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Navigating Disruption in the Global Nuclear Order: Managing Risks and Shaping a New Way Forward

SUMMARY

The global nuclear order has been fundamentally and irreversibly altered by intense geopolitical competition, an increasingly complex strategic environment, and rapid technological advancements, resulting in a dangerously high risk of nuclear weapons use. This paper examines the factors contributing to the disruption of the existing architecture, proposes near-term principles and steps for managing this perilous moment, and emphasizes the urgency of moving toward a more resilient and stable system where nuclear risks are greatly reduced.

Patricia Jaworek, Mark Melamed, Lynn Rusten, and Steve Andreasen
Foreword by Ernest J. Moniz and Joan Rohlfing

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Foreword

In the summer and fall of 2022, NTI began a series of conversations among staff and with outside experts and former government officials to explore a trend that we had observed for years: the steady erosion and, ultimately, the irrevocable disruption of the global nuclear order that had served as the foundation for managing nuclear risks for half a century. Russia's full-scale invasion of Ukraine in February 2022 and its nuclear threats against a non-nuclear-weapon state were the most immediate factor prompting this reexamination, but not the only one. Indeed, the global nuclear order of the past has been fundamentally destabilized by geopolitical, institutional, and technological developments over decades—from the disintegration of the long-standing Euro-Atlantic security and arms control architecture to the unexpected and rapid nuclear buildup in China to the continued development of North Korea's nuclear and missile programs to the unprecedented pace of technological developments already transforming all aspects of society, including warfare.

The most important takeaway from those conversations is that the current trajectory carries with it an alarmingly high and growing risk of nuclear use. For nearly eight decades since the bombings of Hiroshima and Nagasaki in 1945, the world has averted another use of nuclear weapons, sometimes narrowly, through some combination of wise leadership, courageous actions and decisions, and sheer luck. Unfortunately, too many of our leaders and experts have learned the wrong lesson from humanity's flirtations with disaster: that a system of security premised on nuclear deterrence—which carries with it the explicit threat of nuclear annihilation—is somehow stable, infallible and will be effective in perpetuity. The near misses of the past are not evidence that the system will hold forever, but in fact demonstrate that failure is likely—perhaps sooner than we think. Instead of clinging to the false hope that our luck will hold indefinitely, we must develop new approaches for preventing nuclear use before our good fortune runs out.

First and foremost, leaders of nuclear-armed states must recognize and act on the principle that any use of nuclear weapons would be catastrophic and must be avoided. To reduce nuclear risk will require sustained attention and bold leadership. Nuclear deterrence and our approach to managing nuclear risks were largely developed in a bygone era and designed for different circumstances. Continuing to rely on decades-old theories, policies, and procedures is akin to cruising along on autopilot as we edge ever closer to a precarious cliff.

Leaders and publics must demand that policymakers adopt new ways of thinking and new models for establishing guardrails and constraints around nuclear weapons. The emerging and future global security landscape will be characterized by multipolar competition, geopolitical tension and instability, possible emergence of additional nuclear-armed states, and growing integration of emerging technologies with nuclear risks. There are lessons and tools from the past that remain relevant and useful, especially as leaders and publics navigate the transition to a more sustainable architecture that is fit for purpose. But new and adaptable policy and technology tools also will be critical to avoid the use of nuclear weapons in an environment that will remain dangerous, unsettled, and technologically evolutionary. Ultimately, leaders and publics must take seriously the imperative of moving toward an international security strategy that does not risk the catastrophic destruction of humanity by nuclear weapons. The threats posed by nuclear weapons are not lost on recent American administrations or on the current one: "When you say major

threat, to me, we have one really major threat, and that's called nuclear weapons…we are closer to World War III today than we've ever been,"- President Donald Trump, September 2024. Now is the time to start translating this awareness into comprehensive risk reduction.

As the war in Ukraine grinds on and a crisis in the Middle East commands global attention, nuclear dangers have again been eclipsed by other issues on leaders' long list of priorities and concerns. But the risk of a nuclear weapon being used—intentionally or due to an accident, miscalculation, or blunder—remains higher than at any time since the Cuban Missile Crisis. The potential pathways to catastrophe are frighteningly plausible, and the ability to prevent escalation once leaders start down that road is, at best, uncertain. At some point, our luck will run out, and when the current system fails, it can fail catastrophically. No one should be satisfied with such a system. It is time for leaders to commit to developing a better alternative.

We recognize that this report on "Navigating Disruption in the Global Nuclear Order" is but an early step along the way toward a more resilient security architecture that greatly reduces the threat posed by nuclear weapons. The journey needs to be pursued with urgency.

Ernest J. Moniz
Co-Chair and Chief Executive Officer, NTI

Joan Rohlfing
President and Chief Operating Officer NTI

Executive Summary: Key Findings

The global nuclear order is facing irreversible disruption driven by geopolitical complexity, regional conflicts, and unprecedented technological advancement. The risk that a nuclear weapon will be used is higher than at any time since the Cuban Missile Crisis, and the tools for managing and reducing that risk are underused and, increasingly, insufficient. In today's dynamic environment, sustained, bold leadership—especially from nuclear-armed states—is crucial to lower tensions, reduce the risks of nuclear use, and work toward a world without nuclear weapons. Leaders must urgently reaffirm and act upon core principles that have historically prevented nuclear conflict, proliferation, and arms racing and simultaneously develop new approaches to address the systemic and structural issues that perpetuate and exacerbate the deterioration of the current global nuclear system.

Disruption of the Global Nuclear Order

A confluence of developments is challenging and fundamentally altering the architecture of norms, agreements, and understandings that have constituted the foundation of the global nuclear order for decades. The drivers of this disruption include:

- Russia's invasion of Ukraine and Vladimir Putin's use of nuclear threats, which have fueled debates about the role of nuclear weapons in providing security and disenchantment with the inequities of a global security system characterized by nuclear haves and have-nots
- Modernization and/or expansion of nuclear arsenals in virtually every nuclear-armed state, risking a renewed nuclear arms race
- Increasing nuclear multipolarity and its implications for nuclear deterrence, arms control, and strategic stability
- Growing pressures for more countries to consider acquiring nuclear weapons
- Rapid development and integration of emerging and disruptive technologies that are outpacing governments' ability to understand and manage the intersection of these technologies with nuclear weapons systems
- Erosion of global disarmament and nonproliferation norms and architecture
- Persistent threats from non-state actors
- Deepening divisions and growing discontent with inequities in the international system

Managing Nuclear Risks in a Turbulent Time: Enduring Principles and New Approaches

These drivers have placed the world on a dangerous trajectory characterized by a heightened risk of nuclear use, a nascent nuclear arms race, and the deterioration of critical guardrails and norms. It is essential that leaders—particularly those in nuclear-armed states—recognize and act on their unique responsibility to chart a less perilous path. The current emphasis on nuclear deterrence—in particular without the necessary balance of arms control, diplomacy, and dialogue—reinforces the perceived value of possessing nuclear weapons while downplaying their significant risks. To change course, leaders must recommit to key enduring principles, including those that follow, and take concrete steps to implement them:

- **"A nuclear war cannot be won and must never be fought,"[1] and the nuclear taboo[2] and the 80-year record of nonuse must be maintained.** States must take action to discourage and disincentivize intentional use and to reduce the risk of use as a result of accident, blunder, or miscalculation. To do so will require restraint as well as consistent recognition and reaffirmation of the inadmissibility of any use of nuclear weapons.

- **Nuclear disarmament must remain a shared goal of the international community, and continuous demonstrable progress toward the goal is essential for sustaining global nuclear order and preventing nuclear use.** The commitment of nuclear-weapon states to disarm is a core tenet of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), which has been the backbone of the global nonproliferation and disarmament architecture for more than half a century. Nuclear-weapon states must recommit and act—unilaterally, bilaterally, and multilaterally—to reinvigorate this commitment and resume progress toward the goal of a world without nuclear weapons.

- **Communication and dialogue between states are essential in good times and bad.** Dialogue—between the United States and Russia, the United States and China, among the P5[3] and other nuclear-armed states, and including key non-nuclear-weapon states—is critical to better understand risk perceptions and security concerns, to prevent crises and manage them when they occur, and to avoid unintended escalation. States must commit to sustained diplomatic engagement on nuclear and other existential risks, even during turbulent periods in their broader relations, and they must be open to engaging on the full range of topics affecting strategic stability, including not just nuclear weapons but also long-range conventional capabilities, missile defense, competition in outer space, and other relevant domains, such as cyberspace and artificial intelligence (AI).

- **Long-standing norms against nuclear proliferation and nuclear testing must be upheld and strengthened.** There is growing momentum in several non-nuclear-weapon states to pursue their own nuclear weapons programs. This trend jeopardizes the fundamental principle that

[1] Joint statement first made by U.S. President Ronald Reagan and General Secretary of the Central Committee of the Communist Party of the Soviet Union Mikhail Gorbachev at their summit in Geneva, November 19–21, 1985.

[2] The nuclear taboo refers to the claimed international norm against the use of nuclear weapons. See Nina Tannenwald, "The Nuclear Taboo: The United States and the Normative Basis of Nuclear Non-Use," *International Organization* 53, no. 3 (1999): 433–468.

[3] The P5 are the five nuclear-weapon states recognized under the Treaty on the Non-Proliferation of Nuclear Weapons: China, France, Russia, the United Kingdom, and the United States.

global security is served by preventing the further dissemination of nuclear weapons and that the perceived benefits of acquiring nuclear weapons are outweighed by the security risks and costs. States with and without nuclear weapons must reestablish the strategic rationale that has underpinned decades of nonproliferation policy, including by emphasizing the benefits of forgoing nuclear weapons. The United States (and other nuclear-weapon states) can play a key role in this by maintaining and strengthening the security assurances it offers to allies and partners as well as negative security assurances that nuclear weapons will not be used against non-nuclear-weapon states. Nuclear-armed states also should recommit to their national moratoriums on nuclear testing and take steps to increase confidence and transparency around activities at their nuclear test sites.

