happen in the world,” adding that “if anybody over there want it, they are welcome.”⁶

The world’s ability to muddle through the next phase of international tensions without a major crisis, and to prevent such a crisis from escalating to nuclear Armageddon, is in doubt.

Falling Dominoes

The evidence of arms-control disintegration is obvious and is nowadays broadly discussed among states, within the world’s professional community, and by the mass media. Still, the array of emerging systemic crises is worth examining.

5. *Ibid.*, 62.

6. “Putin predostereg SSHA protiv novogo Karibskogo Krizisa” [Putin Warned the United States Against a New Cuban Crisis], RIA Novosti, February 20, 2019, <https://ria.ru/20190220/1551153828.html>.

Ten years have passed since Russia and the United States have discussed any option for the START follow-on agreement—the longest pause in strategic arms talks for fifty years.

The United States' and Russia's withdrawal from the 1987 Intermediate-Range Nuclear Forces (INF) Treaty was the last turning point. Given the U.S. renunciation of the 1972 Anti-Ballistic Missile (ABM) Treaty in 2002, this removed the remaining cornerstone of the nuclear-arms-reduction regime launched by the 1991 Strategic Arms Reduction Treaty (START I). Ten years have passed since Russia and the United States have discussed any option for the START follow-on agreement—the longest pause in strategic arms talks for fifty years. Although both parties fulfilled their reduction obligations under the current New START by the February 2018 deadline (albeit with a number of reservations from Russia), and the extension has now been successfully implemented, the treaty will expire in 2026. The chances for successful negotiations on a new agreement after the abrogation of the INF Treaty, and given deep disagreements between the two parties on ballistic-missile defense (BMD) and other important issues, are bleak indeed.

Against this background of the apparent abandonment of bilateral nuclear arms control, the United States and Russia are entering a new cycle of the arms race. Unprecedentedly, it will include competition not only in offensive nuclear weaponry but also in offensive and defensive non-nuclear strategic and medium-range weapons, as well as in the development of space weapons and cyber warfare.

Russia has been modernizing its strategic triad for more than a decade, deploying and developing two new intercontinental-ballistic-missile (ICBM) systems (the SS-27 Mod 2/3 *Yars* and SS-29 *Sarmat*), one submarine-launched ballistic-missile (SLBM) system (the SS-N-32 *Bulava-30*), two heavy-bomber systems (the Tu-160M *Blackjack* and PAK DA), and long-range nuclear as well as conventional and easily convertible to nuclear air-, ground-, and sea-launched cruise missiles (the Kh 102/101 [AS-23A/B], 9M729 [SSC-8], and 3M14 [SS-N-30], respectively).

Russia is also developing and deploying a new generation of nuclear and dual-purpose weapon systems unveiled in Putin's March 1, 2018, address: the *Avangard* strategic nuclear boost-glide hypersonic system; *Poseidon* long-range, high-speed, nuclear-propelled and nuclear-armed heavy torpedoes; *Burevestnik* nuclear-powered intercontinental nuclear cruise missiles; *Kinzhal* air-launched hypersonic middle-range missiles; and a

number of other sub-strategic nuclear and dual-purpose systems.⁷ Given the demise of the INF Treaty, intermediate-range land-based *Kalibr*-type cruise missiles and hypersonic missiles may be deployed. (Indeed, the U.S. government has alleged that Russia has already deployed a ground-launched cruise missile similar to the *Kalibr* 3M14.)

The United States, for its part, is developing strategic systems for limited nuclear strikes. These include *Trident-2* SLBMs with low-yield W76-2 warheads, B61-21 variable-yield gravity bombs for heavy bombers and tactical-strike aircraft, long-range stand-off air-launched nuclear cruise missiles, and nuclear sea-based cruise missiles. The U.S. withdrawal from the INF Treaty has lent further momentum to the development of land-based medium-range cruise, ballistic, and hypersonic systems. In the longer term, beginning in the mid-2020s, the United States plans to modernize its whole strategic triad, replacing heavy bombers, ICBMs, and nuclear submarines with SLBMs.⁸

Unlike the Cold War version, the new nuclear arms race will be multilateral, involving states such as China, India, Pakistan, Israel, and North Korea as well as the United States and Russia.

Unlike the Cold War version, the new nuclear arms race will be multilateral, involving states such as China, India, Pakistan, Israel, and North Korea as well as the United States and Russia. The intensification of the arms race would undoubtedly undermine the nuclear non-proliferation regime. The review conference of the Nuclear Nonproliferation Treaty (NPT) in 2015 ended in failure, and the next conference, scheduled for 2021 due to the COVID-19 pandemic, is likely to fail as well. The nuclear-weapons states have reneged on their obligation under the NPT's Article VI to "undertake to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament." Further aggravations include the U.S. withdrawal from the 2015 multilateral nuclear deal on the Iranian atomic program, the deadlock over the concept of a zone free of weapons of mass destruction in the Middle East, and the deep split between nuclear and non-nuclear NPT

7. "Poslanie Prezidenta Federal'nomu Sobraniyu. 1 marta 2018 g." [Statement of the President of Russia to the Federal Assembly], Kremlin, March 1, 2018, <http://www.kremlin.ru/events/president/news/5695>.

8. Office of the Secretary of Defense, *Nuclear Posture Review*, February 2018, 23, <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF>.

Strategic circumstances have profoundly changed during the last fifty years, and arms control has largely failed to adapt to the changes.

states over the Treaty on the Prohibition of Nuclear Weapons approved by the UN General Assembly on July 6, 2017.⁹ The probable degradation of NPT norms will prevent the treaty from effectively addressing the challenges of the significant future growth of the world's atomic energy and trade in nuclear materials and technologies. As a consequence, the line between peaceful and military use of nuclear energy through the nuclear fuel cycle will become even blurrier.

The new cycle of the arms race among nuclear-weapons states will probably encourage a new round of nuclear proliferation: Iran and Saudi Arabia could well join the nuclear club, as could Brazil, Egypt, Japan, Nigeria, South Korea, Taiwan, and Turkey, among others. This would eventually seal the fate of the Comprehensive Nuclear-Test-Ban Treaty (CTBT), which for twenty-three years has not entered into legal force because of the refusal of the United States and several other nations to ratify it. Under the thunder of nuclear explosions, the Fissile Material Cut-Off Treaty, on which negotiations have been stalled for more than a quarter-century, will die a quiet death. Increased production of weapons-grade uranium and plutonium, and nuclear-arms proliferation in the unstable regions of the world, will sooner or later afford international terrorists with access to nuclear explosives. This could end current civilization if a war between nuclear states does not do so earlier.

McNamara must have been pleasantly surprised at the fifty years of successful nuclear arms control and non-proliferation that followed his 1967 speech. But the impending implosion of his hopes and ideas would have deeply depressed him.

The Political Roots of the Crisis

The present confrontations between Russia and the West and the United States and China are exacerbating the crises of arms control and whipping up the arms race, but the roots of the crisis run deeper. Traditional nuclear arms control emerged on the basis of a predominantly bipolar world order, a more or less symmetrical balance of power between the United States and the Soviet Union, and a relatively simple delineation between nuclear

9. Treaty on the Prohibition of Nuclear Weapons, adopted July 7, 2017, United Nations, <http://undocs.org/en/A/CONF.229/2017/8>.

and conventional weapon systems. Strategic circumstances have profoundly changed during the last fifty years, and arms control has largely failed to adapt to the changes.

The collapse of the Soviet Union accelerated the emergence of a multipolar world order. Other power centers—China and the EU globally, and India, Iran, Japan, Pakistan, Turkey, and others regionally—started playing increasingly important international roles. With few exceptions, nuclear arms control did not figure prominently in their external interests and security concepts. In addition, the transition from confrontation to cooperation among the great powers during the 1990s brought the probability of war between them close to zero. This development redirected the international security agenda to ethnic and religious conflicts, international terrorism, nuclear proliferation, and illegal arms and drugs trafficking. For a time, the unprecedented improvement in relations between Russia and the West actually encouraged monumental breakthroughs in nuclear arms control: huge Cold War-era stockpiles were reduced by roughly an order of magnitude in weapons numbers and, to an even greater extent, in aggregate destructive power.¹⁰ This was accomplished by unilateral reductions on the part of France, Russia, the United Kingdom, and the United States, and even more through the INF Treaty, START I (1991), START II (1993), the START III Framework Agreement (1997), the Strategic Offensive Reductions Treaty (SORT) in 2002, and finally New START (2010). The deeper trend over the course of these agreements was worrying, however, as the substantial achievements of 1987–1997 gave way to complacency.

