THINKING STRATEGICALLY ABOUT RISK REDUCTION: WHAT ROLE SHOULD IT PLAY IN A TWO-PEER SECURITY ENVIRONMENT?

ANNA PÉCZELI

May 2025

THINKING STRATEGICALLY ABOUT RISK REDUCTION

ANNA PÉCZELI

LIVERMORE PAPERS ON GLOBAL SECURITY No. 14
Lawrence Livermore National Laboratory
Center for Global Security Research
May 2025

Production Editor/Technical Editor: Kristine Wong Graphics/Cover Design Production: Thomas Reason & Catherine Lee

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory in part under Contract W-7405-Eng-48 and in part under Contract DE-AC52-07NA27344. The views and opinions of the author expressed herein do not necessarily state or reflect those of the United States government or Lawrence Livermore National Security, LLC. ISBN 978-1-952565-27-4 LCCN-2025908724 LLNL-MI-2003363
TID-83730-25

Thinking Strategically About Risk Reduction: What Role Should It Play in a Two-Peer Security Environment?

Anna Péczeli[1]

Table of Contents

1 The author is deeply grateful to Brad Roberts, Mike Albertson, Rupal Mehta, Lewis Dunn, John Warden, and George Perkovich for their invaluable feedback on earlier drafts. Their insights greatly improved this report.

About the Author

Dr. Anna Péczeli is a senior fellow at the Center for Global Security Research (CGSR) at Lawrence Livermore National Laboratory. She is also an affiliate at the Center for International Security and Cooperation (CISAC) at Stanford University. From 2019 to 2022, Anna was a postdoctoral research fellow at CGSR. Prior to that, she worked at Stanford University: in 2018-2019 she was a visiting postdoctoral research scholar at The Europe Center, and in 2016-2017 she was a Stanton nuclear security fellow at CISAC. In Hungary, she was a senior research fellow at the Institute for Strategic and Defense Studies at the National University of Public Service, an assistant lecturer at Corvinus University of Budapest, and an adjunct fellow at the Hungarian Institute of International Affairs. During her PhD studies, she held a visiting research fellowship at the Peace Research Institute Frankfurt, and a visiting Fulbright fellowship at the Nuclear Information Project of the Federation of American Scientists in Washington, DC. She earned a PhD degree in International Relations from Corvinus University of Budapest. Her research focuses on U.S. nuclear posture, the future of arms control and strategic risk reduction in a multi-domain environment, and extended nuclear deterrence in Europe.

Preface

Brad Roberts

As the international security environment has eroded over the last decade, nuclear dangers have risen. At the same time, concern has grown about our ability to manage, mitigate, and eliminate those dangers, given the dismantling of the arms control regime and the discovery of weaknesses in the U.S. deterrence posture. In this context, there has been an energetic search for updated strategies to reduce nuclear risk.

That search has revealed some important obstacles to updated strategies. First, "risk reduction" is one of those terms in the strategic lexicon that is used with great frequency but with varied meanings; greater clarity and a common usage would be useful. Second, the supposed lessons of the past are often invoked but seem little understood; a more systematic view is needed. Third, legacy approaches offer little leverage for risk reduction in the current security environment; tailored adaptation is needed. Policymaking to reduce nuclear dangers can be strengthened by addressing these challenges.

Dr. Anna Péczeli's Livermore Paper is designed to meet this need. With clarity and insight, it moves thoughtfully through a systematic review of definitions, historical context, and needed adaptations. It then offers fresh thinking about how to apply these lessons to improve policymaking and reduce nuclear dangers in the context of sustained major power rivalry. The result is pathbreaking.

The thinking reflected here took shape in a period spanning the Biden administration and the beginning of the second Trump administration and was finalized in April 2025. The views expressed here are those of

the author and should not be attributed to the Center for Global Security Research, Lawrence Livermore National Laboratory, or any of its sponsors.

Executive Summary

Over the past 10 years, the international system has changed in fundamental ways. An unprecedented multipolar and multi-domain competition emerged between the United States, Russia, and China—and the threat of major power war, including nuclear war, has returned. This led to renewed interest in using risk reduction to address nuclear dangers. However, despite the high profile of risk reduction, these tools have been unable to bring much needed relief in great power relations.