- **Nuclear risks require sustained leadership focus.** Nuclear weapons and nuclear policy are inherently presidential; in each of the nine nuclear-armed states, the decision to use—or not use—a nuclear weapon ultimately rests with the single national leader of each of those states. In an era of growing nuclear risks with potentially existential consequences, those leaders must prioritize and personally engage in efforts to reduce those risks. And leaders of non-nuclear-weapon states must do their part to make clear that any use or threat of use of nuclear weapons is inadmissible.

But principles alone will not suffice. In this transformative era, leaders need the following new tools and approaches, inter alia, to uphold the principles and to manage and reduce nuclear risks and the intersection of those risks with new technologies:

- Participation and engagement of a broader array of nuclear-armed and non-nuclear-armed states in risk reduction and disarmament efforts
- More equitable inclusion and active engagement of non-nuclear-weapon states, including from the Global South, in shaping the nuclear order
- More flexible and adaptable mechanisms, venues, and forms of agreement for mitigating risks
- Greater exercise of unilateral restraint
- Steps to increase the amount of time leaders have to decide on nuclear use during a crisis and updates to policies, procedures, and guardrails to account for modern risks and technologies
- Mechanisms to minimize the disruption that can be caused by outlier or uncooperative states
- Greater interaction between the private sector and governments to better understand rapidly evolving technological developments; the impact—both positive and negative—of those developments on nuclear weapons systems and strategic stability; and the technologies, guardrails, and governance mechanisms that may be needed to mitigate potential harms.

With these assumptions in mind, the report enumerates specific recommendations to illustrate how the enduring principles identified in this report can be upheld and reinforced using a mix of familiar and new tools and approaches fit for purpose in this evolving landscape.

Transforming the Global Nuclear Order

The bold leadership that is needed to manage nuclear risks in the near term will be even more necessary to drive the development of and the transition to a more sustainable global nuclear order over the longer term. The threat to use nuclear weapons is an inherent feature of nuclear deterrence; for as long as nuclear deterrence remains at the heart of the global nuclear order, the risk of catastrophic failure will persist. The trends that have disrupted the nuclear order should be seen as evidence of the need to fundamentally change the system, not as a reason to double down on nuclear deterrence. Global challenges demand transnational and cooperative solutions based on a more holistic concept of security that acknowledges and accounts for the increasingly intersectional nature of global issues. The report does not provide detailed prescriptions for a new nuclear order, but it does identify broad categories for further work to develop an alternative system. This critical work for a safer future should include:

- **Designing an alternative security architecture,** including an examination of the political, institutional, legal, and technological requirements for a system where the consequences of failure are not existential
- **Reexamining the global effects of nuclear use** to better understand how the use of nuclear weapons would impact modern society and to ensure that nuclear policies, postures, and decision-making processes are informed by realistic assessments of the full and far-reaching consequences of use
- **Considering the applicability to nuclear disarmament efforts of new legal and normative principles** shaping the debates about climate and other existential risks
- **Promoting respectful and inclusive dialogue** based on the recognition that nuclear war threatens everyone—whether they reside in nuclear-armed states or non-nuclear-armed states—and therefore all states should have a voice and a role to play in discussions of nuclear risks
- **Developing compelling narratives to engage the public** to make nuclear weapons policies and the associated risks more accessible and, ultimately, more responsive to the people who are shouldering those risks.

Introduction

For nearly eight decades, the nuclear shadow has loomed over humanity. The atomic bombings of Hiroshima and Nagasaki in August 1945 demonstrated the devastating power of nuclear weapons even in their infancy and marked the beginning of a new era in which a handful of countries and individuals possess the capacity to destroy modern civilization. It is a daunting but critically important responsibility to prevent such a catastrophe. Yet nuclear-weapon states today are increasing their investments in decades-old concepts of nuclear security that may no longer prevent nuclear use in an era of growing complexity, confrontation, and competition.

For most of the 79 years since nuclear weapons were first used, managing the global nuclear order has relied heavily on the theory of nuclear deterrence, with the attendant threat of nuclear annihilation for the attacked and the attacker. Through a combination of prudent judgment and good fortune, this approach has prevented (so far) any further use of nuclear weapons in war. However, past success does not guarantee future results—especially when the theory of nuclear deterrence, which was designed for a slower-paced, analog-based, and generally bipolar world more than 70 years ago, now operates in an increasingly complex and digitized world that includes nine nuclear-armed states and modern technologies with implications that are not yet fully understood. This report is thus driven by the urgent understanding that the decades-old record of "nuclear non-use is not an inherently permanent achievement. It is a condition that must be secured by each successive generation of leaders."[4]

This project was born out of the irrevocable disruption of the established global nuclear order. For a multitude of reasons, the world faces a greater risk of nuclear use now and in the future than at any time since the height of the Cold War. Even as the immediate goal remains the prevention of nuclear use, there is an urgent need for simultaneous work to create a world that is safe from preventable nuclear catastrophe for the long term. Alongside proven methods of nuclear risk reduction, arms control, and diplomacy, new approaches and solutions that address the systemic issues and structural challenges in the current international order are essential if humanity is to prevent nuclear use for another 80 years and beyond. Unless the world is possessed by a collective death wish, returning to the nuclear order of the Cold War is neither feasible nor desirable; instead, it is essential to manage and reduce nuclear risks through this turbulent historical period and chart a path toward a more stable future order that relies less—and ultimately, not at all—on nuclear weapons for security. This report provides concrete recommendations for navigating pressing nuclear perils and proposes guiding principles, ideas, and areas for further work to shape a more stable future security system.

The analysis and recommendations presented in this report reflect the views of NTI, informed by the insights and perspectives of participants in NTI's Global Nuclear Order Project from 2023 to 2024. This report does not necessarily reflect the views of the individual experts who participated.

[4] Henry A. Kissinger, Eric Schmidt, and Daniel Huttenlocher, *The Age of AI and Our Human Future* (New York: Little, Brown and Company, 2021, 149.

Section I. Disruption of the Global Nuclear Order

The global nuclear order of the past has been fundamentally disrupted and destabilized by a variety of geopolitical and technological developments over several decades, including the war in Ukraine and Russia's attempted use of nuclear coercion, steady erosion of the long-standing Euro-Atlantic security and arms control architecture; China's unexpected and rapid nuclear buildup; and the unprecedented pace at which technological developments are transforming all aspects of society, including warfare. These dynamics have coalesced to challenge—and in some cases, irreversibly alter—the fundamental norms, agreements, and understandings that formed the foundation of the global nuclear order. Some of the resulting disruptions have been sudden and unexpected, while others have occurred gradually over years or even decades. Some are specific to the architecture of norms and agreements governing nuclear weapons, while others reflect broader shifts in geopolitics, international law, institutions, technology, and society writ large. Together, they threaten to upend the methods world leaders have used to manage the threat from nuclear weapons for the past half-century—with unknown consequences.

The Implications of the War in Ukraine

Russia's full-scale invasion of Ukraine in February 2022, along with its nuclear threats and repeated saber-rattling throughout the war, has brought the risk of nuclear escalation back to the headlines. The use of implicit and explicit nuclear threats by a nuclear-armed state to provide cover for a war of aggression against a state without nuclear weapons has put a spotlight on the inequities of the current nuclear order. The special case of Ukraine, which has a unique history of relinquishing nuclear weapons on its territory after the collapse of the Soviet Union in exchange for security guarantees from Russia, the United Kingdom, and the United States, has sparked renewed debate about the value of nuclear weapons and the effectiveness and limitations of nuclear deterrence.

The potential for Russian nuclear use in Ukraine is not merely an academic discussion. In the fall of 2022, the U.S. intelligence community reportedly believed there was a 50 percent chance that Russia would use a tactical nuclear weapon in Ukraine.[5] While it remains unclear whether and how seriously Russian President Vladimir Putin considered the use of a nuclear weapon, the risk was perceived as high enough that Chinese President Xi Jinping and Indian Prime Minister Narendra Modi—neither of whom had been active in decrying Russia's actions in Ukraine—were compelled to publicly intervene and emphasize the importance of avoiding the use of nuclear weapons.

The use of implicit and explicit nuclear threats by a nuclear-armed state to provide cover for a war of aggression against a state without nuclear weapons has put a spotlight on the inequities of the current nuclear order.

Even as the threat of nuclear use seemed to subside for a time, there continued to be a serious and sustained debate among prominent Russian experts about whether Moscow's threshold for nuclear use was too high. This debate culminated in an announcement by Putin on September 25, 2024, of a revision to Russia's nuclear doctrine that dangerously lowers the threshold for nuclear use by asserting the right to use nuclear weapons in response to aggression against Russia by a non-nuclear-weapon state "with the participation or support of a nuclear-weapon state." The updated doctrine undermines the security assurances provided to non-nuclear-weapon states and introduces new uncertainties about Russia's policies and military responses that will exacerbate the risk of miscalculation and a wider conflict in and around Ukraine, particularly if Russia faces significant losses on the battlefield or more Ukrainian counterattacks deep into its territory, especially if those counterattacks are supported by western arms. In addition, Russia has unprecedentedly weaponized civil nuclear facilities during this conflict by putting nuclear power plants in the crosshairs of military conflict and risking a nuclear incident.

Russia's reckless brinkmanship has not only heightened the risk of nuclear escalation but also fueled troubling debates about the role of nuclear weapons in providing security in the Euro-Atlantic region and beyond. Nuclear-armed states and their allies feel validated in their belief that nuclear weapons serve as the ultimate guarantor of security, now more than ever. In contrast, many states without nuclear weapons and not covered by extended deterrence view these weapons as either irrelevant to their security or an existential threat and as a shield that allows nuclear-armed states to act with impunity.

[5] W. J. Hennigan, "Nuclear War Is Called Unimaginable. In Fact, It's Not Imagined Enough," *New York Times*, March 7, 2024.

While Russia's invasion of Ukraine is not the sole driver of these trends (which will be discussed in greater detail in the following sections), the war has had—and will continue to have—profoundly disruptive consequences for the global nuclear order.