Despite Moscow's regular appeals to turn the bilateral arms-reduction process into a multilateral one, occasionally joined by Washington, the other seven nuclear states declined. They have routinely asserted that Russia and the United States still possessed 90 percent of the global nuclear arsenal and called for more substantial reductions as a precondition for their participation in multilateral disarmament efforts. Some multilateral agreements were achieved: indefinite extension of the NPT (1995), the signing of the CTBT (1996), and the adoption of the Additional Protocol to the NPT, which expanded International Atomic Energy Agency (IAEA) safeguards (1997). Nevertheless, the two leading powers failed to elaborate consistent and equitable principles of multilateral nuclear-arms limitations (parity, strategic stability, national or aggregate quotas for the third nuclear-weapons states), to propose a sensible sequence by which third states could join the process, or to put forward a practical substantive agenda for

10. Calculations are based on *SIPRI Yearbook 2017: Armaments, Disarmament and International Security* (Oxford: Oxford University Press, 2017), 648–717; and *SIPRI Yearbook 1990: World Armaments and Disarmament* (Oxford: Oxford University Press, 1991), 3–51.

negotiations on classes and types of weapon systems and realistic verification methods.

In the context of ongoing proliferation of medium- and long-range ballistic and cruise missiles, the two leading powers proved unable to adapt existing arms-control treaties (in particular, this relates to the ABM and INF treaties and the New START follow-on) to the new military environment. Instead, the probable emergence of a multilateral nuclear and missile world became a convenient argument for the abrogation of such agreements. Another mistake was the common assumption that improved political and economic relations between states made arms control irrelevant. In reality, there was a large gap between merely ceasing to be enemies and becoming allies, and arms control remained useful, if not crucial, for narrowing that gap. The nuclear arms race between Russia and the United States actually stopped during the 1990s and 2000s.¹¹ But other types of technological developments tangibly affected military capabilities of states and non-state entities. As a result, traditional demarcation lines between nuclear and conventional arms, offensive and defensive weapons, and global and regional systems were eroded.

The effective hiatus of aggressive arms control after 1997, and still more after 2010, has led to the wholesale disintegration of the arms-control system and the beginning of a new cycle of the arms race.

When START I was about to expire in 2009, it fell to the Barack Obama and Dmitry Medvedev administrations to hastily work out New START (the Prague Treaty), which effectively legalized the strategic nuclear force levels set by SORT seven years earlier. Having been a useful stopgap measure, the treaty failed to address new weapons developments and was quite relaxed in its traditional limits, including the counting rules and verification regime.¹²

11. Examples of small-scale and slow remaining modernization programs of the time are the United States' refitting its missile submarines with Trident-2 instead of Trident-1 missiles, and Russian deployment of the SS-25 Topol ground-mobile ICBM as a replacement for older ICBMs, SLBMs, strategic submarines, and bombers.

12. SORT in 2002 fixed ceilings of 1,700–2,200 warheads per party, while New START reduced them to 1,550 warheads in 2010. However, its new counting rules provided substantial "discounts." For example, strategic bombers counted as one delivery vehicle and one warhead, while each could carry 12–20 nuclear cruise missiles and gravity bombs. Submarines in overhaul and other de-alerted weapons were not counted under the main ceilings. Hence, the actual force loading by the START I counting rules is closer to 2,000 warheads per party.

There has been no material progress since. The effective hiatus of aggressive arms control after 1997, and still more after 2010, has led to the wholesale disintegration of the arms-control system and the beginning of a new cycle of the arms race.

New long-range, precision-guided offensive arms are degrading the nuclear threshold.

Technological Drivers of Disintegration

Trends in military technology have been blurring the fundamental arms-control delineation between nuclear and conventional offensive systems. The development of high-precision, long-range non-nuclear air- and sea-launched cruise missiles relying on advanced electronics and command-control and information systems, increasingly based in space, have been especially consequential. Such weapons were effectively demonstrated in the wars in Iraq (1990, 2003), Kosovo (1999), Libya (2011), and Syria (2014–2018).¹³ New long-range, precision-guided offensive arms are degrading the nuclear threshold in several ways. First, most of them are using dual-purpose delivery systems such that the other side would not know whether it was under conventional or nuclear attack before actual explosive impact.¹⁴ Second, many of the weapons are able to hit the nuclear forces and command-and-control information systems of the opponent, potentially prompting nuclear retaliation or pre-emption. The threats posed by U.S. long-range cruise missiles to Russian strategic missiles may be exaggerated, as Russia's silo launchers and underground command centers are super-hardened.¹⁵ The fact remains that the American weapons can hit early-warning radars, light shelters for mobile ICBMs, missile submarines

13. This applies to U.S. systems such as the Tomahawk sea-launched cruise missile (BGM-109) and air-launched cruise missiles (AGM-84, AGM-158B JASSM-ER). Russian non-nuclear cruise missiles are the Kalibr 3M-54 and 3M-14 sea-launched cruise missiles, and the Kh-55SM, Kh-555, and Kh-101-type air-launched cruise missiles.

14. These are heavy and medium bombers, tactical-strike aircraft, ships, and attack submarines with missiles capable of carrying both nuclear and conventional warheads: the Kalibr and Tomahawk sea-based cruise missiles (some of which will again be armed with nuclear warheads), air-launched cruise missiles of the Kh101/102 type or the AGM-158, and Iskander-type ground-launched tactical ballistic and cruise missiles.

15. Alexey Arbatov and Vladimir Dvorkin, eds., *Nuclear Proliferation: New Technologies, Weapons, Treaties* (Moscow: Carnegie Moscow Center, 2009), 85–103; and Alexey Arbatov, Vladimir Dvorkin, and Natalia Bubnova, eds., *Missile Defense: Confrontation and Cooperation* (Moscow: Carnegie Moscow Center, 2013), 183–225.

at bases and heavy bombers at airfields, as well as command-and-control and communications sites that are not hardened.

A much larger potential threat to strategic targets may come from prospective boost-glide weapons. The United States has been developing and testing several systems of this type.¹⁶ Recently, Russia overtook the United States with its analogue, called the *Avangard*, and in 2019 started deploying it on modified SS-19-X-Mod4 ICBMs and later possibly on new heavy SS-29 ICBMs (*Sarmat*), which are to replace SS-18 (*Satan*) missiles.¹⁷ The United States and Russia are not the only countries to develop high-precision long-range conventional (including boost-glide hypersonic) weapons. China is working on its project at an accelerated pace, India is developing these weapons as well, and other countries are likely to follow.

The concepts and systems for limited nuclear strikes (“tailored options”) are also blurring the nuclear-conventional threshold. The United States is apparently associating such options with strategic/tactical gravity bombs (B61-21), W76-2 low-yield warheads for a portion of its *Trident-2* SLBMs, the nuclear long-range air-launched cruise-missile system, and new medium-range sea-based (nuclear) cruise-missile systems.¹⁸ Russia is vaguer on the notion of limited nuclear warfare, but some unofficial sources relate it to nuclear platforms, such as the boost-glide *Avangard* and various sub-strategic systems.¹⁹

Another avenue of technical development is dissolving the border separating defense and offense. In 2007, the United States initiated deployment of a global missile-defense system with regional segments in the Euro-Atlantic and the Pacific. Over Russia’s objections, the United States refused to develop a joint system, or to accept binding obligations not to calibrate its missile-defense system to intercept Russian missiles. Starting in 2011, Russia initiated an air-space defense program that includes missile defense.²⁰ Some senior Russian military and military-industrial authorities

16. James M. Acton, *Silver Bullet? Asking the Right Questions About Conventional Prompt Global Strike* (Washington, D.C.: Carnegie Endowment for International Peace, 2013), 33–63, <http://carnegieendowment.org/2013/09/03/silver-bullet-asking-right-questions-about-conventional-prompt-global-strike-pub-52778>.

17. “Statement of the President of Russia to the Federal Assembly.”

18. *Nuclear Posture Review*, xii.

19. See N. Boitzov, “Terminologija v Voennoi Doktrine” [Terminology in the Military Doctrine], *Nezavisimoe voennoe obozrenie*, no. 40, October 3, 2014; and D. Akhmerov and M. Valeev, “Aerostat–Drug ‘Sarmata’” [Balloon–A Friend of ‘Sarmat’], *Voенno–Promyshlennyi Kur’er*, no. 39, October 12–18, 2016, 6, available at <http://www.vpk.news.ru>.

20. “Expanded Meeting of the Defense Ministry Board,” Kremlin, December 19, 2014, <http://eng.kremlin.ru/transcripts/23410>.

have indicated that the U.S. system's defensive capability against Russian strategic forces is negligible because the Russian ICBMs and SLBMs are sufficiently numerous, survivable, and equipped with effective BMD penetration aids.²¹ Many Russian and American defense and security experts share this view.²² Nevertheless, Russia's political leadership has continued to insist that U.S. BMD is undercutting Russian nuclear deterrence and bilateral strategic stability. While such claims are to a significant degree politically motivated, the open-ended nature of the U.S. BMD program and an American rejection of any technical or strategic limitations or predictability regime for that program could raise legitimate strategic concerns.

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The upshot is that new U.S. defensive programs are conceptually erasing the strategic demarcation that McNamara established between “offensive” BMD (intended to negate an opponent's second-strike capability) and “defensive” BMD (intended to protect strategic retaliatory forces against a disarming strike, or defend against a third nuclear state's attack).²³ This line is also being weakened at the operational level. For Russia, the U.S. *Aegis* and *Aegis Ashore* BMD Standard-3 (SM-3) interceptor launchers on ships, and at land bases in Romania and Poland, are indistinguishable from the universal Mk-41 launchers for ship-based *Tomahawk* cruise missiles. Hence, Russia is able to claim that the United States is in violation of the INF Treaty, which prohibited deployment of land-based, long-range cruise missiles and their launchers.