In this report, I argue that the risk reduction framework has not been effective in the current context, because most of the proposals are disconnected from the realities of the security environment. Risks cannot be properly understood outside of the context of the given security environment, and risk reduction approaches must continuously adapt to the changing nature of great power relations. I provide 10 principles that could guide such an adaptation and eventually lead to a more realistic and more feasible risk reduction framework.

The 10 principles are as follows:

1. *Formulating a universally accepted view of risk reduction priorities is unlikely* for three main reasons. First, many nuclear risks are poorly understood or underappreciated. Second, each nation looks at nuclear dangers through the lens of their own security perspective. And third, risk reduction efforts often result in asymmetric benefits. As a result, each nuclear possessor has a different assessment of risk reduction priorities, which makes it extremely hard to set a global agenda for risk reduction.

2. *An incremental approach is more likely to succeed than a comprehensive risk reduction agenda* because a one-size-fits-all solution does not exist. However, a step-by-step approach has the potential to trigger broader measures, and it can also help to involve new participants in the process.

3. *Successful implementation of cooperative risk reduction requires agreement* about the most dangerous outcomes that everyone wants to avoid, a general awareness of and an agreement about the risks that can cause those dangerous outcomes, and an agreement about the right tools to address them. Currently, great powers only agree about the first question. Reaching consensus over the remaining issues will require a sustained dialogue.

4. *There is enough convergence between the great powers to start a dialogue* because they all want to avoid a major nuclear war, and they are also interested in reducing the dangers of inadvertent escalation. This provides a good foundation to come to the table and discuss how they can advance cooperative security.

5. *Risk reduction approaches must continuously adapt to the changing security environment* because nuclear risks are not static, they dynamically change. Nuclear risks can emerge from many different sources therefore tailored and flexible solutions are needed that can rapidly adjust to new requirements.

6. *Nuclear risk reduction is inherently tied to non-nuclear constraints* because nuclear risks can emerge from other domains. Many risks are linked to the great powers' threat perceptions and most nuclear use decisions would probably consider the overall military strength of adversaries. As a result, nuclear risk reduction efforts cannot only focus on nuclear weapons.

7. *A better analytic approach is needed to build consensus among great powers.* Nuclear risks are difficult to quantify—there is no objective mechanism to judge what is the risk on any given day, and what degree of risk reduction would be achieved with a specific mechanism. The analytic toolkit is lacking here because of the blinders and biases in the communities looking at these problems.

This is problematic because great powers do not have the ability to accurately judge in every situation whether an action will be perceived as escalatory or not by their adversaries.

8. *Not all nuclear risks can be handled in a cooperative way* because risk has an ambiguous character in strategy. This means that states have very different levels of risk tolerance, and they also have different approaches to risk manipulation. As a result, there are a few areas where great power interests do not align, and cooperative mechanisms are unlikely to succeed. The only way to deal with these threats is to deter them, which means that deterrence must be considered an essential part of any comprehensive risk reduction strategy.

9. *Deterrence obligations can come into conflict with risk reduction and arms control* because risk reduction measures can sometimes trigger unintended negative outcomes. Due to these conflicting obligations, states have come to prioritize certain risk reduction solutions over other mechanisms, which can involve the acceptance of difficult trade-offs. As a result, states must identify the appropriate balance between deterrence, arms control, and risk reduction tools and reassess this balance as the security environment changes.

10. *There is a path forward even if adversaries refuse to cooperate.* First, deterrence strategies can be adapted to reduce nuclear risks. Second, states can pursue unilateral restraint. And third, closer collaboration with allies can play an important role in risk reduction.

These 10 principles reflect the enduring lessons of the past, the specificities of the security environment today, and the status of great power relations. They are meant to support the development of a systemic approach to risk reduction that builds realistic expectations of what role these mechanisms can play in a two-peer environment. Following these guidelines can help reduce the gap between the aspirational goals of risk reduction and its practical achievements.