Modernization and Expansion of Nuclear Arsenals

Virtually every nuclear-armed state has recently completed or is currently engaged in significant modernization and, in some cases, expansion of its nuclear arsenal. Most notably, in recent years, China has accelerated the expansion of its nuclear arsenal, with little public explanation of its strategic rationale and almost no transparency regarding the changes in its nuclear posture. The U.S. Department of Defense estimates that China's arsenal has surpassed 600 operational warheads as of mid-2024 and will have over 1,000 operational nuclear warheads by 2030 and will continue growing its stockpile through at least 2035,[6] marking a significant departure from its historically modest stockpile.

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Russia has largely completed its nuclear modernization and is moving forward with the development and deployment of a variety of novel delivery systems, including hypersonic delivery vehicles; an autonomous nuclear-powered and nuclear-armed torpedo; and potentially, a nuclear-powered, nuclear-armed cruise missile, which alone or in combination with other systems could significantly reduce decision time for U.S. leaders during a crisis. India and Pakistan continue to enhance their respective nuclear capabilities amid persistent high tensions in South Asia. North Korea's nuclear and missile programs have proceeded apace. And Iran's estimated timeline for developing a nuclear weapon, should Tehran decide to do so, is reportedly shorter than ever, with prospects for renewed efforts toward a diplomatic solution uncertain at best.

The United States is currently conducting a once-in-a-generation modernization program of all three legs of its nuclear triad, at a cost potentially exceeding $1.7 trillion[7] for sustainment and modernization. However, many in the United States argue that even this ambitious program may be insufficient for a future security environment in which Washington faces two "near-peer" competitors, given China's expansion and the expectation of prolonged tensions between Russia and the United States. A growing number of U.S. voices, including prominent bipartisan groups such as the Congressional Commission on the Strategic Posture of the United States, suggest that managing these challenges requires the United States to, at a minimum, plan for the potential need to increase the number of U.S. strategic warheads beyond the limits set by the New Strategic Arms Reduction Treaty (New START) as well as plan for new nonstrategic nuclear capabilities. Russia, China, or both would likely feel compelled to respond to an increase in the size and character of the U.S. arsenal—a clear recipe for an arms race.

[6] U.S. Department of Defense, *Military and Security Developments Involving the People's Republic of China 2024* (December 18, 2024), 101, https://media.defense.gov/2024/Dec/18/2003615520/-1/-1/0/MILITARY-AND-SECURITY-DEVELOPMENTS-INVOLVING-THE-PEOPLES-REPUBLIC-OF-CHINA-2024.PDF.

[7] Federation of American Scientists, "America's Nuclear Weapons Arsenal 2024: Annual Overview Released By The Federation of American Scientists," May 7, 2024, https://fas.org/publication/nuclear-weapons-2024/.

Nuclear Multipolarity

Shifting geopolitical dynamics and the resurgence of competition among nuclear powers have raised questions about whether the fundamental assumptions of nuclear deterrence and strategic stability still hold in a multipolar nuclear order. While perspectives vary on whether the emerging nuclear landscape truly is multipolar—given that U.S. and Russian arsenals remain orders of magnitude larger than those of their nearest competitors—the prevailing view in Washington, as reflected in official U.S. strategy documents and expert reports, is that China has emerged as, and will continue to be, a near-peer or peer competitor, including in the nuclear domain. This distinctly American perspective, which frames current nuclear dynamics as a uniquely interdependent trilateral dilemma, reflects growing—though not universal—agreement in U.S. policy circles that China can no longer be considered a "lesser included case" in U.S. nuclear planning, with possible implications for how U.S. policymakers think about nuclear posture and policy and the prospects for and desirability of continued bilateral arms control based on numerical parity with Russia.

Whether those perceptions align with reality or not, it appears that the U.S. focus on the need and changing requirements for deterring both Russia and China will significantly affect the evolution of the nuclear relationships among the three countries. The prevailing view suggests that the strategies needed to deter one may not be effective for deterring the other or both at the same time, introducing additional layers of ambiguity and unpredictability into the nuclear deterrence relationships among the three nuclear powers. As the United States adjusts its nuclear posture and policies, the rationale for these changes may not be evident to Russia or China, who do not perceive a "three-body problem," but rather continue to view their nuclear relationships with the United States as bilateral. Even if the logic behind U.S. policies is made explicit, it is likely to be viewed with suspicion by leaders in Moscow and Beijing. In an environment of minimal dialogue where actions are driven by worst-case assumptions, this dynamic could trigger a dangerous spiral, further exacerbating arms race dynamics.

It will take time to understand the full implications of the evolving U.S.-Russia-China nuclear relationship, and experts and policymakers should approach the issue of how to manage the relationship with patience, humility, and flexibility. To some degree, the notion that the Cold War era was characterized by a stable bipolar nuclear order has always been more myth than reality. In hindsight, the U.S.-Soviet relationship was arguably never as stable as it appeared, as evidenced by the number of near misses when strategic stability and nuclear deterrence very nearly broke down. The concept of bipolarity is likely itself an oversimplification. Throughout the Cold War, both Washington and Moscow routinely juggled multiple complex relationships, including periods of high tensions with Beijing and instability and divergent perspectives among their respective allies, such as disagreements within NATO and uprisings within the Warsaw Pact. However, as the nuclear landscape becomes increasingly complex and regional tensions grow—including in the Middle East, South Asia, and the Asia-Pacific region more broadly—managing these evolving circumstances requires new strategies. When it comes to the U.S.-Russia-China nuclear relationships, whether viewed as one trilateral stability and deterrence problem or as a set of interlinked bilateral stability and deterrence problems, the net result is a more complex set of circumstances that will complicate and challenge the ability of each of these countries to apply tools and policies such as arms control, signaling, deterrence, and reassurance to enhance stability and security and prevent an arms race.

Horizontal Proliferation Pressures

The war in Ukraine, loss of confidence in security guarantees, and modernization and expansion of nuclear arsenals are key factors driving another challenge to the global nuclear order: the growing risk of additional countries pursuing their own nuclear weapons capabilities. The threat of proliferation is not new. North Korea's nuclear and missile programs have continued to advance for decades, and long-standing concerns about Iran's nuclear ambitions persist, raising the risk of onward proliferation should Iran's rivals in the region decide they need their own nuclear capabilities in response.

However, there is a clear sense that this risk is spreading because of a confluence of developments in the international system. Russia's invasion of a non-nuclear-weapon state, backed by nuclear threats, and its new nuclear doctrine announced in September 2024 are fueling security concerns among Euro-Atlantic countries and are undermining traditional assurances that nuclear-weapon states will not use or threaten to use nuclear weapons against non-nuclear-weapon states. In the Asia-Pacific region, China's nuclear expansion and North Korea's advancing nuclear and missile capabilities are driving perceptions of a worsening security environment. In addition, the long-standing bipartisan consensus in U.S. politics that supports maintaining a robust and extensive network of alliances and partnerships as a force multiplier and as a tool to prevent proliferation is not as robust as it once was, and allies have taken note. These developments, together with the geopolitical and regional threat environment, have led to doubts about the adequacy and long-term reliability of U.S. security guarantees, prompting more open discussions in the capitals of several U.S. allies about whether they might one day need their own nuclear weapons to ensure their security.

Emerging and Disruptive Technologies

While many of the challenges discussed in this report are familiar—and alarming in and of themselves—additional factors are straining the global nuclear order. The development, integration, and deployment of a range of emerging and disruptive technologies, along with the unprecedented pace at which some of these technologies are advancing, are likely to have significant implications for nuclear risks, the functioning of nuclear deterrence, and the future of arms control and risk reduction efforts.

These implications are not just theoretical. The use of advanced technologies in conflict is already ubiquitous, as evidenced by the ongoing wars in Ukraine and Gaza. Artificial intelligence (AI) and AI-enabled systems, hypersonic and precision-guided conventional weapons, space-based capabilities, and cyber operations are reshaping the battlefield. However, the implications of these technologies for nuclear deterrence, strategic stability, and the global nuclear order are not yet fully understood. All technologies have potential risks and benefits. But their introduction and uncertain ramifications complicate decision-making and crisis stability as legacy military systems become increasingly entangled with new capabilities. In addition, technological developments are not occurring sequentially; instead, they are evolving together in constant interaction, making it impossible to predict the impact of any one technology in a vacuum. These technologies are also advancing at an uneven pace across nations, potentially leading to imbalances or asymmetries in conventional or other emerging capabilities among competing states. Such asymmetries could drive states that are lagging behind to pursue or lean more heavily on nuclear weapons to compensate for perceived or actual shortcomings in conventional capabilities.

Risks associated with these technologies can be evolutionary by exacerbating existing pressures, such as further compressing decision times and increasing the likelihood of miscalculations or unintended escalation in high-pressure situations. But they can also be revolutionary by fundamentally disrupting the strategic landscape—for example, by making it easier to decapitate an adversary or threaten the survivability of second-strike capabilities.

In the nuclear realm, there is great potential for the military integration of AI, enhanced cyberattacks, disruptions of space assets, and other related developments to further complicate the ability of leaders to make timely decisions based on reliable information. Although some technological applications, such as AI-enabled C4ISR systems (command, control, communications, computers, intelligence, surveillance, and reconnaissance systems), have the potential to enhance situational awareness and contribute to informed decision-making, a significant acceleration of these processes, together with the opaqueness of the technology and the uncertainties about effective human-machine interaction, could potentially produce catastrophic results. By creating new vulnerabilities in communications channels and facilitating disinformation campaigns, AI could further undermine the reliability of information during a crisis as national leaders grapple with adversaries whose own processes have been accelerated by these same technologies.

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Advances in guidance systems, sensors, AI, and cyber capabilities could make nuclear forces—including, potentially, nuclear submarines, which have long been the backbone of reliable second-strike capabilities for key nuclear powers—more vulnerable to detection and attack. This raises fundamental questions about strategic stability, confidence in second-strike retaliatory capability, and the reliability and credibility of nuclear deterrence.