The development of BMD systems with anti-satellite capabilities is also destabilizing. In the United States, the most advanced system of this class is a modified version of the *Aegis* Mk7 naval anti-missile/anti-satellite system equipped with SM-3 missiles and a self-guided kinetic warhead, tested

21. Ibid.

22. Vladimir Dvorkin and Vladimir Pyriev, “The US/NATO Program and Strategic Stability,” in Arbatov, Dvorkin, and Bubnova, eds., *Missile Defense*, 183–203.

23. McNamara, *The Essence of Security*, 63–66.

against a satellite in 2008.²⁴ Russia envisions anti-satellite capability for the S-500 surface-to-air missile complexes, as well as for the long-range kinetic-kill *Nudol* missile interceptor (an analogue of the U.S. ground-based interceptor system in Alaska and California) for the new A-235 Moscow BMD system.²⁵ China has also joined the anti-satellite arms race, having tested its system in 2008, and India conducted its first test in 2019. Talks between Moscow and Washington on space weapons were conducted in the late 1970s and 1980s and in a multilateral format in the 2000s but failed. Substantial dialogue on cyber-warfare capabilities, which will have an undoubted but as yet unclear effect on strategic stability, has not developed further than preliminary consultations.

Yet another victim of technological developments is the delineation between global and regional offensive and defensive weapons. This has never been ironclad—recall the Cold War debates about Soviet missiles in Cuba, and American forward-based missiles and strike aircraft—but now is creating growing strategic problems. U.S. regional BMD in Europe and in Asia, aimed at Iranian and North Korean missiles, is perceived in Russia and China as intended to intercept their strategic ICBMs and SLBMs at boost phase, thus degrading their respective deterrents. Accordingly, the two powers are developing a range of missile systems to penetrate these defenses. The United States is planning to counter these programs with new nuclear arms of its own, as proclaimed in the U.S. Department of Defense’s *Nuclear Posture Review* of 2018.

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Russia and China perceive the United States’ employment of long-range, precision-guided conventional systems (subsonic and, in the future, hypersonic) against hostile regional states and terrorists as implicitly threatening non-nuclear counterforce strikes. Russia is countering with its air-space defense and long-range dual-purpose offense programs, China

24. Vladimir Dvorkin, “Space Weapons Programs,” in Alexey Arbatov and Vladimir Dvorkin, eds., *Outer Space: Weapons, Diplomacy, and Security* (Washington, D.C.: Carnegie Endowment for International Peace, 2010), 30–45.

25. A. Mardasov, “‘Nudol’: Ubiitza Amerikanskich MBR i Sputnikov” [‘Nudol’: A Killer of the US ICBMs and Satellites], *Free Press*, <http://svpressa.ru/war21/article/174898/>.

Another victim of technological developments is the delineation between global and regional offensive and defensive weapons.

with analogous conventional offensive systems. The U.S. *Nuclear Posture Review* interpreted these measures as new threats, to be deterred by, among other means, threatened nuclear retaliation.²⁶

Russia's concern about third states' medium-range missiles in Asia within reach of its territory has prompted its criticism of the 1987 INF Treaty at a high official level, since it bans only Russian and American weapons of that variety.²⁷ In 2018, Washington echoed this argument, claiming the right to deploy medium-range missiles to counter comparable Chinese weapons. Against that political background, mutual accusations of treaty violations gained momentum and contributed to its collapse.

In light of the growing impact of such systems on strategic stability, leaving them out of arms-control agreements would diminish the effects of nuclear disarmament. Including such weapons in agreements would create tough problems in terms of definitions, counting rules, and verification, all the more so given that conventional systems have been and most probably will be extensively used by the United States, Russia, and other powers in local military operations.

A sharp turn in global politics dealt an especially devastating blow to the nuclear arms-control system. After 2012, Moscow embarked on strengthening Russia's control of the post-Soviet space (Georgia, Ukraine) and its projection of force beyond it (Syria, Venezuela), modernizing its conventional forces, and energizing the implementation of a nuclear modernization program that had begun earlier. In response, the United States and its allies imposed economic sanctions and revived the strategy of isolation, containment, and arms build-up against Moscow. A fierce propaganda fight broke out, amped up by hacker sabotage operations. Military competition between Russia and the United States intensified in Eastern Europe, the Baltic and Black Sea areas, and the Arctic and Asia-Pacific regions.

26. *Nuclear Posture Review*, 21.

27. Meeting of the Valdai International Discussion Club, Kremlin, <http://news.kremlin.ru/news/19243>; and "INF Treaty Can't Last Endlessly, Ivanov Said," RIA Novosti, http://ria.ru/defense_safety/20130621/945019919.html.

Lessons of the Cold War Arms Race

The expectation at the top level of the Harry Truman administration was that it would take a generation or more for the Soviet Union to break the U.S. nuclear monopoly established at the end of the Second World War.²⁸ With some help from espionage, however, it happened only four years later. The U.S. attempt to restore its preponderance with a thermonuclear-weapon test at the Pacific Eniwetok Atoll on October 31, 1952, was thwarted even sooner—by the Soviet hydrogen-bomb test on August 12, 1953. As Daniel Ellsberg, once one of McNamara’s “whiz kids,” has noted, during the ensuing decades the crash production of fission and then fusion nuclear weapons went on, apparently without any rational justification. The United States was simply matching growing production rates with an ever-expanding target list, while the Soviet Union was just catching up.²⁹ This course produced insane levels of destructive overkill on both sides.

The United States’ plan for the actual use of nuclear weapons, set out in the Strategic Air Command’s first Single Integrated Operational Plan (SIOP-62), called for quickly following any armed conflict with the Soviet Union with massive airstrikes, conducted by 1,850 heavy and medium bombers, that would drop 4,700 atomic and hydrogen bombs on cities and military installations across the Soviet Union, China, and their allies.³⁰ The Pentagon’s estimates were that this attack would have resulted in 800 million casualties in the targeted and adjacent neutral countries.³¹ That amounted to approximately one-third of the global population at the time.

The U.S. nuclear build-up peaked around 1965 at about 34,600 warheads, and by the end of the 1980s this had declined to 24,700 weapons. The Soviet stockpile was consistently rising and, according to the highest available assessment, reached a plateau of 46,100 warheads by the end of the 1980s. The cumulative destructive power of the U.S. arsenal was at its maximum of 19,000 megatons in 1960, while that of the Soviet Union peaked at 19,700 megatons in 1975. Taken together, the two superpowers accumulated the maximum destruction potential of 26,000 megatons

28. Daniel Ellsberg, *The Doomsday Machine: Confessions of a Nuclear War Planner* (New York: Bloomsbury, 2017), 266–268.

29. *Ibid.*, 270.

30. Fred Kaplan, *The Wizards of Armageddon* (New York: Simon & Schuster, 1983), 269.

31. Ellsberg, *The Doomsday Machine*, 100–104.

(equivalent to 1.3m Hiroshima bombs) in 1973–1974.³² William Perry, U.S. secretary of defense in 1993–1996, wrote in 2015:

When I look back on those years, I see a historically all-too-familiar irrational, impassioned thinking that . . . drove the frenzied debates on nuclear strategy, drove the huge additions in destructiveness we made to our nuclear forces, and brought us to the brink of blundering into a nuclear war . . . Even before the nuclear arms buildups of the 1970s and 1980s, our nuclear forces were more than enough to blow up the world. Yet we obsessively claimed inadequacies in our nuclear forces. We fantasized about a “window of vulnerability.” Both governments—ours and that of the Soviet Union—spread fear among our peoples. We acted as if the world had not changed with the emergence of the nuclear age, the age in which the world changed as never before.³³

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The rivalry of the two superpowers in new nuclear-delivery vehicles had four distinct but overlapping rounds. In the late 1940s and 1950s, it involved bombers and medium-range missiles; in the 1960s and early 1970s, strategic land- and sea-based ballistic missiles; in the 1970s and early 1980s, ballistic missiles with multiple individually targeted re-entry vehicles (MIRVs); and in the 1980s, medium-range cruise missiles and strategic ballistic missiles with enhanced hard-target kill capability (that is, against hardened ICBM silo launchers and command centers). Until the end of the 1980s, arms-race cycles went through intensive build-ups of new generations of delivery systems that fully or partially replaced the preceding ones.

Various weapon systems affected the probability of nuclear war in different ways. Some, such as sea-based long-range ballistic missiles and ICBMs in hardened silos and on ground-mobile launchers, lowered that probability insofar as they provided for survivable retaliatory capability. Others, such as ICBMs and SLBMs with enhanced counterforce (that is, disarming-strike)

32. Thomas B. Cochran, William M. Arkin, and Milton M. Hoeing, *Nuclear Weapons Data-book: Vol. IV—Soviet Nuclear Weapons* (New York: Harper & Row, 1989), 22–27, 42–43.