Today's environment is more complex and dangerous than any time before, and the conditions for cooperative risk reduction simply do not exist. Thus, if great powers want to advance a risk reduction agenda, they should

start with creating the conditions for success and define what success means in the current context. Despite the many difficulties that cooperative security faces today, there is a positive path forward because there is agreement between the great powers on the desire to avoid major nuclear war and the wish to reduce the chances of inadvertent escalation. This suggests that the international community should keep striving for renewed dialogue.

Over time, that dialogue could help to create greater agreement on the most dangerous behaviors and practices, and the best mechanisms to deal with them. In the interim, there are several unilateral steps that the United States could take to avoid augmentation of nuclear risks, and U.S. leaders should encourage others to do so as well.

Introduction

The mechanism of nuclear risk reduction was born in the Cold War era, and its logic was closely connected to arms control and deterrence theory. Initially, risk reduction evolved hand in hand with the concept of arms control, and they were considered to be symbiotic tools of cooperative security. While risk reduction remains a loosely defined term even today, it is generally accepted that the goals of nuclear risk reduction include reducing the possibility that nuclear weapons are used, either intentionally or inadvertently, and if they are used, then minimizing the damage caused by these weapons.[2] During the Cold War period, the United States and the Soviet Union agreed on a number of important risk reduction mechanisms that provided guardrails to their competition. These bilateral measures were not only successful in addressing some of the most pressing dangers of great power competition, but they also provided a model solution to other regions and paved the way for more comprehensive multilateral mechanisms.

In the post-Cold War era, risk reduction had to adapt to the new realities of the security environment as the risk of major nuclear war was significantly reduced, and new types of threats emerged. In response, risk reduction expanded both in terms of scope and participants. New approaches were developed and there was also an important conceptual shift that disassociated risk reduction from arms control and deterrence.

Over the past 10 years, the international system has changed again in

2 Wilfred Wan, *Nuclear Risk Reduction: The State of Ideas* (Geneva: United Nations Institute for Disarmament Research, 2019). https://unidir.org/files/publication/pdfs/nuclear-risk-reduction-the-state-of-ideas-en-767.pdf. Accessed November 9, 2024.

fundamental ways, and there is renewed interest in using risk reduction to address nuclear dangers. As an unprecedented multipolar and multi-domain competition has emerged between the United States, Russia, and China, the threat of major power war, including nuclear war, has returned. At the same time, formal arms control mechanisms have severely degraded, and there is barely any functioning mechanism left to control nuclear dangers. In this complex and increasingly dangerous environment, the international community has been desperate for feasible solutions. This is how the profile of risk reduction has increased again, and the past few years have seen a lot of enthusiasm about the topic. International forums like the United Nations, the Nuclear Non-Proliferation Treaty (NPT) review cycles, the P5,[3] the Group of Seven (G7),[4] and other mechanisms all put the issue on their agenda and produced very ambitious plans to advance risk reduction measures. The great powers have also expressed a commitment to risk reduction as it aligned with their gradual step-by-step approach towards their disarmament obligation under the NPT. Parallel with these developments, academic attention on risk reduction has exploded.[5]

3 The five nuclear weapon states recognized by the NPT—China, France, Russia, the United Kingdom, and the United States.

4 The Group of Seven is an intergovernmental political and economic forum consisting of Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.