The fact that countries strive to maintain a technological edge is not new. However, the danger of the current moment lies in the convergence of growing complexity and ambiguity in the technological environment, worsening geopolitical and regional tensions, dangerous dynamics of confrontation and competition, and a lack of meaningful dialogue. Technological developments driven by the private sector are outpacing the ability of national governments—individually or collectively—to develop normative, legal, or regulatory structures and agreements and build a technologically savvy workforce to manage the associated risks and capitalize on the opportunities. This current climate creates challenges across the nuclear, strategic, and diplomatic space even as the exact impacts of these still-evolving technologies remain unpredictable.

Erosion of Global Disarmament and Nonproliferation Norms and Architecture

The convergence of these trends is accelerating the decline of the global architecture of arms control and nonproliferation agreements that have been central to managing nuclear risks during the last 20 years of the Cold War and the three decades of the post–Cold War period. Treaties and agreements once considered foundational to Euro-Atlantic security and to U.S.-Russian strategic stability, including the Anti-Ballistic

Missile Treaty, the Intermediate-Range Nuclear Forces (INF) Treaty, the Open Skies Treaty, the Treaty on Conventional Armed Forces in Europe (CFE), and the Vienna Document, have been abrogated, withdrawn from, suspended, violated, or ignored by one side or the other or both. As it stands, when New START expires in February 2026, U.S. and Russian strategic nuclear forces will be almost entirely unconstrained for the first time in 50 years. With the INF Treaty no longer in force following Moscow's deployment of intermediate-range missiles in violation of the treaty and the United States' subsequent withdrawal from the treaty, Berlin and Washington have recently agreed to deploy conventionally armed, long-range missiles in Germany in 2026. The Comprehensive Nuclear-Test-Ban Treaty (CTBT) has not yet entered into force, and there are fears that long-standing national moratoriums on explosive nuclear testing may be under threat in Russia, the United States, and elsewhere.

The NPT, long viewed as the cornerstone of the global disarmament and nonproliferation regime, is increasingly under duress, riven by divisions among the five nuclear-weapon states (NWS)—the P5 (China, France, Russia, the United Kingdom, and the United States)—recognized under the treaty, and by divisions among NWS and non-nuclear-weapon states (NNWS). Ongoing nuclear modernization and an increasingly one-sided pursuit of nuclear deterrence by nuclear-armed states are viewed as contrary to the spirit of disarmament, as codified by Article VI of the NPT. This divide is further exacerbated by Russia's refusal to separate dialogue or progress on nuclear risk reduction, arms control, and nonproliferation from Western support for Ukraine and broader discussions about the future of the Euro-Atlantic security architecture and China's recent acceleration of its nuclear weapons program. The perceived failure of the P5 to take seriously their Article VI obligations is fueling distrust and frustrations among NPT member states, especially in the Global South, and creating a deadlock that undermines the credibility and effectiveness of the treaty.

Threats from Non-State Actors

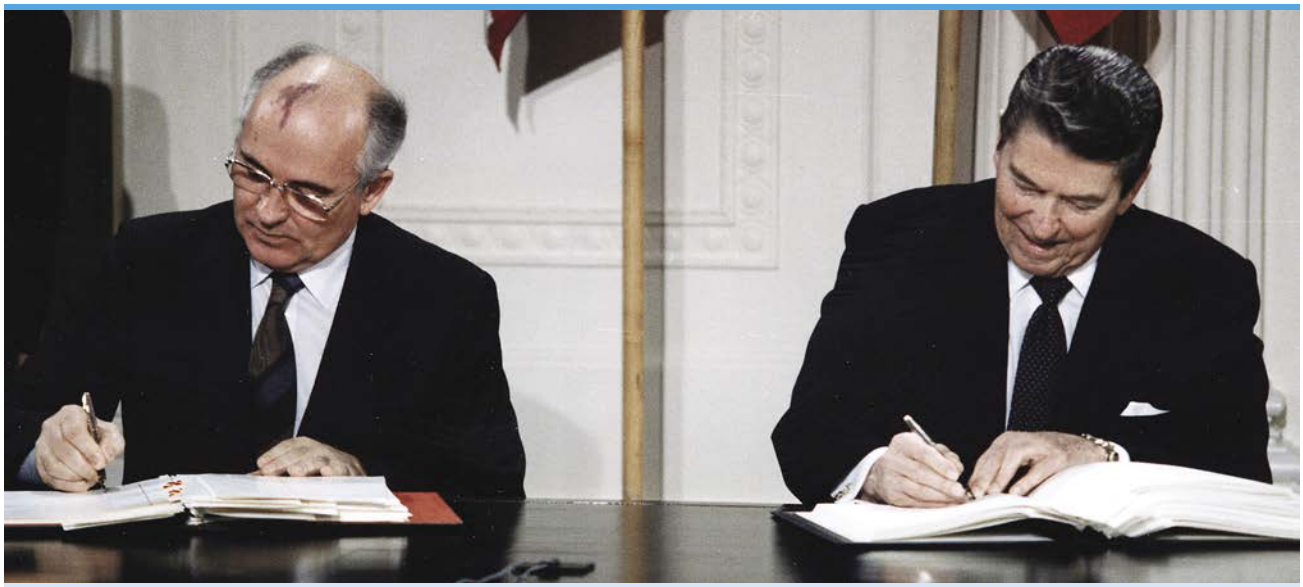
As highlighted by George P. Shultz, William J. Perry, Henry A. Kissinger, and Sam Nunn in a series of essays beginning in 2007, nuclear terrorism—whether through the acquisition of nuclear materials, a crude bomb, or a nuclear weapon—falls outside the conceptual framework of traditional nuclear deterrence. In an environment characterized by expanding nuclear arsenals, increasing global stocks of weapons-usable nuclear materials, the erosion of international agreements and cooperation to prevent proliferation, and the growing vulnerability of critical infrastructure, including nuclear facilities, sustained focus on mitigating risks from nuclear terrorism is more important than ever. The ability of terrorist groups to carry out sophisticated, coordinated attacks and their access to advanced technologies like unmanned aerial vehicles, AI, and large language models (LLMs) make this task both more challenging and more essential.

Growing Discontent with Inequity in the International System

Although the disconnect between nuclear haves and have-nots is not new, it is arguably more pronounced today than ever before, revealing deep-seated frustrations and growing impatience over the lack of progress on disarmament. These divisions reflect discontent with the inherent inequity of the global nuclear order and of the broader international system, and they raise critical questions about whose perspectives are valued, heard, and prioritized. An order that consistently ignores the security concerns of a large majority

of states naturally limits opportunities for political action and change. The Humanitarian Initiative[8] and the resulting Treaty on the Prohibition of Nuclear Weapons (TPNW), which went into force in 2021, exemplify the growing resistance to the nuclear status quo by those whose views and security concerns have been marginalized historically and their willingness to directly challenge the legitimacy of nuclear weapons and deterrence as contributors to international peace and security on the basis of the catastrophic humanitarian and societal consequences of these weapons. Backed largely by states from the Global South, as well as nongovernmental organizations and civil society, this initiative is becoming more vocal and empowered—particularly through the TPNW—in challenging power asymmetries in the current global nuclear order and stressing the inevitability of nuclear disarmament based on the ideas of intersectionality, rights-based approaches, and justice. These voices will likely continue to grow louder and demand progress through persistent struggle against existing structures and assumptions underpinning the policies and forces of nuclear-armed states.

[8] A group of non–nuclear-weapon states that "have sought to push nuclear disarmament forward by focusing on the severe humanitarian consequences of nuclear war." See "Treaty on the Prohibition of Nuclear Weapons (TPNW)," Overview, NTI, accessed December 3, 2024, www.nti.org/education-center/treaties-and-regimes/treaty-on-the-prohibition-of-nuclear-weapons/.



President Reagan and General Secretary Gorbachev signing the Intermediate-Range Nuclear Forces Treaty at the White House on December 8, 1987.

Section II. Managing Nuclear Risk in a Turbulent Time: Enduring Principles and New Approaches

These trends and challenges have disrupted the international system and put the world on a trajectory toward renewed nuclear competition and growing risk of nuclear use. In this scenario, global agreements (such as the NPT) teeter on the edge of ineffectiveness; bilateral arms control agreements lapse with no prospect for their revival; nuclear arsenals increase; norms against explosive nuclear testing and threats of nuclear use as a tool of coercion erode and eventually collapse; and a crisis—or multiple crises—could bring nuclear-armed states to nuclear use, with virtually no channels of dialogue to facilitate de-escalation. The guardrails that have prevented the spread and use of nuclear weapons will no longer exist, and the threshold for nuclear use will become lower. Leaders may act on the unproven assumption that nuclear weapons can be used in limited and controllable ways; they may believe that the use of nuclear weapons in some circumstances is not only justifiable but inevitable. This path's threat to the survival of humanity and the planet is incalculable and unacceptable.

There is a viable, and far preferable, alternative. It requires leaders—especially those in nuclear-armed states—to recognize and act on their unique ability and responsibility to chart a different path. As a first step, leaders of all states must urgently reaffirm and recommit to the core principles and norms that were

foundational to the global nuclear order of the past and that must endure as a foundation for managing the nuclear order of the present and future. If supported by concrete implementation steps and approaches fit for purpose today and into the future, these principles would vastly reduce the risk of nuclear use in the near term and underpin efforts to transform the global nuclear order over the longer term.

These principles do not require a dramatic reorientation of security interests or a meeting of the minds; in fact, they are necessary and useful precisely because no such revolution in global affairs appears to be on the horizon. Instead, the principles reflect self-interested fundamental beliefs and broad guidelines that should underpin nuclear policy and decision-making and therefore represent the baseline shared existential interest of states and humanity in self-preservation and avoidance of nuclear catastrophe. The principles can, if adopted and implemented, provide a strong framework for efforts to avoid the worst-case outcomes while the international system and the global nuclear order continue to be shaped by turbulence and friction.

Guiding Principles for Reducing and Managing Nuclear Risks

1. "A nuclear war cannot be won and must never be fought," and the "nuclear taboo" and 80-year record of nonuse must be maintained.
2. Nuclear disarmament must remain a shared goal of the international community, and continuous demonstrable progress toward the goal is essential for sustaining global nuclear order.
3. Communication and dialogue between states are essential in good times and bad.
4. Long-standing norms against nuclear proliferation and testing must be upheld and strengthened.
5. Nuclear risks require and deserve sustained leadership focus.