33. William Perry, *My Journey at the Nuclear Brink* (Palo Alto, Calif.: Stanford University Press, 2015), 55.

McNamara recognized the crowning irony of nuclear weapons: While thermonuclear power is almost inconceivably awesome and represents virtually unlimited potential destructiveness, it has proven to be a limited diplomatic instrument.

capability, increased the threat of first strike or preemption. McNamara in San Francisco nonetheless recognized the crowning irony of nuclear weapons:

While thermonuclear power is almost inconceivably awesome and represents virtually unlimited potential destructiveness, it has proven to be a limited diplomatic instrument . . . There is a strong psychological tendency to regard superior nuclear forces as a simple and unfailling solution to security . . . What must be understood is that our nuclear strategic forces play a vital and absolutely necessary role in our security and that of our allies, but it is an intrinsically limited role.³⁴

McNamara's paradox is the fundamental lesson of the seventy-year nuclear arms race. Just two or three decades ago, in the late 1980s and 1990s, the notion was commonly accepted in the Euro-Atlantic and post-Soviet political and strategic communities, but now is increasingly questioned. Although today the number and megatonnage of the weapons in the U.S. and Russian arsenals are many times lower than they were in McNamara's time, the current nuclear balance still reflects massive overkill: about 1,600 megatons, or some 80,000 Hiroshimas.³⁵ Furthermore, modern nations have far lower tolerances for war casualties and face considerably greater economic and social fragility than they did during the Cold War. Even though societies are weaker and more risk-averse, the United States and Russia consider their existing destructive potentials insufficient for effective deterrence. Thus, policy-makers do not appear to have learned McNamara's lesson. They seem more focused on technological breakthroughs for the sake of gaining a decisive theoretical military advantage than on actual improvements in national and international security by enhancing arms-control systems and regimes.

The history of the nuclear arms race is full of examples of initial strategic breakthroughs that have led to serious damage to national security. Having been the first to create nuclear weapons, the United States assumed it would enjoy long-term world dominance. At the time, this implied using the nuclear threat to contain Joseph Stalin's communist expansion

34. McNamara, *The Essence of Security*, 59–60.

35. K. Sivkov, "Razoruzhen i ochen' opasen" [Disarmed and Very Dangerous], *Voenno-Promyshlennyi Kur'er*, no. 11, March 22–28, 2017, 1–4.

and, if necessary, dropping atomic bombs on major Soviet cities. As John Newhouse has recounted, after warily considering the so-called “Baruch Plan”—which called for the transfer of atomic weapons and technology to the IAEA, a UN body—in 1946, the Truman administration adopted an “anti-Soviet line . . . combined with a conviction that Soviet science would always lag well behind America’s, whose security . . . must lie in doing whatever it took to preserve a long lead in advanced weapons over the enemy.”³⁶

Only three years later, of course, the United States lost its nuclear monopoly and in another ten years—after Soviet development of long-range bombers and ICBMs—the United States was once and forever deprived of its traditional invulnerability to conflicts and wars sourced beyond the two oceans that surrounded its territory. Thirty years after Hiroshima, the People’s Republic of China could target the United States with nuclear missiles, and in another fifty years North Korea could do so. The creation of the atomic bomb may have been inevitable. But clearly Truman and other American officials of his time did not foresee the long-term outcome of the nuclear arms race and proliferation, and had they done so they would have been horrified.

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A less dramatic but still instructive example is the U.S. initiative in the deployment of MIRVed sea- and land-based strategic missiles. The United States began to develop them in the mid-1960s to trump any robust ABM defense that the Soviets might deploy in the future. In 1969, however, the U.S.–Soviet Strategic Arms Limitation Talks (SALT) generated the prospect of stringent mutual limits on ABM systems, which materialized with the ABM Treaty in 1972. Once that treaty came into view, there was no longer any urgent need to deploy MIRVed missiles. But McNamara’s successors proceeded with the deployment of MIRVed *Minuteman-3* ICBMs in 1970 and *Poseidon* SLBMs in 1971 in order to gain superiority over the Soviet Union in nuclear warheads after missile launchers had been limited by the SALT I agreement. This move was seen as enabling the expansion of the United States’ target list in the Soviet Union and returning to a counterforce strategy (that is, attacking the strategic military forces of the opponent), which was officially declared in 1974 with the “retargeting doctrine” of Secretary

36. John Newhouse, *War and Peace in the Nuclear Age* (New York: Alfred A. Knopf, 1989), 69.

of Defense James Schlesinger.³⁷ Once again, Washington was establishing a lead in advanced military technology. And once again, the other side caught up swiftly, deploying one new MIRVed SLBM and three MIRVed ICBM systems. In the late 1970s, this provoked a panic in the United States with respect to the “window of vulnerability” of its land-based missile force that cast fatal doubt on the SALT II Treaty and lasted throughout the 1980s.

A more recent and revealingly analogous case involves conventional high-precision, long-range systems. Initially, the technology was incorporated into dual-purpose air-launched cruise missiles (ALCMs) and sea-launched *Tomahawk* cruise missiles (SLCMs), developed and deployed by the United States starting in the mid-1970s. The Soviet Union followed suit in the early 1980s, but, due to inadequate guidance systems, only with missiles carrying nuclear warheads. American conventional SLCMs were mass-produced and extensively used in local conflicts, but eventually were integrated into the U.S. strategic doctrine and began to affect the nuclear balance as an instrument of “conventional deterrence” against nuclear opponents—namely, Russia and China.³⁸ In this area, American superiority continued for much longer—about thirty years—but eventually Russia caught up, and by 2010 started mass production of conventional precision-guided SLCMs (the Kalibr 3M14 [SS-N-30A] and ALCMs [Kh-555 AS-22 and Kh-101 AS-23A]). Their number by 2018 increased thirty-fold, and they were effectively demonstrated in Syria after 2015.³⁹ Current Russian military doctrine postulates: “In the context of implementing the missions of strategic deterrence by use of force the Russian Federation envisions employment of high precision weapons.”⁴⁰

In the meantime, since old cruise missiles are subsonic, with long flight times and limited range, the United States initiated a program dubbed “prompt conventional global strike” to develop boost-glide weapons capable of hitting any target in the world with precision-guided conventional warheads within sixty minutes after launch.⁴¹ Supposedly, such arms were

37. See Ronald L. Tammen, *MIRV and the Arms Race* (New York: Praeger, 1973), 114; and “Third Annual Report to the Congress on United States Foreign Policy,” February 9, 1972, in *Public Papers of the Presidents of the United States, Richard M. Nixon, 1972* (Washington, D.C.: U.S. Government Printing Office, 1974), 307.

38. Robert Einhorn and Steven Pifer, *Meeting U.S. Deterrence Requirements: Toward a Sustainable National Consensus* (Washington, D.C.: Brookings Institution, 2017), https://www.brookings.edu/wp-content/uploads/2017/09/fp_20170920_deterrence_report.pdf.

39. “Statement of the President of Russia to the Federal Assembly.”

40. Kremlin, “The Military Doctrine of the Russian Federation,” <http://news.kremlin.ru/media/events/files/41d527556bec8deb3530.pdf>.

41. See Acton, *Silver Bullet?*

Speaking at the Valdai Discussion Club in 2015, Putin said: “A strategy already exists for a so-called first disarming strike, including with the use of long-range, high-precision non-nuclear weapons, the effect of which may be compared to that of nuclear arms.”

intended to counter terrorists and rogue states, but Moscow, keeping in mind the U.S. concept of strategic “conventional deterrence,” suspected that this qualitatively new American capability would also be a strategic threat to Russia. Speaking at the Valdai Discussion Club in 2015, Putin said: “A strategy already exists for a so-called first disarming strike, including with the use of long-range, high-precision non-nuclear weapons, the effect of which may be compared to that of nuclear arms.”⁴²

In tests of boost-glide systems in 2010–2011, the United States seemed to take the lead over Russia. By 2018, however, Russia conducted a series of successful tests of the boost-glide *Avangard* system and commenced deployment of two missile regiments in 2019. Obviously impressed by Russian advances in cruise missiles and hypersonic systems, the Pentagon, in the 2018 *Nuclear Posture Review*, for the first time officially expressed concern over this threat: “Extreme circumstances could include significant non-nuclear attacks. Significant non-nuclear strategic attacks include, but are not limited to, attacks on the US, allied, or partner civilian population or infrastructure, and attacks on US or allied nuclear forces, their command and control, or warning and attack assessment capabilities.”⁴³ It is uncertain whether *Avangard* gliders carry nuclear or conventional warheads, whether they can be MIRVed, whether their accuracy is sufficient for non-nuclear strikes, and whether Russia will keep its advantage in boost-glide hypersonic systems for a sustained period. But an emerging U.S. vulnerability to conventional missile attacks would represent a major strategic shift.

The Soviet Union also experienced comparable “boomerang effects” of the arms race. Its launch of the first artificial satellite *Sputnik* in 1957 demonstrated its primacy in space and intercontinental-missile technology. Prompted by Soviet leader Nikita Khrushchev’s bravado (“we are forging missiles like sausages” and “we will bury you”), John F. Kennedy campaigned in part on the existence of a “missile gap” favoring the Soviet

42. Meeting of the Valdai International Discussion Club, President of Russia, October 22, 2015, <http://en.kremlin.ru/events/president/news/50548>.