5 See for example, Lewis A. Dunn, "Managing Nuclear Risks in an Era of Strategic Confrontation," in Michael Albertson, ed., *Aligning Arms Control with the New Security Environment* (Livermore, CA: Lawrence Livermore National Laboratory, 2024), https://cgsr.llnl.gov/content/assets/docs/2024-0528-cgsr-cccasional-paper-aligning-arms-control.pdf (accessed October 9, 2024); Brad Roberts, ed., *Major Power Rivalry and Nuclear Risk Reduction: Perspectives from Russia, China, and the United States* (Livermore, CA: Lawrence Livermore National Laboratory, 2020), https://cgsr.llnl.gov/content/assets/docs/Major-Power-Rivalry-and-Nuclear-Risk-Reduction.pdf (accessed October 9, 2024); Brad Roberts, "On adapting nuclear deterrence to reduce nuclear risk," *Dædalus* 149, no. 2 (2020), pp. 69–83; Benoît Pelopidas and Kjølv Egeland, "The false promise of nuclear risk reduction," *International Affairs* 100, no. 1 (January 2024), pp. 345–360; Wilfred Wan, *Nuclear risk reduction—A framework for analysis* (Geneva: United Nations Institute for Disarmament Research, 2019), https://unidir.org/files/2019-11/nuclear-risk-reduction-a-framework-for-analysis-en-.pdf (accessed October 13, 2024); Wilfred Wan, ed., *Nuclear risk reduction: closing pathways to use* (Geneva: United Nations Institute for Disarmament Research, 2020), https://unidir.org/publication/nuclear-risk-reduction-closing-pathways-to-use (accessed October 9, 2024); Wilfred Wan, *Nuclear risk reduction: looking back, moving forward, and the role of NATO* (Rome: Istituto Affari Internazionali, 2020), https://www.iai.it/en/pubblicazioni/nuclear-risk-reduction-looking-back-moving-forward-and-role-nato (accessed October 9, 2024); James E. Cartwright, chair, *Global Zero Commission on Nuclear Risk Reduction: De-Alerting and Stabilizing the World's Nuclear Force Postures* (Washington, DC: Global Zero, 2015), https://www.globalzero.org/wp-content/uploads/2018/09/global_zero_commission_on_nuclear_risk_reduction_report_0.pdf (accessed October 26, 2024); Maxwell Downman and Marion Messmer, *Re-emerging Nuclear Risks in Europe: Mistrust, Ambiguity, Escalation and Arms-racing between NATO and Russia* (London: British-American Security Information Council, 2019), https://basicint.org/wp-content/uploads/2019/05/Risk-Report-Web-1.pdf (accessed October 26, 2024); Petr Topychkanov, "Taking forward the

Thus, the market for ideas is incredibly rich, but practical results are scarce. Given the high profile of risk reduction, it is baffling why these tools have been unable to bring much needed relief in great power relations. My aim is to uncover why the risk reduction framework[6] has not been effective in the current environment and what can be done to make it more successful. One of my key arguments is that nuclear risks cannot be understood without the broader security context, and thus risk reduction must adapt to the realities of the given environment. In the past, risk reduction measures successfully adapted to new circumstances, but adaptation has not yet occurred in this two-peer environment.[7] The current security environment is more challenging than any previous era, and the conditions for cooperative risk reduction simply do not exist. Therefore, I contend that if great powers want to advance a risk reduction agenda, they should start with creating the conditions for success and define what success means in the current context. The unique contribution of my approach is that it takes a systemic view of the risk reduction framework and explores what role it can realistically play in a competitive environment.

Despite the many difficulties that cooperative security faces today, there is a positive path forward—great powers can work to create the conditions for success, and they can also make progress through unilateral mechanisms. I provide a comprehensive list of recommendations on how to work towards cooperative measures, and how to advance risk reduction without adversary buy-in.

Regarding the scope, the report puts the emphasis on the United

dialogue on nuclear risk reduction," *Journal for Peace and Nuclear Disarmament* 4, no. 1 (2021), pp. 157–62; Sylvia Mishra, "The nuclear risk reduction approach: a useful path forward for crisis mitigation," Asia-Pacific Leadership Network (January 27, 2023), https://www.apln.network/analysis/commentaries/the-nuclear-risk-reduction-approach-a-useful-path-forward-for-crisis-mitigation-and-building-bridges (accessed October 9, 2024); John Gower and Christine Parthemore, *A practical strategy for nuclear risk reduction and disarmament* (Washington DC: Council on Strategic Risks, 2021), https://councilonstrategicrisks.org/2021/04/19/briefer-a-practical-strategy-for-nuclear-risk-reduction-and-disarmament-fulfilling-the-code-of-nuclear-responsibility (accessed October 9, 2024); Corentin Brustlein, *Strategic risk reduction between nuclear-weapons possessors* (Paris: Institut français des relations internationales, 2021), https://www.ifri.org/en/publications/etudes-de-lifri/proliferation-papers/strategic-risk-reduction-between-nuclear-weapons (accessed October 9, 2024); Rishi Paul, *Advancing strategic risk reduction in Europe* (London: The British American Security Information Council, 2020), https://basicint.org/wp-content/uploads/2020/06/European-Strategies-for-Strategic-Risk-Reduction-WEB.pdf (accessed October 9, 2024).