While upholding these principles remains essential for managing and reducing nuclear risks into the future, the means of doing so will necessarily differ from the past given the ongoing evolution in and stresses on the global nuclear order. Rapid technological developments, a changing geopolitical environment, and broader shifts in the international system introduce new complexities and questions. It would be myopic and foolhardy to assume that approaches to managing nuclear dangers should remain largely unchanged. To the contrary, the evidence suggests those approaches are no longer up to the task.

Any suitable framework for managing nuclear risks now and in the future must account for how the world has changed and will continue to evolve. While in this moment of transition it may be simple to conclude that the old architecture is no longer equal to the challenge, it will take time to fully define what should replace it. Nonetheless, it is possible to articulate baseline assumptions and steps for managing this period of turbulence and flux.

In this time of multipolarity, managing and reducing nuclear risks and the intersection of those risks with new technologies will require, inter alia:

- Participation and engagement of a broader array of nuclear-armed and non-nuclear-armed states in risk reduction and disarmament efforts
- More equitable inclusion and active engagement of non-nuclear-weapon states, including from the Global South, in shaping the nuclear order
- More flexible and adaptable mechanisms, venues, and forms of agreement for mitigating risks
- Greater exercise of unilateral restraint
- Steps to increase the amount of time leaders have to decide on nuclear use during a crisis and updates to policies, procedures, and guardrails to account for modern risks and technologies.
- Mechanisms to minimize the disruption that can be caused by outlier or uncooperative states
- Greater interaction between the private sector and governments to better understand rapidly evolving technological developments; the impact—both positive and negative—of those developments on nuclear weapons systems and strategic stability; and the technologies, guardrails, and governance mechanisms that may be needed to mitigate potential harms.

With these assumptions in mind, the next section provides specific recommendations to illustrate how the enduring principles identified in this report can be upheld and reinforced using a mix of familiar and new tools and approaches tailored to the evolving landscape.

1 "A nuclear war cannot be won and must never be fought," and the nuclear taboo and 80-year record of nonuse must be maintained.

The statement "A nuclear war cannot be won and must never be fought"—first articulated by U.S. President Ronald Reagan and Soviet leader Mikhail Gorbachev in 1985—reflects the foundational understanding that nuclear warfighting is a lose–lose proposition. In January 2022, the leaders of China, France, Russia, the United Kingdom, and the United States reiterated this declaration in a joint statement on preventing nuclear war and avoiding arms races.[9] While trust in this commitment was undermined by Russia's invasion of Ukraine just one month later and subsequent nuclear threats by Vladimir Putin, the statement underscored several logical conclusions that should follow from adhering to this principle. If taken seriously, the principle necessitates a comprehensive range of implementation measures, including upholding disarmament commitments, preventing nuclear proliferation, avoiding an arms race, and engaging in "constructive dialogue with mutual respect and acknowledgment of each other's security interests and concerns."[10]

The most urgent priority in reducing strategic and nuclear risks is to prevent any use of a nuclear weapon.

The most urgent priority in reducing strategic and nuclear risks is to prevent any use of a nuclear weapon. A nuclear war could occur due to accident, miscalculation, blunder, or the deliberate decision by a leader to order the use of a nuclear weapon. In recent decades, because the prospect of intentional nuclear use seemed remote, the primary focus of many nuclear-weapon states and experts has been on preventing nuclear use by blunder, and numerous agreements and practices have been undertaken by states with that aim in mind. Now, with increasing concern that a nuclear weapon might be used intentionally in a regional conflict, it is essential to devote greater attention to disincentivizing intentional nuclear use.

Discouraging and Disincentivizing Intentional Use

With increased competition among nuclear powers and the tensions emanating from Russia's war on Ukraine, there is real potential for future conflict between Russia and the United States, China and the United States, or both. Not only has Putin directly threatened nuclear use in the Ukraine conflict, but also there is increasing discussion in the governments and expert circles in all three countries about limited nuclear use options and the possibility of intentional use to gain a perceived military or political advantage. Theories about escalation management are just that—theories that, fortunately, have never been tested in practice. Wagering the future of humanity on these untested notions of how leaders would or should react in a conflict that escalates to nuclear use, and on the theory that limited nuclear use can be controlled and

[9] The White House, "Joint Statement of the Leaders of the Five Nuclear-Weapon States on Preventing Nuclear War and Avoiding Arms Races," January 3, 2022, https://bidenwhitehouse.archives.gov/briefing-room/statements-releases/2022/01/03/p5-statement-on-preventing-nuclear-war-and-avoiding-arms-races/#:~:text=We%20affirm%20that%20a%20nuclear,deter%20aggression%2C%20and%20prevent%20war.

[10] The White House, "Joint Statement of the Leaders of the Five Nuclear-Weapon States on Preventing Nuclear War and Avoiding Arms Races."

remain limited, is an unacceptably risky bet, which is why preserving and strengthening the nuclear taboo is so critical.

Disincentivizing intentional nuclear use by any state is a responsibility of the entire international community. It must not be the sole province of the elite club of five recognized nuclear-weapon states under the NPT or the nine states with nuclear weapons. All members of the international community have a voice and influence, and they must exercise these. Disruptive, noncooperative, or belligerent states must be isolated; and the peaceful majority must not be prevented from expressing their interests and will. Every state should make mutually reinforcing diplomatic declarations and statements, including to:

- **Publicly reaffirm a universal commitment to the inadmissibility of the use of nuclear weapons.** This reaffirmation could be done through some combination of unilateral, bilateral—including the United States and China, the United States and Russia, or both—and multilateral statements. Continued statements by the P5, the G7 (Group of Seven), the G20 (Group of 20), and other groupings on the "inadmissibility of the use of nuclear weapons" would be valuable, particularly if accompanied by concrete actions.
- **Clearly and consistently emphasize the unacceptability of nuclear use and possible consequences, in public and private.** All members of the international community must be consistent in communicating their interest in avoiding any use of nuclear weapons, both in their public statements and interactions with leaders of nuclear-armed states. Particularly in times of crisis, influential or trusted third-party actors could play a critical role in de-escalation and in dissuading leaders of nuclear-armed states from considering nuclear use.[11] This could include, to the extent possible, establishing and spelling out clear consequences for any use of nuclear weapons.
- **Acknowledge mutual vulnerability and embrace "mutual coexistence."** Key nuclear powers—in particular the United States, Russia, and China—must accept and acknowledge their mutual vulnerability. The United States and Russia have long accepted the fact that each is vulnerable to the other's nuclear deterrent. While U.S. policy documents have at times hinted at a similar recognition of vulnerability to China, U.S. officials have been reluctant to fully concede this point, possibly due to concerns about U.S. allies in the Asia-Pacific region or as a negotiating tactic, expecting some reciprocal concession from China. Given the number, diversity, and range of Chinese nuclear systems and the policy and technological limitations of U.S. missile defenses, it is difficult to argue that the United States could confidently preempt and prevent a credible Chinese second strike. Acknowledging as much would be a step toward reducing the logic of a burgeoning arms race.
- **Exercise restraint in nuclear rhetoric.** Threatening or implying the possible use of nuclear weapons for any purpose other than to deter the use of nuclear weapons is highly destabilizing and increases the risk of use. In particular, nuclear threats during a crisis can raise the risk of miscalculation and escalation. Such threats contribute little to stable deterrence and instead lower the threshold for nuclear use.

[11] While it's impossible to know whether or to what extent the interventions of Xi Jinping and Narendra Modi in fall 2022 influenced Putin's calculations about nuclear use—or whether Russia was seriously considering using a nuclear weapon—this type of engagement/diplomacy could prove useful in future crises.

- **Commit to ensuring the safety and security of civilian nuclear facilities in conflict.** The safety and security of nuclear facilities in times of crisis is an increasing concern. Weaponizing such facilities by seizing them or threatening to attack them in conflict as Russia has done in Ukraine poses a new, unacceptable category of nuclear risks. States must reexamine existing strategies for reducing the risk of catastrophe at nuclear facilities during armed conflict and natural disasters and explore additional steps that governments and international institutions can take to ensure that facilities are prepared to withstand future crises. Specific steps that states could take to preserve and strengthen this norm can be found in the May 2024 NTI paper, "Nuclear Facilities in Times of Crisis."

Preventing Use by Blunder

The risk of unintentional or accidental escalation is also growing, due to factors including increased tensions, lack of dialogue, the speed of warfare, and technological advances in cyber capabilities, AI, space, and other domains that are interacting with nuclear weapons systems. In an increasingly dynamic environment, leaders and those with responsibility for the safety, security, and operations of nuclear weapons must ensure the risks are considered, recognized, and mitigated. This can be done through unilateral policies, self-restraint measures, technical policies and procedures, and adherence to multilateral norms or agreements intended for this purpose. Such measures could include the following:

- **Increase decision time for leaders.** During a crisis, leaders of nuclear-armed states might have mere minutes to decide whether to order a nuclear strike. Forcing any leader to make such a consequential decision under enormous time pressure and likely with incomplete or unreliable information is a recipe for disaster. While the pursuit and integration of advanced technologies into nuclear weapons and command and control systems will continue—if not accelerate—in pursuit of strategic advantage, balancing that impetus with the goal of maximizing decision time, rather than further compressing it, will be crucial to reducing nuclear risks and blunders. The integration of AI-enabled systems to improve the accuracy and reliability of early warning systems and to enhance situational awareness and detect threats earlier could increase decision time. Changes to force structure and posture, including potentially reexamining the role of "use-or-lose" systems like silo-based ICBMs to reduce "launch on warning" dynamics, could also reduce time pressure. Mechanisms for routinely sharing data on ballistic missile launches from early warning systems in real time could also build confidence and increase decision time.