43. *Nuclear Posture Review*, 21.

Union (it turned out to be illusory), and was obliged to initiate a crash missile build-up.⁴⁴ From 1961 to 1967, the United States' strategic-missile force increased forty times over and achieved a 4:1 superiority over the Soviet Union's force.⁴⁵ Khrushchev's desperate attempt in 1962 to curtail the United States' growing superiority by deploying medium-range missiles to Cuba provoked a crisis in which only sheer luck and some timely political acumen saved the world from catastrophe. The crisis ended with Moscow's withdrawal of the missiles and, while American officials had confidentially indicated to their Soviet counterparts that the United States would remove medium-range nuclear missiles from Turkey at a later date, Moscow's international humiliation. Khrushchev's successors invested immense resources to close a missile gap they now perceived to favor the United States and thus achieve strategic parity in the 1970s.

The Soviet BMD program in the mid-1960s incentivized the development of the American MIRVed systems, leading to two massive and costly arms-race cycles in the 1970s and 1980s.

Another example was the development of BMD systems. The Soviet Union made an early start in 1953 and initially got ahead of the United States, achieving the first successful intercept of a medium-range missile in 1961.⁴⁶ Once again, Khrushchev could not refrain from reckless boasting: "We can without missing hit a fly in the outer space."⁴⁷ But the American BMD program, started in 1958, had outpaced the Soviet one by 1963. Since the late 1960s, American BMD programs—the *Safeguard* system from 1969–1972, Reagan's Strategic Defense Initiative (SDI, or "Star Wars") after 1983, and European BMD since 2007—have plagued Moscow. As noted, the Soviet BMD program in the mid-1960s incentivized the development of the American MIRVed systems, leading to two massive and costly arms-race cycles in the 1970s and 1980s involving fivefold increases in strategic-warhead numbers and the destabilization of the nuclear balance.

44. L. Glazkova, *Mozhet li povtorit'sya Karibskii krizis?* [Can the Cuban Crisis Be Repeated?], <https://www.pnp.ru/politics/mozhet-li-povtoritsya-novyy-karibskiy-krizis.html>.

45. McNamara, *The Essence of Security*, 57.

46. Pavel Podvig, "The Development of Soviet and Russian Ballistic Missile Defense in the 20th Century," in Arbatov, Dvorkin, and Bubnova, eds., *Missile Defense*, 33–51.

47. Cited by A. Kislyakov, PRO "'Verbu,' Mukhu, 'Kaktus' i 'Krota'" [ABM, 'Verba', Mukha, 'Kaktus', and 'Krota'], RIA Novosti, <https://ria.ru/20071217/92808803.html>.

Perhaps the most striking example was the deployment of the Soviet RSD-10 *Pioneer* (SS-20) land-based, intermediate-range ballistic missiles (IRBMs), which started in 1976. Allegedly, it was designed to replace obsolete SS-4 and SS-5 missiles and maintain regional balance vis-à-vis U.S. forward-based nuclear-attack aircraft and French and British nuclear forces. In reality, the Soviet deployment was hugely excessive, reflecting the absence of any rational civilian control over the military-industrial complex. The total number of SS-4 and SS-5 missiles was about 700, but the new ground-mobile SS-20 IRBMs were MIRVed, and constituted a radical qualitative improvement and manifold build-up of nuclear forces in terms of aggregate warheads.⁴⁸ As revealed later, the planned total deployment of missiles of this type was 650, of which two-thirds were to be located in Europe and one-third in Asia. Of those, 405 (carrying 1,215 warheads in total) were already deployed by 1987.

Responding in 1979, the United States and NATO decided to bring 108 *Pershing-2* IRBMs and 464 BGM-109G U.S. ground-launched cruise missiles to Europe. According to Oleg Grinevsky, a patriarch of Soviet diplomacy, the Soviet Foreign Ministry (in particular, Deputy Minister Georgy Kornienko) timidly proposed stopping or limiting the SS-20 build-up so as to preclude the U.S. deployment. But Marshal Dmitry Ustinov, the defense minister, and Marshal Nikolay Ogarkov, head of the General Staff, consolidating the hardline position of the Communist Party Politburo under Yuri Andropov, flatly refused.⁴⁹ The U.S. deployment started in 1983, and led to a second dangerous crisis in superpower relations and a breakdown of arms-control negotiations in Geneva. But Moscow's view of the situation soon changed dramatically: while Soviet missiles could not reach American territory, those of the United States could easily cover all of the Soviet Union's European territory. Worse still, as seen from the Kremlin, *Pershing-2* missiles were capable of striking targets with high-precision, ground-penetrating warheads and, in an ominously short (seven-minute) flight time, destroying hardened underground national command centers. Furthermore, ground-launched cruise missiles, with their low trajectory, could not be tracked by radars and therefore afforded almost zero warning time—and, according to Soviet military estimates, might destroy up to 65 percent of other military and civilian targets across the European part of the Soviet Union.⁵⁰

48. O. Grinevskiy, *Perelom. Ot Brezhneva k Gorbachevu* [The Turning Point: From Brezhnev to Gorbachev] (Moscow: Olimpia, 2004), 13.

49. *Ibid.*, 18–23.

50. *Ibid.*, 23.

The upshot was that Moscow's attempt to redress the theatre nuclear balance with NATO turned into a major blunder that deeply undercut its security. As a matter of damage control, Mikhail Gorbachev, the new Soviet leader, in 1987 was compelled to agree to the INF Treaty, based on the principle of "double global zero." It effectively required the elimination of 1,846 Soviet medium- and shorter-range deployed and reserve missiles—1,000 missiles more than corresponding U.S. missile cuts and covering three times as many nuclear warheads. The medium-range-missile saga of the 1980s is of particular relevance with the collapse of the INF Treaty.

Ignoring the Lessons

Vasily Klyuchevsky, a Russian historian who lived in the nineteenth century, is supposed to have observed: "History does not teach anybody anything—it just punishes for not learning its lessons." It looks as though the nuclear powers are on the verge of once again living up to this grim insight.

The main novelty of the current U.S. nuclear strategy and weapons programs is the concept of a limited or selective nuclear war, which originated in the 1960s with massive deployments of tactical nuclear arms in Europe and Asia. From the early 1970s, the United States promoted various options for selective and limited strategic strikes against Soviet military targets.⁵¹ In the 2018 *Nuclear Posture Review*, this concept once again took on a central role and was addressed to Russia:

Recent Russian statements on this evolving nuclear weapons doctrine appear to lower the threshold for Moscow's first-use of nuclear weapons. Russia demonstrates its perception of the advantage these systems provide through numerous exercises and statements. Correcting this mistaken Russian perception is a strategic imperative . . . To address these types of challenges and preserve deterrence stability, the United States will enhance the flexibility and range of its tailored deterrence options.⁵²

As noted, this concept would rely on the full range of sea- and air-launched nuclear and dual-purpose systems, and possibly medium-range

51. Secretary of Defense James R. Schlesinger, *Annual Defense Department Report, FY 1975* (Washington, D.C.: U.S. Government Printing Office, March 4, 1974), http://history.defense.gov/Portals/70/Documents/annual_reports/1975_DoD_AR.pdf?ver=2014-06-24-150705-323.

52. *Nuclear Posture Review*, 21.

land-based ones, though the United States has not as yet indicated that it will deploy INF-covered land-based systems in Europe.⁵³

As for Russia, it played with this idea in 2003, when an official Ministry of Defense document announced plans for the “de-escalation of aggression . . . [by] the threat to deliver or by the actual delivery of strikes of various intensity using conventional and (or) nuclear weapons.” Thus, the document assumed the possibility of “dosed combat employment of selected components of the Strategic Deterrence Force.”⁵⁴ Current Russian military doctrine and other official documents make no mention of such concepts, but they have been frequently discussed in professional military circles, including those associated with governmental institutions, which stressed “the limited nature of a first nuclear strike, which is designed not to harden, but rather to sober up an aggressor, to force it to halt its attack and move to negotiations.”⁵⁵

Moscow has often followed the U.S. example by adapting its strategy and doctrine to fit its technology.

In an address to the Russian Federal Assembly on March 1, 2018, Putin said: “Any use of nuclear weapons against Russia or its allies, weapons of small, medium or any yield at all, will be considered as a nuclear attack on this country. Retaliation will be immediate, with all the attendant consequences.”⁵⁶ This statement does not appear to countenance the concept of limited nuclear response, though it also does not negate it. Russian military doctrine postulates: “The Russian Federation shall reserve the right to use nuclear weapons in response to the use of nuclear and other types of weapons of mass destruction against it and/or its allies, as well as in the event of aggression against the Russian Federation with the use of conventional weapons when the very existence of the state is in jeopardy.” The purpose of a nuclear strike is defined as “the infliction of the unacceptable level of damage on an aggressor in any conditions.”⁵⁷ These formulations too do

53. Ibid.

54. “Current Goals in the Development of the Armed Forces of the Russian Federation,” *Red Star*, October 11, 2003, http://old.redstar.ru/2003/10/11_10/3_01.html.