6 Generally understood as a broad set of cooperative and unilateral measures that aim to reduce the dangers of nuclear war and close the most likely pathways to nuclear use.

7 The term "two-peer environment" refers to the security context where the United States is faced with two nuclear-armed major powers, Russia and China.

States, Russia, and China, since they are the dominant actors in this two-peer environment, and they are also the largest producers and consumers of nuclear risks. However, great power relations are also shaped by the global context. Therefore, I outline the main efforts that multilateral institutions and other actors are taking, and there is a separate section on the role of U.S. allies.

The report is divided into five main chapters. The first chapter explores what is nuclear risk reduction and provides an overview of the state of play. It starts with an exploration of the theoretical foundations of risk reduction and explains the enduring lessons of Thomas Schelling's work. I then explore why risk reduction is trending again in the current environment. The next part talks about the definitional problems that are mostly due to the subjective nature of nuclear risks and the difficulties of measuring the likelihood of nuclear war. The following section explores the sources of nuclear risk through an analytical framework that is built on the different pathways to nuclear use. The last part highlights the main takeaways and provides some definitional clarity by outlining how I approach risk reduction in this report.

The second chapter gives a historical overview of past risk reduction efforts, and it compares how risk reduction was different in the Cold War from the era that followed. It closes with a few enduring lessons about past practices that still hold relevance for today's realities.

The third chapter is focused on the current security environment. It opens with an overview of global risk reduction efforts to show that there is a huge gap between the aspirational goals and the practical achievements. The next section takes a deep dive into the specific characteristics of the current security environment. I identify eight key challenges that hinder progress in risk reduction and conclude with a section on the policy implications of these challenges.

The fourth chapter starts with an overview of the U.S., Russian, and Chinese risk reduction agendas to demonstrate the key differences. The next part identifies the three main preconditions of advancing cooperative risk reduction and shows how two of them are completely absent today. The following section outlines how to build the conditions for cooperative success and provides several practical recommendations. The last part explores what the United States can do without its adversaries, and it examines three main lines of effort: unilateral restraint, deterrence adaptation, and working with allies.

The concluding chapter pulls all the strings together and it provides a list of first principles that should guide the great powers' approach to risk reduction in the current security environment. This builds on the enduring lessons of the past, the specificities of the international system today, and the status of great power relations. These principles are meant to support the development of a systemic approach to risk reduction that builds realistic expectations of what role these mechanisms can play in a two-peer security environment.

What is Nuclear Risk Reduction?

The Origins of the Concept

Nuclear risk reduction as a specific concept only became a common term in the 1980s. After Senators Sam Nunn and John Warner organized a bipartisan Congressional Working Group on Nuclear Risk Reduction, they made a proposal to establish "crisis control centers" in Washington, DC and Moscow.[8] The intended purpose of these centers was to exchange information on ballistic missile launches, nuclear accidents, and incidents at sea. They were also meant to provide a reliable channel to exchange information in peacetime, and to communicate in times of crisis and war. The U.S. Nuclear Risk Reduction Center (NRRC) was established by National Security Decision Directive 301 (NSDD-301)[9] in February 1988. Both risk reduction centers began formal operations on April 1, 1988.

Although the term was not commonly used before, the mechanisms of nuclear risk reduction have been in debate since the late 1950s and early 1960s. In this era, arms control and risk reduction emerged as alternative tools to the less realistic and more ambitious abolition movement. This conceptual shift in U.S. nuclear thinking was largely due to the influence of RAND Corporation strategists. Their unique methodology that combined

8 U.S. Department of State, "History of the NRRC," Archived Content (undated). https://2009-2017.state.gov/t/avc/nrrc/c26272.htm. Accessed October 7, 2024.