- **Conduct national fail-safe reviews.** All nuclear-armed states should conduct comprehensive reviews of their nuclear weapons and related policies and postures to ensure they are doing everything possible to mitigate the risk of nuclear use as a result of unauthorized use, accident, miscalculation, or blunder. Such reviews can be conducted unilaterally (the United States is currently conducting its first such review in more than three decades) and are in each state's national interest, making them a critical risk reduction step that can be taken even when bilateral or multilateral engagement is difficult. Given the pace of technological and geopolitical developments, reviews should be conducted periodically on a recurring basis.

- **Recognize and acknowledge that the intersection of emerging and disruptive technology with nuclear weapons presents risks and that experts' and policymakers' understanding and appreciation of those risks is still evolving.** An explicit, baseline acknowledgment of the potential

risks and a commitment to dialogue aimed at enhancing mutual understanding of those risks could be a valuable point of departure for engagement in bilateral and multilateral channels. In addition to providing clarity on the risks as currently perceived, the establishment of a forum (or multiple forums) for ongoing multistakeholder discussion would allow states to better understand and manage risks continuously—and allow them to evolve along with the challenges.

- **Mitigate risks of nuclear use through strategic restraint, transparency, and robust communication.** The growing entanglement of conventional and nuclear command and control, communication, and intelligence capabilities renders these systems increasingly vulnerable, both to kinetic and non-kinetic attacks, and raises the risk of miscommunication, miscalculation, and inadvertent nuclear use. Ukraine's attack on two Russian strategic early-warning radars in May 2024 represents one such example. At the same time, ongoing modernization efforts and the growing sophistication of cyber capabilities introduce new digital vulnerabilities that broaden the attack surface and threaten the uninterrupted functioning of nuclear weapons and related systems. As new technologies, in particular AI, become integrated into nuclear arsenals, keeping a "human in the loop" is welcome and necessary, but far from sufficient. As the technological complexity—and thus vulnerability—of nuclear C4ISR capabilities grows, leaders in nuclear-armed states need to exercise greater restraint and transparency and develop robust communication channels.
- **Establish adaptable mechanisms and venues for reviewing and updating guardrails and "rules of the road."** Managing this period of uncertainty will require best practices and norms that can be updated as circumstances change and new risks—or new understandings of existing risks—emerge. States will be reluctant to lock themselves into long-term agreements that are onerous to change, putting a premium on adaptability. In some (but not all) cases, practices or measures developed in the near term could serve as precursors to more enduring, binding measures in the future.
- **Increase engagement between governments and the private sector.** Fortunately, national governments have successfully maintained a monopoly on nuclear weapons. The same cannot be said for emerging technologies including AI, outer space capabilities, and cyber capabilities, where, in some cases, commercial development increasingly matches—and perhaps surpasses—state-sponsored development. Managing these technologies and their potential impact on nuclear and strategic risks will require governments to engage directly with the private sector to understand and develop ways to mitigate these potential challenges.

2 Nuclear disarmament must remain a shared goal of the international community, and continuous demonstrable progress toward the goal is essential for sustaining global nuclear order.

The goal of nuclear disarmament is fundamental to reducing nuclear risks, preventing nuclear use, and maintaining the NPT regime. For more than three decades starting in the mid-1980s, there was a steady decline in the number of nuclear weapons across the world and a sense that the trend lines would continue in that direction. That is no longer the case. China is expanding its arsenal. Russia has suspended participation in New START and is abstaining from new negotiations, introducing novel delivery systems, revising its

nuclear doctrine to increase the role of nuclear weapons, and potentially choosing to rely more on nuclear deterrence to compensate for the loss of significant conventional capabilities during the war in Ukraine. The United States is modernizing its nuclear forces and debating the need for additional weapons or new capabilities. A costly and dangerous new nuclear arms race—which now includes at least three states instead of just two—is beginning.

In addition to being a legal requirement under the NPT, nuclear disarmament remains the only surefire pathway to eliminate the risk of use of nuclear weapons in the long term. As long as nuclear weapons exist, the potential for use—whether intentional or accidental—persists. Nuclear-armed states must demonstrate their commitment to this ultimate objective and reinvigorate progress toward the goal by taking concrete steps to reduce the number of nuclear weapons and their role in national security strategies.

Toward those ends, the P5 and other nuclear-armed states should take the following steps:

- **The United States and Russia should continue to abide by New START limits through the treaty's expiration in February 2026 and beyond.** The United States and Russia should commit (1) not to exceed New START limits on strategic nuclear warheads and delivery systems after the treaty expires and (2) to initiate negotiations on a follow-on agreement. While a formal arms control agreement to succeed New START appears unlikely before the treaty expires, Washington and Moscow should make clear that neither side has any need or intention to exceed the central limits of the treaty even after it expires. This could take the form of an executive agreement between the two countries or political commitments made jointly or through parallel, unilateral statements, and could be monitored using national technical means. The two sides should also begin talks on a follow-on arrangement to preserve the limits on their arsenals and potentially further reduce those arsenals

- **The United States and China should identify and implement confidence-building mechanisms as a first step toward eventual engagement and action on arms control.** These mechanisms could include an agreement for advance notification of ballistic missile launches and the establishment of a U.S.-China "Nuclear Risk Reduction Center" link or similar mechanism for exchanging such notifications.

- **The P5 should conduct an in-depth exploration of "no first use" (NFU) policies.** Noting the considerable work needed to make NFU commitments credible and verifiable, serious and sustained dialogue within the P5 on the value of NFU policies and realistic pathways to implementation would represent an important step in showing good faith efforts toward disarmament. Willingness to explore and exchange views on NFU policies could be a potential avenue for engaging Beijing on nuclear issues given China's recent stated interest in a broader P5 NFU declaration or agreement. This process could begin with bilateral U.S.-China Track I or Track II dialogue, including dialogue on topics such as posture, policy, and other changes that would make NFU and other declaratory policy statements credible to a competitor or adversary. These discussions would require considerable efforts and engagement to avoid counterproductive outcomes, acknowledging and grappling with the well-known counterarguments, including verification challenges and concerns about the implications for extended deterrence and nonproliferation goals. As these discussions progress, they would need to be complemented by careful consultation with other key states, in particular among the United States and its allies who rely on U.S. extended deterrence.

- **Multilateral formats should play a continued—and perhaps expanded—role in managing challenges related to strategic stability and nuclear risks.** While the United States and Russia still retain by far the largest nuclear arsenals in the world, and can and should continue bilateral engagement to limit and perhaps modestly reduce their strategic nuclear stockpiles, the medium- to long-term future of nuclear arms control and risk reduction is almost certain to be multilateral. The track record of the P5 process is decidedly mixed when it comes to results, but it is the rare forum for dialogue on nuclear doctrine and posture that has survived the geopolitical tensions of recent years. For that reason alone, it is worth preserving and enhancing. But in a world of nine nuclear-armed states, the P5 process alone is not sufficient to reduce nuclear risks and advance nuclear disarmament. At some point, new and expanded multilateral formats will also be necessary to bring India and Pakistan into a broader dialogue, as well as other nuclear-armed states.

Diplomacy on nuclear issues and other strategic or existential risks should not be seen as a reward for good behavior but as a crucial mechanism for preventing misunderstandings, accidents, or blunders that could lead to a crisis, and for managing and preventing unintended escalation when crises do arise.

3 Communication and dialogue between states are essential in good times and bad.

Open and active channels of dialogue and communication must be established and sustained, especially between adversaries and amid intense competition or conflict. Diplomacy on nuclear issues and other strategic or existential risks should not be seen as a reward for good behavior but as a crucial mechanism for preventing misunderstandings, accidents, or blunders that could lead to a crisis, and for managing and preventing unintended escalation when crises do arise. In today's strategic environment, where priorities differ and challenges are numerous, states must be willing to engage on a broad spectrum of topics related to nuclear and strategic risks, including their own priorities and concerns as well as those of their competitors.

The current lack of dialogue between Russia and the United States and between China and the United States is dangerously detrimental to the global community's ability to manage complex and evolving nuclear relationships. Reviving and strengthening dialogue is essential to increase mutual understanding, manage differences, and find areas of common ground for cooperation and confidence-building. Such efforts could focus on the following:

- **Renewing dialogue among key states aimed at improving mutual understanding of security concerns and reducing misperceptions that lead to worst-case assumptions and planning.** This should include bilateral U.S.-Russia and U.S.-China engagement and, eventually, multilateral dialogue.
  - The United States and Russia must commit to "strategic stability" (or rather "strategic *instability*") talks, with the primary objective of understanding each other's security concerns even if formal arms control or risk reduction measures are not politically feasible in the near term.

  - Similarly, the United States and China suffer from fundamental misperceptions about each other's capabilities, intentions, and concerns. U.S. rhetoric about China as a "near-peer" nuclear power juxtaposed with U.S. unwillingness to accept mutual vulnerability with China may be sending mixed messages to Beijing. From Washington's perspective, the rationale behind China's unexpected nuclear expansion is at best opaque, fueling worst-case assumptions about the reasons for China's build-up and how large an arsenal China plans to field in the future. While formal arms control may be unlikely at this stage, enhanced dialogue, normative discussions, crisis avoidance, and risk reduction are more feasible objectives in the near term.

- **Pursuing dialogue on nuclear and strategic issues that is resilient to political disagreements and turmoil.** Strategic stability and arms control dialogues have never been the forum for resolving any and all geopolitical disputes; past progress has been possible precisely by compartmentalizing issues in a way that allowed for movement on reducing existential nuclear risks even amid political friction and conflict. Key states have frequently refused to follow this practice, with Washington curtailing strategic stability talks with Moscow following Russia's invasion of Ukraine; Moscow refusing to come back to the table as the war continues; and Beijing repeatedly abandoning nascent bilateral dialogues with the United States over the years to express dissatisfaction with other U.S. policies and actions.

- **Constructing a comprehensive agenda that encompasses strategic issues of concern for all parties, recognizing that progress may move at different speeds for different issues.** With the emergence of new technologies and the rapid advances made in existing domains, there are nuclear and non-nuclear capabilities that could have strategic impacts. This will require parties to be open to engaging on a wide range of issues and capabilities: nuclear capabilities, of course, but also missile defense; precision, long-range conventional strike capabilities; cyber threats to early warning and nuclear command and control; outer space assets; the integration of AI with military capabilities; and others. Nevertheless, states should recognize and be open to the likelihood that agreements, norms, and other measures that can reduce risks and enhance security may develop sooner in some of these baskets than in others.