55. Yevgeny Akhmerov, Marat Valeev, and Dmitry Akhmerov, “The Balloon Is a Friend of ‘Sarmat,’” *Military-Industrial Courier*, October 12, 2016, https://vpk.name/news/165525_aerostat_drug_sarmata.html.

56. “Statement of the President of Russia to the Federal Assembly.”

57. “The Military Doctrine of the Russian Federation.”

not embrace the notion of limited nuclear war, but do not exclude them either. It is not clear when and how exactly the “existence of the state” can be considered in jeopardy, and what “level of damage” to the enemy might be interpreted as sufficient.

Moscow has often followed the U.S. example by adapting its strategy and doctrine to fit its technology. No matter how much the deterrence doctrine is used to justify supposedly limited nuclear capabilities, they actually lower the nuclear threshold and increase the likelihood of any armed clash between the superpowers escalating into a nuclear conflict with a subsequent exchange of mass nuclear strikes. Having retained more sub-strategic nuclear arms than the rest of the world combined, Russia could be shifting its emphasis to conventional or dual-purpose systems.⁵⁸ Nevertheless, if the United States is really concerned about neutralizing Moscow’s suspected concept of limited nuclear use, the best way to do so would be to flatly deny such a possibility instead of responding in kind. Still better would be a joint U.S.–Russia declaration excluding any nuclear first strike or first use, as voiced in the 1970s and 1980s with respect to “winning and fighting nuclear war,” especially if it were substantiated by a follow-on to START and a radical reduction in sub-strategic nuclear forces.

The same boomerang dialectics may arise with advanced hypersonic weapon systems. Russia’s program has been justified by the need to penetrate the American BMD system on the U.S. continent, in Europe, in Asia, and on surface ships. Putin declared the last successful test of the boost-glide *Avangard* in December 2018 as “a New Year’s present to the country” and even compared it with the *Sputnik* launch of 1957.⁵⁹ Describing its unique qualities, he said: “It flies to its target like a meteorite, as a burning ball, fireball . . . As you understand nobody in the world has anything comparable . . . Sometime probably there will be, but in the meantime our guys will invent something else.”⁶⁰ On cue, the United States has accelerated its hypersonic-development program.⁶¹ The future strategic importance of the new weapon systems remains uncertain. It will be defined by their cost and scale of deployment, accuracy and class of warhead (nuclear or

58. According to independent estimates, Russia has about 1,850 units of such nuclear weapons. *Ezhegodnik SIPRI 2017. Vooruzheniya, razoruzhenie i mezhdunarodnaya bezopasnost* [SIPRI Yearbook 2017: Armaments, Disarmament and International Security] (Moscow: Nauka, 2018), 338.

59. “Putin Warned the United States Against a New Cuban Crisis.”

60. “Statement of the President of Russia to the Federal Assembly.”

61. Patrick Tucker, “The US Is Accelerating Development of Its Own ‘Invincible’ Hypersonic Weapons,” *Defense One*, March 2, 2018, <https://www.defenseone.com/technology/2018/03/united-states-accelerating-development-its-own-Invincible-hypersonic-weapons/146355/>.

conventional), resistance of command-and-control and navigation assets to countermeasures, and the availability of opposing tracking and intercept systems. From a strategic perspective, such a system might be needed if the United States could create a BMD system capable of defending against 1,500 Russian ballistic missiles' nuclear warheads, or at least a few hundred of those surviving a counterforce strike. But this is impossible in the foreseeable future, and the expansion of U.S. BMD, envisioned by the ballistic-missile-defense review of 2019, does not imply anything like SDI's notional capabilities.⁶² (In fact, the Soviet Union initiated development of a nuclear boost-glide system called *Albatross* in the mid-1980s as a countermeasure to SDI.) Hence, *Avangard*, like a number of other advanced arms programs that Putin announced in 2018, may look exciting to Russia as a technological achievement, but is obviously excessive as a response to the United States' BMD systems. If deployed at limited scale, hypersonic arms will not tangibly affect the strategic balance. But if both sides were to deploy them in large numbers, with nuclear or highly accurate conventional warheads, they could disrupt Moscow's nuclear deterrence strategy and Russia's national security.

At the Valdai Discussion Club in Sochi in October 2018, Putin formulated the main concept of the Russian nuclear doctrine:

Our concept is based on a launch-on-warning strike. . . . This means that we are prepared and will use nuclear weapons only when we know for certain that some potential aggressor is attacking Russia, our territory . . . A missile attack early warning system . . . monitors the globe, warning about the launch of any strategic missile . . . and identifying the area from which it was launched. Second, the system tracks the trajectory of a missile flight. Third, it locates a nuclear warhead impact zone. Only when we know for certain—and this takes a few seconds to understand—that Russia is being attacked we will deliver a retaliatory strike.⁶³

This launch-on-warning concept is extremely controversial, leaving supreme national command authority only a few minutes for a decision, which may be triggered by a technical mishap, strategic miscalculation, or psychological stress. Some fifty years ago, Herbert York warned about “a state of affairs in which the determination of whether or not doomsday has arrived will be made either by an automatic device . . . or by a

62. Office of the Secretary of Defense, “Missile Defense Review,” January 2019, <https://media.defense.gov/2019/Jan/17/2002080666/-1/-1/1/2019-MISSILE-DEFENSE-REVIEW.PDF>.

63. Transcript of the meeting of the Valdai Discussion Club, October 18, 2018, <http://en.kremlin.ru/events/president/news/58848>.

pre-programmed President who, whether he knows it or not, will be carrying out orders written years before by some operations analyst.”⁶⁴

Hypersonic systems are prone to making the situation still more dangerous. Launched to fly at an altitude of 50–60 kilometers, their trajectory goes largely under the BMD radars’ beams with broadly changing azimuths, which makes their flight path unpredictable and precludes interception at a pre-programmed rendezvous point. Moscow emphasizes this very characteristic in its BMD penetration strategy. At the same time, however, the characteristic precludes confirmation of a missile attack by tracking radars after the launch of hypersonic boosters is detected by early-warning satellites 60–90 seconds after start. As long as there are no space-based infrared systems for tracking hypersonic gliders, after their booster’s launch is detected by satellites, the next time a hypersonic glider will be seen is three to four minutes before impact, which does not leave time for authorization of a launch-on-warning strike.⁶⁵ While the air-defense challenges presented by hypersonic systems may be addressable through the deployment of different sensors and other technical innovations, this remedy would take time to develop and its feasibility remains uncertain.

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If the United States and Russia broadly introduce hypersonic arms, both nations will face this problem. But, according to Putin, launch on warning amounts to Russia’s main deterrence concept. About half of its strategic warheads are deployed on silo-based ICBMs (including the forthcoming *Sarmat* heavy missiles and *Avangard* boosters). They are the primary weapon systems for launch on warning due to both their vulnerability to counterforce strike and their high (“hair-trigger”) launch readiness. For the United States, the concept is secondary since only a quarter of its force (by actual loading) is deployed on silo-based ICBMs. Thus, Moscow, having initiated the hypersonic arms race, may in the future face the threat of a disarming strategic strike and would have to consider several fraught options. One would be to sustain “the infliction of the unacceptable level of damage on an aggressor in any conditions,” envisioned by the current

64. Herbert York, *Race to Oblivion* (New York: Simon & Schuster, 1970), 232.

65. Acton, *Silver Bullet?* 70.

military doctrine, without launch on warning.⁶⁶ This would imply mammoth costs in relocating the strategic force in sufficient numbers to highly survivable ground-mobile, sea- and air-basing modes, along with their command-and-control complexes.

Another option might be to retain the launch-on-warning concept, under which retaliation should be authorized upon receiving information from early-warning satellites. This would mean neglecting the history of satellites' false alarms over the course of their decades of service. In addition, the reliability of space systems could become compromised by growing anti-satellite capability or cyber warfare.

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The third option would be to reduce “the unacceptable level of damage on an aggressor” and rely primarily on ground-mobile and sea-based systems, while gradually phasing out silo-based ICBMs. This move would save a lot of money and might be facilitated by lowering the overall force numbers under the follow-on START. This would be in line with the rational strategic program elaborated in 1998 by a Russian version of a “blue ribbon” military-civilian panel commissioned by then-Minister of Defense Marshal Igor Sergeyev and headed by Nikolay Laverov, vice-president of the Russian Academy of Sciences.⁶⁷ Rational considerations would seem to dictate this option, but times have dramatically changed since 1998.

Given the parlous state of U.S.–Russia relations, the arms-control crisis, and the nature and ideology of Moscow's decision-making system, the first or second alternative, or some combination of the two, seems more likely in the foreseeable future if hypersonic systems become a key element of the arms race.

Reflections on Disarmament

One lesson from the last half-century of arms control is that shifts in the military balance make the sides periodically alternate their stances on the limitation or prohibition of certain weapon systems. Arms-control negotiators have frequently joked that Moscow and Washington have the same

66. “The Military Doctrine of the Russian Federation.”

67. Alexey Arbatov, “Understanding the US–Russia Nuclear Schism,” *Survival* 59 (2) (April–May 2017): 33–66.

positions on all arms-control issues, just at different times. An important moment in strategic arms control occurred at a June 1967 meeting in Glassboro, New Jersey, between American President Lyndon Johnson and Soviet Prime Minister Alexei Kosygin. McNamara urged Kosygin to appreciate the destabilizing effect of ABM systems. Kosygin categorically rejected this viewpoint, indignantly asserting: “Defense is moral, offense is immoral.”⁶⁸ By that time, the Soviet Union had decided to deploy the Moscow area A-35 *Galosh* missile-defense system, while McNamara was dragging his feet on the proposed U.S. *Nike-X* BMD. In just two years, Moscow would embrace McNamara’s philosophy, regarding BMD as destabilizing and sticking to this position for the ensuing half-century, while Washington would adopt Kosygin’s position, during the 1980s and thereafter.

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The reason for the flip is obvious: each party is trying to limit arms in which the opponent is superior and maximize its own military advantages. But in the course of the arms race, the sides regularly match or overtake each other and correspondingly change arms-control priorities. For example, Russia has for many years emphasized the threat of U.S. precision-guided, long-range conventional systems, portrayed by Putin as weapons of “the first global disarming strike.”⁶⁹ After Russia recently built up its conventional cruise-missile capability and achieved a breakthrough in hypersonic systems, this threat all but disappeared from the Russian list of strategic concerns. Likewise, Russian deployment of the new-generation ground-mobile conventional A-235 *Nudol* and S-500 BMD systems may change its attitude toward missile defense. One conclusion is that it is not worthwhile to ideologically demonize the other side’s advantages in arms programs or differences in negotiating positions. These asymmetries regularly alternate and require clear-headed professional assessments rather than shrilly politicized pronouncements on various “gaps.” Another important lesson is that arms-control treaties, even if concluded in a tense international environment, have usually enhanced mutual security and facilitated *détente*. The ABM Treaty and SALT I agreement of 1972 were

68. Newhouse, *War and Peace in the Nuclear Age*, 205.

69. Transcript of the meeting of the Valdai Discussion Club, Sochi, October 24, 2014, <http://news.kremlin.ru/transcripts/46860>.

concluded despite the opposition of Soviet hardliners in the Politburo soon after the escalation of the U.S. bombing of Vietnam and its mining of Haiphong Harbor, which damaged Soviet ships. These agreements stimulated broader progress in nuclear-arms limitation, reduction, and elimination, enhancing international security, improving U.S.–Soviet relations, and helping to end the Vietnam War.

Conversely, the breakdown of arms-control negotiations or refusal to ratify agreements has always damaged security and never helped resolve other international problems. Washington's rejection of SALT II ratification due to the Soviet invasion of Afghanistan in 1979 hindered strategic arms control, and in no way facilitated peace in Afghanistan or great-power cooperation on international security. Likewise, the Russian political elite's indignation over NATO expansion and the use of force in Yugoslavia prevented timely ratification of START II and the conclusion of the treaty on the basis of the START III Framework Agreement of 1997. This was counterproductive for arms control and did not alleviate mutual grievances and mistrust in NATO–Russia relations. Finally, Moscow's refusal to start negotiations on the START follow-on after 2012 contributed to the ensuing crisis of arms control and to new strategic tensions between Russia and the West.

Moscow's refusal to start negotiations on the START follow-on after 2012 contributed to the ensuing crisis of arms control and to new strategic tensions between Russia and the West.

Possibly the most important lesson from the history of arms control is that it is very difficult to build disarmament agreements, but quite easy to destroy them. Doing the latter has never enhanced national or international security and has invariably compromised it. For instance, the United States denounced the ABM Treaty in 2002, citing the missile threat of rogue states. Eighteen years later, the United States has 44 strategic ground-based, mid-course defense-system interceptors in Alaska and California, increasing to 64 by 2023.⁷⁰ Yet, under the 1974 protocol to the ABM Treaty of 1972, each side was permitted 100 interceptor missiles, which the United States could base in North Dakota. The treaty did not envision any restrictions on technical characteristics of interceptors (that is, as to range, guidance system, or warhead type), while the location, if necessary, could be easily renegotiated as an amendment to the treaty. The U.S. Standard-3 *Aegis*-type interceptors in Europe and Asia or on surface ships, for use

70. "Missile Defense Review."

against medium-range ballistic missiles, could come under the documents included in the 1997 agreement on the delineation of strategic and theatre missile-defense systems.⁷¹ So the ABM Treaty could easily have been preserved with light amendments that would have permitted the United States to do everything it has done since 2002, or is planning to do in the foreseeable future.

U.S. withdrawal from the ABM Treaty did not alleviate overall strategic tensions, and in fact made them worse. Missiles and missile technologies have proliferated. North Korea withdrew from the NPT in 2003, started nuclear tests in 2006, and had been testing missiles of ever-growing range up to 2018. Iran agreed to curtail its nuclear program in 2015 not because of U.S. BMD development but for unrelated reasons and continues to develop and test missiles. After New START in 2010, U.S.–Russia strategic negotiations stopped, the main objection on Moscow’s side being the absence of the ABM Treaty and cooperative development of defense systems by the two nations. In 2018, Russia unveiled a package of new offensive programs to counter the U.S. BMD, which is seen in Moscow as an open-ended program. China is emulating Russia on this score.

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Another example is Russia’s “suspension” of its participation in the Treaty on Conventional Armed Forces in Europe (CFE) in 2007 and “final suspension” in 2015. Initially, Moscow justified these steps as a means of applying pressure on NATO to ratify the 1999 CFE Adaptation Agreement. But in 2011, NATO states responded by also ceasing their adherence to the terms of the treaty. Presently, there is no functioning conventional-forces-limitation regime in Europe. Russia has been building up its forces in its western and southern military districts, as in Crimea, South Ossetia, and Abkhazia. On the other side of their borders, NATO has undertaken defensive deployments in the Baltic states, Poland, and Romania, and U.S. military units and heavy arms and equipment are returning to the continent. Substantial NATO superiority over Russia in all military and economic

71. This agreement permitted tests of BMD interceptors against missile targets with a speed of no more than 5 km/sec and range of 3,500 km. For the future, it was permitted to develop land- and air-based interceptors with a speed of up to 5.5 km/sec, and sea-based interceptors of up to 4.5 km/sec. Such BMD subsystems were exempted from the limitations of the ABM Treaty.

dimensions, alongside American logistics and power-projection capabilities, make the prospects for Russian security along its western borders quite precarious. Moscow would probably have felt more comfortable if NATO forces in Eastern Europe had been tangibly limited by CFE national and territorial quotas, and open to confidence-building and transparency regimes.

Still greater near-term threats may emerge after the collapse of the INF Treaty and eventual expiration of START without a follow-up treaty. The loss of their stabilizing effects cannot be offset by any medium-range or strategic-weapons program on either side. Possible deployment of new U.S. medium-range missiles in Europe and Asia occasioned by the end of the INF Treaty would, due to their short flight time and low trajectory, render a Russian deterrent based on launch on warning unconvincing, as there would be no time for its implementation. According to a statement by one respected Russian military commander, this might force Russia to move to the highly risky concept of a preemptive nuclear strike.⁷² If the United States were to follow suit by adopting a similar concept, crisis stability would be practically impossible to maintain.

The revolutionary impact of military technological progress is not something new, but quite a logical and historically regular phenomenon. However, the progress of U.S.–Soviet/Russian arms control talks during the last fifty years, despite some setbacks and exemptions, did manage to impose deep and stabilizing reductions on their medium range and strategic forces.

Dealing with new threats to strategic stability in the follow-on START treaty requires that the long-range (i.e., more than 600 km)⁷³ air-launched nuclear and conventional cruise and hypersonic missiles and nuclear gravity bombs are included under a common warhead ceiling, and that they be counted according to the actual loading of the heavy bombers. In the past, air-launched missiles were counted under warheads ceilings in the 1991 START I and in the 1993 START II treaties.⁷⁴ Limits on strategic delivery vehicles and warheads should also cap the innovative weapon systems: ground-based intercontinental cruise missiles and long-range autonomous underwater drones, as well as land- and sea-based boost-glide hypersonic systems with ranges defined similar to what was in the SALT and START

72. In an interview, Colonel General Viktor Esin, former chief of staff of the Russian Federation Strategic Missile Forces, said: “If the Americans begin to deploy their missiles in Europe, we will have no choice but to abandon the doctrine of launch-on-warning and move to a doctrine of preemptive strike.” See “Interview with Colonel General Viktor Esin,” *Zvezda Weekly*, November 8, 2018, <https://zvezdaweekly.ru/news/t/2018117102-0iaAI.html>.

73. The 600 km range was set to define strategic ALCMs and heavy bombers equipped with such weapons for SALT II (1979) and START I treaties.

74. Only the 2010 New START Treaty adopted liberal count rules for each bomber: one delivery vehicle = one warhead, although in reality, it could carry up to 20 missiles.

treaties (e.g., land-based missiles with ranges greater than 5,500 km and sea-based missiles with ranges greater than 600 km).⁷⁵ Such weapons should be limited regardless of whether their warheads are nuclear or conventional. Most of these new systems can be verified using the methods and means of START/INF regimes.