- **Establishing, fortifying, and sustaining crisis communication channels at the operational and political levels.** Though such channels exist, they are frequently ignored, underused, or even cut off in times of crisis when they are most needed.

- **Managing new challenges with variable—and expanded—diplomatic geometry.** Multilateral group formats are likely to be necessary to facilitate dialogue and address key cross-cutting strategic challenges associated with emerging technologies. New and emerging capabilities are likely to be dispersed differently and perhaps more widely, requiring different actors to be engaged in managing associated challenges. While the P5 could provide a useful baseline of participants, additional states should be integrated as appropriate, along with essential expertise from the private sector.

  - As an example, a multilateral grouping of states and private-sector representatives could be convened for a dialogue dedicated to addressing military and civilian developments in outer space and their interrelationship. The significant reliance of nuclear powers on outer space assets for early warning, command and control, and other nuclear and strategic missions, combined with the rapid development of new technologies that could place those assets at risk

(intentionally or by accident) poses an urgent but insufficiently understood risk. Moreover, many states are dependent on civilian assets in space. This dialogue should encompass the dangers posed by potential weaponization of space, including recent reports on Russia's possible plans to place a nuclear weapon in space, as well as the potential challenges posed by the extensive and rapidly growing commercialization of space.

4 Long-standing norms against nuclear proliferation and testing must be upheld and strengthened.

Preventing the Spread of Nuclear Weapons to Additional Countries

For over half a century, preventing the further horizontal proliferation of nuclear weapons has been at the core of the NPT, reflecting a fundamental and widely shared recognition that nuclear risks will be harder to manage if nuclear weapons are more widely disseminated. Although the further spread of nuclear weapons has not been prevented entirely, the global nonproliferation architecture with the NPT as its cornerstone has been key to avoiding the most dire forecasts from the early nuclear age. However, this norm is increasingly under threat and in urgent need of reaffirmation, as a growing number of countries openly consider whether they might one day desire nuclear weapons in the face of a worsening geopolitical environment and the perceived unreliability or inability of other approaches to ensure security.

States could take the following steps to preserve and strengthen the norm against proliferation:

- **Reinvigorate dialogue and engagement to strengthen the strategic logic against proliferation.** Renewed efforts are needed to educate experts and political leaders—in countries with and without nuclear weapons—about the security rationale underpinning decades of nonproliferation policy, costs to countries that decide to pursue a nuclear weapons capability, and security risks that would come with further spread of nuclear weapons, even to "friendly" or "responsible" countries.
- **Highlight assurance and restraint as a necessary complement to deterrence.** Deterrence, or the threat of punitive action or retaliation, must be paired with assurances about the security benefits countries receive by not pursuing a nuclear weapons capability, including in the form of negative security assurances that states without nuclear weapons will not be subject to nuclear use or threats. This stick-and-carrot dynamic is increasingly out of balance, which risks reinforcing the perceived value of possessing nuclear weapons and underselling the risks of acquiring them.
- **Maintain and strengthen U.S. security assurances to allies.** While controversial in certain countries (and among some participants of this project), reliable U.S. leadership and security assurances have been critical counterweights to proliferation in both the Euro-Atlantic and Asia-Pacific regions. An erosion of U.S. leadership on this front could lead to allied proliferation and serious consequences—and heightened tensions—for numerous states across the globe, including states that have traditionally opposed U.S. extended deterrence guarantees.

Averting a return to explosive nuclear testing

The ongoing failure to bring the CTBT into force combined with mutual mistrust between the United States and China and the United States and Russia regarding compliance with the three-decade-old moratoriums on explosive nuclear testing raises concerns about the long-standing norm against nuclear testing. Russia's "de-ratification" of the CTBT in November 2023 has exacerbated this concern, despite Moscow's assurances that it has no intention of conducting a test. In the United States, public reports indicate that the U.S. government also discussed resuming testing in 2019,[12] and there have been more recent calls to resume testing by former U.S. government officials,[13] raising doubts about whether and for how long the United States will continue to uphold its moratorium. A resumption of testing by any of these states could prompt others to follow suit. Given the inextricable links between the testing moratoriums and the NPT, a resumption of testing would deal a devastating—potentially fatal—blow to the cornerstone of the global nonproliferation and disarmament architecture, lending urgency to the need for states to take steps to shore up this norm.

The decision to use or to not use a nuclear weapon ultimately rests with individual leaders in each of the nine nuclear-armed states.

States could pursue the following steps to preserve and strengthen the norm against explosive nuclear testing:

- **Issue high-level political statements reaffirming national testing moratoriums.** These could be joint statements by the P5, bilateral statements among key members of the P5, or unilateral assurances. Nuclear-armed states that are not part of the NPT should declare their commitment to refrain from resuming explosive nuclear testing, while non-nuclear-armed states should press for the reaffirmation and maintenance of moratoriums by all nuclear powers.
- **Develop and conduct reciprocal transparency and confidence-building measures related to nuclear test sites.** The United States, Russia, and China should engage in a dedicated dialogue to address specific concerns about test site activities and identify technical steps that each country could take to reassure others of compliance with their respective testing moratoriums. Building on recent U.S. proposals for test site visits, these measures should outline objectives, procedures, and specific steps to provide confidence that states are abiding by their moratoriums.

5 Nuclear risks require sustained leadership focus.

The decision to use or to not use a nuclear weapon ultimately rests with individual leaders in each of the nine nuclear-armed states. Each leader has the ability to unleash catastrophic destruction; accordingly, each has a solemn responsibility to do everything in their power to prevent such an outcome. Today, key leaders are veering into the very dangerous territory of threats, saber-rattling, nuclear arms racing, and military

[12] John Hudson and Paul Sonne, "Trump Administration Discussed Conducting First U.S. Nuclear Test in Decades," *Washington Post*, May 22, 2020; Julian Borger, "US Security Officials 'Considered Return to Nuclear Testing' After 29-Year Hiatus," *Guardian*, May 23, 2020.

[13] Robert O'Brien, "The Return of Peace through Strength," *Foreign Affairs*, July/August 2024.

conflict with unknowable consequences. Acting to reduce nuclear risks—including by implementing the recommendations in this report—will require leaders to swim against the strong geopolitical currents that are pushing them toward ever-increasing confrontation. It will require leaders to consciously and continuously prioritize steps to reduce risks; reject measures that ratchet up dangerous rhetoric and brinkmanship; and push their governments and militaries to take bold steps to exercise restraint, catalyze a more positive dynamic, and move the world toward a safer path.

At the same time, leaders of non-nuclear-armed states have a crucial role in reducing nuclear risks by leveraging their political capital and alliances to make clear that any nuclear use or threat is inadmissible and carries the risk of grave repercussions—for everyone, everywhere. Without consistent engagement from national leaders across the globe, the chances of nuclear use—whether intentional or accidental—vastly increase.

Alley of Flags leading to the Palais de Nations, which houses the United Nations Office in Geneva.

Section III: Transforming the Global Nuclear Order

As important as courageous leadership is for managing nuclear risks in the near term, it will be even more critical in driving the transition to a new, more sustainable global nuclear order. Even if all the principles and recommendations outlined thus far are adopted and implemented tomorrow, the risk that nuclear weapons could be used again remains. The threat or risk of nuclear use is not a "bug" that can be separated from the system; it is not even just a peripheral feature. Rather, the risk of use lies at the very heart of nuclear deterrence, which relies on the credible threat of mutual annihilation. If nuclear deterrence was robust in the past, it almost certainly will not be in the future. A global nuclear order built on nuclear deterrence will forever be at risk of catastrophic—potentially existential—failure.

For all that has been written about nuclear deterrence, it is inherently a gamble. The various actors perceive and interpret the theory differently, and failure to recognize this can lead to mistaken assumptions about how an adversary might behave when pushed into a corner during a crisis, react to escalation, and respond to another country's use of a nuclear weapon. It is no surprise that experts keep debating whether a given country would truly cross the threshold of use or is merely bluffing. There have already been numerous well-known near misses, and there have doubtless been others that have not yet come to light and maybe never will. Yet, little to no time is dedicated to the consequences of deterrence failure, considerations of which remain largely disconnected from nuclear policy and decision-making.

Humanity will remain in great peril as long as its continued existence relies solely on the capacity of a handful of individuals to act rationally, exercise good judgment, and make sound decisions under incredible stress and time pressure; on complex weapons systems, now entangled with new technologies, to operate as intended; and on technology itself to never falter or fail. As the world becomes more complex and less like the one in which the system of nuclear deterrence first emerged, a failure of deterrence—that is, the use of nuclear weapons—becomes more likely, if not inevitable.

The true lesson from nearly eight decades of living under the nuclear shadow is that humanity should not—indeed, cannot—go on like this indefinitely. Yet too many states—especially the nine nuclear-armed states—remain stuck on autopilot, content to maintain a narrow approach to security that divides the world into nuclear haves and have-nots and leaves no margin for error. Instead of treating recent disruptions in the nuclear order as a rationale for increasing reliance on nuclear weapons, leaders must recognize it as a flashing red warning light signaling the urgent need for a renewed examination of the assumptions, drivers, and risks of the nuclear system.

Overcoming the inertia of the current system will require bold leadership and a willingness to explore new ideas and solutions, take political risks, and adopt a more holistic concept of security that considers the increasingly transnational and intersectional nature of modern existential risks. It will not be easy, but it need not be impossible. In many ways, the public and civil society are well ahead of policymakers and national leaders in recognizing that the world has changed. While governments are spending trillions of dollars on legacy weapons they hope they will never have to use, their citizens are calling for leaders to prioritize actions to protect them against the immediate harms wrought by climate change, pandemics, and disruptive technologies. None of these challenges can be effectively addressed by countries acting alone—even the most powerful ones. However, the resurgence of competition among nuclear powers and the renewed emphasis on nuclear weapons competition hinder cooperation on the development of global solutions to meet these challenges.

Therefore, in addition to the important work of near-term risk reduction, parallel efforts should examine options for designing an alternative security system, creating space for inclusive dialogue, and exploring interdisciplinary approaches to make progress toward a world without nuclear weapons. While this project did not detail what this transformed nuclear order should look like, it did explore guiding concepts and principles for such a system and identified topics for further consideration in shaping an alternative system. That work should include the following key elements:

- **Designing an alternative security architecture:** Realizing and maintaining a world without nuclear weapons is a complex endeavor but not an impossible dream. Important work on the "irreversibility of nuclear disarmament" (e.g., within the framework of the NPT) is already underway and needs to be expanded upon. This should include a comprehensive examination of the political, institutional, legal, and technological requirements of a new security architecture guided by the principle that the consequences of system failure cannot threaten to end or fundamentally disrupt civilization. This may require new or reinvigorated security arrangements in key regions (including the Euro-Atlantic, Northeast Asia, South Asia, the Middle East, and elsewhere) as well as broader changes to the international system.

- **Reexamining the global effects of nuclear use:** Global systems have become complex and deeply intertwined, creating new vulnerabilities and increasing the risk of cascading system failures with potentially far-reaching consequences for the environment, the economy, and modern society. Building on the critical work to understand the climatic and agricultural effects of nuclear use, it is time to update and expand the base of scientific evidence on the consequences of deterrence failure to include the full range of downstream, second-order effects of nuclear war. The recent adoption of the UN resolution on Nuclear War Effects and Scientific Research is an important step in the right direction.[14] The consideration of the humanitarian, environmental, economic, and societal effects of nuclear use should be required due diligence for a high-risk, high-consequence strategy. In addition, it can serve as a tool to strengthen the nuclear taboo, connect the nuclear weapons issue to questions of social and intergenerational justice, engage diverse audiences, and foster a multidisciplinary and multistakeholder approach to nuclear risk reduction and disarmament.
- **Cross-applying overarching norms and principles between nuclear risks and other existential threats:** While the laws, norms, and principles traditionally governing nuclear weapons have been static or receding—with the notable exception of the TPNW—other spaces have experienced significant shifts in their normative frameworks and have spearheaded innovative approaches to increase accountability for harmful behavior, evidenced, for example, by the recent wave of rights-based climate litigation. There is a need for a thorough examination of how to reconcile global sustainability goals with the risk that the use of nuclear weapons could bring devastating environmental and climate effects; the principle of intergenerational justice with the short-sightedness of today's policy decisions; and the imperative to adhere to international humanitarian and human rights law with the past, present, and future harms caused by nuclear weapons.
- **Promoting respectful and inclusive dialogue:** Nuclear war threatens everyone, so discussions about nuclear weapons should reflect that. Most states neither possess nor seek nuclear weapons, and their security concerns are consistently marginalized or dismissed, perpetuating the existing inequalities in the order. Given the gravity of the consequences of nuclear weapons, individuals and states alike must approach the issue with humility, openness to dialogue, and respect for diverse perspectives.
- **Developing compelling narratives to engage the public:** With the end of the Cold War and the ensuing significant reductions in nuclear stockpiles, nuclear dangers largely receded from the public consciousness. While the fears and mass protests of the 1980s have faded, the risk of nuclear use and the catastrophic consequences remain very real. There is a need for new narratives and approaches to inform the public about the dangers and to catalyze their involvement in efforts to reinvigorate the movement to reduce and ultimately eliminate the threat of nuclear weapons. Whether the public realize it or not, they are shouldering the burden of nuclear risks; they should have a commensurate role in compelling leaders to better manage those risks.

[14] United Nations, "In 79 Separate Recorded Votes, First Committee Approves 24 Drafts on Nuclear Weapons, Including Traditional Text on Road Map to Nuclear-Weapon-Free World," press release, November 1, 2024, https://press.un.org/en/2024/gadis3754.doc.htm.

Conclusion

The global nuclear order is at a critical juncture and, in many ways, it is marked by a worsening state of disarray. Geopolitical tensions and intensifying strategic competition, amplified by technological advancements, have destabilized and undermined the international security environment. Russia's war of aggression against Ukraine has profoundly and irreversibly altered the European security architecture, with broader implications for global security dynamics. President Putin's repeated threats to use nuclear weapons in Ukraine not only carry a grave risk of nuclear escalation but also reinforce the perceived value of nuclear weapons as the ultimate guarantors of security. Together with the other drivers and risks outlined in this report, these threats have set into motion a dangerous erosion of international norms and agreements and the deterioration of guardrails that have contributed to preventing nuclear use for nearly 80 years.

However, to accept this trajectory as inevitable is to live with a future defined by existential risk—one where a single miscalculation or moment of blunder could lead to civilizational destruction. Decisions made today will impact generations to come. Instead of complacency, it is time for bold leadership to reduce the growing risks of nuclear use while laying the groundwork for a more sustainable security system capable of adapting to an evolving strategic environment. Leaders must take essential near-term steps to reduce the risk of nuclear use, such as recommitting to key principles and norms and adopting new tools and approaches to manage risks in this turbulent time, and they must initiate the long-term transformation of the global nuclear order toward a more resilient security architecture that builds a safer, more secure world for future generations.

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About the Authors

Patricia Jaworek is a director with NTI's Global Nuclear Policy Program, where she works to reduce the risk of nuclear use and to advance the goal of a world without nuclear weapons, focusing on the Euro-Atlantic security architecture and the global nonproliferation and disarmament regime. She also supports NTI's efforts to examine new risks from emerging and disruptive technologies and leads activities to advance understanding of the global and long-term effects of nuclear weapons use and their implications for nuclear policy. Previously, she held positions at the NATO Parliamentary Assembly in Brussels, focusing on NATO deterrence and defense policy, and at CRDF Global, where she helped develop solutions to mitigate the proliferation of CBRNE (chemical, biological, radiological, nuclear, and explosives) threats. Jaworek is a member of the Young Deep Cuts Commission (YDCC) and the Younger Generation Leaders Network on Euro-Atlantic Security (YGLN), where she collaborates with other leaders on the future of nuclear risk reduction and arms control. She holds a joint master's degree in transatlantic affairs from the Tufts University Fletcher School of Law and Diplomacy and the College of Europe, and a law degree from the University of Hamburg, specializing in European and public international law.

Mark Melamed is the deputy vice president of NTI's Global Nuclear Policy Program. In this role, he works on policies and programs related to nuclear arms control, strategic stability, and the global disarmament and nonproliferation regime. Before joining NTI, Melamed worked on arms control and security issues within the U.S. government. He served as deputy director in the Office of Multilateral and Nuclear Affairs at the U.S. Department of State, focusing on the development and implementation of U.S. nuclear policy in various United Nations forums, the Conference on Disarmament in Geneva, and the review process for the Treaty on the Non-Proliferation of Nuclear Weapons. From 2012 to 2014, he was the director for arms control at the National Security Council. He has also held positions at the State Department working on NATO defense policy, European security, and arms control issues, and he served as summit coordinator for the 2014 NATO Summit in Wales. Melamed began his government career as a Presidential Management Fellow at the Department of Energy. He was a Fulbright Fellow at the Polish Institute of International Affairs and holds an MPA from the Princeton School of Public and International Affairs and a BA from the University of Arizona.

Lynn Rusten is a national security consultant. She served as the vice president for NTI's Global Nuclear Policy Program from 2018 through 2024, where she led efforts to reduce the risk of nuclear weapons use, prevent their spread, and ultimately eliminate them as a global threat. With expertise in nuclear arms control, nonproliferation, and national security policy, Rusten has held senior positions in the White House, Department of State, and Congress. Before joining NTI in 2017, she served as the senior director for arms control and nonproliferation on the White House National Security Council staff and held key roles at the Department of State, including chief of staff for the Bureau of International Security and Nonproliferation and senior advisor in the Bureau of Arms Control, Verification and Compliance, where she led the interagency process supporting the negotiation and ratification of New START. Earlier in her career, she was a senior professional staff member on the Senate Armed Services Committee and director of the National Academy of Sciences' Committee on International Security and Arms Control, and she held

positions at the U.S. Arms Control and Disarmament Agency and the Congressional Research Service. Rusten holds an MS in national security strategy from the National War College, an MA in Russian and East European studies from the University of Michigan, and a BA in government with high honors from Oberlin College.

Steve Andreasen is a national security consultant to NTI and teaches courses on national security policy and crisis management in foreign affairs at the Hubert H. Humphrey School of Public Affairs, University of Minnesota. He served as director for defense policy and arms control on the National Security Council at the White House from February 1993 to January 2001. He was the principal advisor on strategic policy, nuclear arms control, and missile defense to the national security advisor and the president. During the George H. W. Bush and Reagan administrations, Andreasen served in the State Department's Bureau of Political-Military Affairs and the Bureau of Intelligence and Research, dealing with a wide range of defense policy, arms control, nuclear weapons, and intelligence issues.

About the Global Nuclear Order Project

In 2023, NTI launched the Global Nuclear Order project to consider the trajectory of nuclear and strategic risks and to identify steps that states could take to salvage or, if necessary, reconstruct the architecture for managing these challenges. Over the course of 12 months, NTI convened a series of nine virtual and in-person meetings, bringing together more than 60 experts from approximately 20 countries spanning the Euro-Atlantic and Asia-Pacific regions, including experts from each of the five nuclear-weapon states recognized under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT).

Through those discussions, participants explored the most urgent sources of nuclear and strategic risks, examined common and divergent interests of key countries, identified near-term actions to mitigate the worst effects of the dangerous prevailing dynamics, and began to scope and outline a framework for building a more stable order over the longer term.

This report reflects NTI's key findings from the project, including an overview of the challenges identified and concrete recommendations for addressing them. The steps laid out are urgent and necessary to halt and reverse the alarming deterioration of the strategic environment.

About the Nuclear Threat Initiative

The Nuclear Threat Initiative (NTI) is a nonprofit, nonpartisan global security organization focused on reducing nuclear, biological, and emerging technology threats imperiling humanity.

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