The roots of the present crisis of arms control are not in the technical complexity of the current strategic relationships, as intricate as they are, nor in the turmoil in the world order, as chaotic as it is. The core of the problem is rather the distinct failure on the part of the new generation of political elites on both sides to appreciate the high strategic importance and priority of arms control.

In this way, the most destabilizing long-range strategic systems, which are blurring a clear line between conventional and nuclear warfare, would become subject to verifiable arms control (including conventional missiles and low-yield nuclear bombs). Indirectly, their numbers would be limited, since under common ceilings they would “compete” with the number of proven and reliable nuclear-tipped strategic ballistic missiles. The latter would also have to be reduced to allow for ground- and air-launched cruise missiles, hypersonic boost-glide and ram-jet missiles, and underwater nuclear drones under the overall limit. In fact, even under New START the above change in counting rules would require at least a 30 percent cut in land- and sea-based ballistic missiles’ warheads—no less than proposed by President Obama in 2016.

The proposed model of START follow-on would not address a number of potentially destabilizing weapon systems and technologies: anti-missile defense, space arms, cyber-warfare, directed-energy weapons, tactical nuclear weapons, and a great variety of drones with artificial intelligence. Those systems and technologies cannot be addressed immediately, either technically or diplomatically. However, it does not mean that there is no sense in addressing weapons and technologies that may be immediately managed by arms control under the follow-on START treaty for the sake of salvaging strategic stability. Eventually the exotic weapons might be taken care of by future negotiations, provided that the first steps outlined above are urgently taken to prevent the final collapse of the arms control regimes.

75. Such criteria were set in the SALT I (1979) and START I (1991) treaties.

The roots of the present crisis of arms control are not in the technical complexity of the current strategic relationships, as intricate as they are, nor in the turmoil in the world order, as chaotic as it is. The core of the problem is rather the distinct failure on the part of the new generation of political elites on both sides to appreciate the high strategic importance and priority of arms control. Indeed, the current state leaders and defense and foreign policy cadres came to positions of influence in the beginning of the new century (or even later) and inherited “for free” the legacy of the arms control system built during the preceding decades. Hence, they have been taking it for granted and treating it as a pawn in the game of foreign and domestic politics. They have a very vague idea of the world without such a system and do not know (or believe in myths) about dangerous crises and wasteful cycles of the nuclear arms race of the Cold War times.

It is absolutely certain that continuation of the present course of actions of the major states is leading the world to an uncontrolled, multifaceted, and multilateral arms race and eventually to catastrophe.

There is no certainty that they would accept the solutions presented above or any other reasonable and practical proposals for getting out of the deepening dead ends. However, it is absolutely certain that continuation of the present course of actions of the major states is leading the world to an uncontrolled, multifaceted, and multilateral arms race and eventually to catastrophe. In the last few years there has been a proliferation of well-intended studies on various substitutes for formal arms control in the absence of the INF Treaty or START.⁷⁶ All of the options are considerably less effective than existing arms-control treaties with respect to preserving strategic stability and predictability, and managing the arms race. Furthermore, if the present political elites of leading nations lack the will or knowledge to sustain formal arms control, they are still less likely to manage the strategic environment by dubious surrogates. While thinking about a bleak future for arms control and entertaining other purportedly

76. Sergey Karaganov, “On the New Nuclear World: How to Strengthen Deterrence and Maintain Peace,” *Russia in Global Politics* 15 (2) (March–April 2017); Andrey Kortunov, “The End of the Bilateral Era: How the US Withdrawal from the INF Treaty Changes the World Order,” Carnegie Moscow Center, October 23, 2018, <https://carnegie.ru/commentary/77551>; and Vincent Manzo, “Nuclear Arms Control Without a Treaty? Risks and Options After the New START: CNA’s Strategy, Policy, Plans, and Programs Division (SP3),” Deterrence and Arms Control Paper no. 1, April 2019.

tolerable arrangements may be intellectually exciting, that vocation could turn counterproductive. Politically, it would service the illusion that living without formal arms control might not be so bad and that the damage from its disintegration could be limited. Instead, they should be providing politicians with a realistic picture of the myriad future dangers of a world without arms control.

The problem of saving the effect of the INF Treaty could be quickly fixed by agreeing on a moratorium on the deployment of the intermediate-range missiles in Europe with short-notice, and on-site inspections at Russian *Iskander/Novator* (9M729) missile bases and U.S. *Aegis Ashore* bases in Romania and Poland in order to remove mutual suspicions.⁷⁷ Negotiating a START follow-on would be more challenging, but possible during the next five years if there were firm political directives from the Kremlin and the White House. After all, New START was negotiated in just one year.

McNamara finished his luminous San Francisco speech with these words: “In the end, the root of man’s security does not lie in his weaponry, it lies in his mind. What the world requires in its third decade of the Atomic Age is not a new race towards armament, but a new race towards reasonableness. We had all better run that race.”⁷⁸ Those words have never been as relevant as they are now—in the eighth decade of the Atomic Age.

77. On October 26, 2020, about a year and a half after this essay was published in the journal *Survival*, President Putin made the same proposal to NATO: on-site inspections in the Kaliningrad region of Russia to verify the absence of 9M729 missiles’ deployment, and in Poland and Romania to make sure that *Tomahawk* missiles are not installed in *Aegis Ashore* BMD launchers. In addition, Putin promised to refrain from deployment of 9M729 missiles in the European part of Russia, conditional on the nondeployment of U.S. INF-types of missiles in Europe; see <https://tass.ru/politika/9828905>. If this had been proposed in June 2019, it would have been more difficult for the United States to abrogate the INF Treaty in August. “Too little, too late” is a plague of arms control.

78. McNamara, *The Essence of Security*, 67.

Contributors

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The American Academy's Project on Promoting Dialogue on Arms Control and Disarmament

The rapid deterioration of relations among China, Russia, and the United States has significant and worrisome consequences for the stability and security of the current global nuclear order. Differently from the Cold War, the current nuclear age is characterized by a simultaneous collapse of arms control agreements and the absence of any strategic dialogue among the three main nuclear players that would serve to minimize and reduce the potential risks of a nuclear escalation. But as was demonstrated throughout the Cold War years, the creation of working group platforms for creative brainstorming on areas of common ground is an essential step to reduce tensions and promote a more cooperative intentional environment.

The Academy has partnered with The Pugwash Conferences on Science and World Affairs to convene a series of meetings, which began in 2018, to explore potential directions for a larger project to foster dialogue between nuclear experts and former officials from the United States, China, and Russia. One strand of project work consists of a series of bilateral U.S.–Russia and U.S.–China dialogues designed to identify critical goals in arms control. A second strand of work will build on the Academy's experience organizing educational sessions for the U.S. Congress through offering a series of engagements with Members of Congress and their staffs to deepen knowledge in Congress on key issues and challenges facing the United States in arms control and international security.

The Academy's Historic Nuclear Work

The Academy has played a crucial role in the nuclear field, particularly when a viable path to cooperation and collective governance was not clear. In 1959, at the height of the Cold War and the nuclear standoff between the United States and the USSR, members of the American Academy, including Donald Brennan, Thomas Schelling, and Henry Kissinger, among others, gathered at the Academy to rethink the framework that had governed the relations between the two superpowers following World War II and to offer a new model of global interaction. The work of this group, in partnership with contemporaneous policy-makers, helped pave the way for the adoption of a new and veritably transformative American nuclear



Participants in the Academy's 1959 Arms Control Study

posture based on strategic stability and arms-reduction, rather than on arms-accumulation.

Since 1960, the American Academy of Arts and Sciences has conducted more than a dozen major projects on arms control and nuclear policy topics, ranging from the future of submarine-based deterrents to international arrangements for nuclear fuel reprocessing to weapons in space. The Global Nuclear Future Initiative (2008–2019) addressed nuclear issues such as mitigating the problem of insider threats and managing spent nuclear fuel. Meeting the Challenges of the New Nuclear Age (2016–present) is a two-phase project that seeks to articulate a new framework for governing relations among the nine existing nuclear weapons states, with particular attention to strengthening strategic stability within two critical nuclear triangles: China, the United States, and Russia as well as India, Pakistan, and China.

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The Russian Academy of Sciences

The Russian Academy of Sciences was established by order of Emperor Peter I by decree of the governing Senate of January 28 (February 8), 1724. It was recreated by the Decree of the President of the Russian Federation of November 21, 1991, as the highest scientific institution in Russia. The Russian Academy of Sciences (RAS) is a state academy of sciences, an organization of science that conducts scientific management of scientific research in the Russian Federation, a legal entity and a non-profit organization created in the form of a federal state budgetary institution. The Academy comprises more than 1,000 scientific institutes and research centers, employing 40,000 researchers. Its governing body includes the President, Presidium, and General Assembly, consisting of 860 full members (academicians) and 1,100 corresponding members of the Academy. In addition, the RAS has 470 foreign honorary members. On the territory of the Russian Federation, the Russian Academy of Sciences is the assignee of the USSR Academy of Sciences. The Academy is the assignee of the Russian Academy of Medical Sciences and the Russian Academy of Agricultural Sciences.

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