9 The White House, "National Security Decision Directive 301 (NSDD-301)," Ronald Reagan Presidential Library and Museum (February 22, 1988). https://www.reaganlibrary.gov/reagans/reagan-administration/nsdd-digitized-reference-copies. Accessed October 7, 2024.

mathematics, science, modeling, risk analysis and international affairs created a new scientific approach to strategy. While RAND analysts focused most on the competitive aspects of the nuclear era, Thomas Schelling thought that the Cold War competition was not necessarily a zero-sum game.[10] In fact, he argued that "while a nation's military force opposes the military force of potentially hostile nations, it also must collaborate, implicitly, if not explicitly."[11]

His writings are widely considered to be the intellectual foundation of both arms control and risk reduction.[12] In their seminal work, *Strategy and Arms Control*, Schelling and his co-author, Morton Halperin argued that pursuing cooperation and implementing arms control was possible, because "our military relation with potential enemies is not one of pure conflict and opposition."[13] They believed that there were many core objectives that were shared by both the United States and the Soviet Union, which could serve as the basis of engagement. These included: "the avoidance of war that neither side wants, in minimizing the costs and risks of the arms competition, and in curtailing the scope and violence of war in the event it occurs."[14]

Schelling and Halperin deliberately used a broad definition for arms control that included legally-binding or informal measures, unilateral or negotiated arrangements, and different tools that focus on specific weapons or behaviors. Anything that helped to avoid catastrophe was included under the umbrella of arms control. If one adopts this definition, most risk reduction

10 Fred Kaplan, *The Wizards of Armageddon* (New York, NY: Touchstone Book, 1983), pp. 330–331.

11 Thomas C. Schelling and Morton H. Halperin, *Strategy and Arms Control* (Mansfield Centre, CT: Martino Publishing, 2014), p. 1.

12 Although Schelling stands out as the most influential theorist on these topics, he worked in concert with other brilliant analysts who also made important contributions to the conceptualization of arms control and risk reduction. In the so-called "Charles River Gang" that comprised of Harvard and MIT academics, several different study groups were established to work on arms control. The group included Donald G. Brennan, Robert R. Bowie, Henry Kissinger, Jerome Wiesner, Paul Doty, Bernard Feld, Thomas C. Schelling, and Morton H. Halperin. Their intellectual work was also supported by Hermann Kahn, Edward Teller, and William Frye. The results of their study group meetings were published as a special issue of the *Dædalus* journal, an edited volume by Brennan, and the Schelling-Halperin book *Strategy and Arms Control*. These resources became a primer for students and practitioners alike, and President Kennedy later called the 1960 *Dædalus* special issue "the Bible" of the subject. Donald G. Brennan, ed., *Arms Control, Disarmament, and National Security* (New York, NY: George Braziller, Inc., 1961). See more about the history of these early efforts in Michael Krepon, *Winning and Losing the Nuclear Peace* (Stanford, CA: Stanford University Press, 2021), pp. 59–60.

13 Thomas C. Schelling and Morton H. Halperin, *Strategy and Arms Control*, p. 1.

14 Ibid., p. 1.

mechanisms become part of the broader arms control framework. However, in the post-Cold War period, these two terms were disassociated. Due to the success of formal arms control agreements, policymakers developed a much narrower understanding of arms control, and it became synonymous with treaty-based measures that set limits on the development, deployment, and use of nuclear weapons. A great example is Senator Deb Fischer's speech at the Center for Strategic and International Studies in April 2019, where she explained that "when I refer to arms control I mean treaty-based reductions in nuclear arms, which is what I believe most people today think of when they hear that phrase arms control."[15]

Since this understanding of arms control is still dominant in policy circles, arms control and risk reduction became two separate approaches to security—the former imposes legally-binding limits on nuclear arsenals, and the latter is a complementary mechanism that includes less formal measures to reduce nuclear dangers and advance stability. While risk reduction elements might still be included in arms control treaties, risk reduction can also be pursued independently. These concepts also differ in the sense that arms control is based on the underlying assumption that mutually beneficial cooperation between adversaries is possible even in the midst of heightened political and military competition.[16] Risk reduction, on the other hand, is not necessarily cooperative. Risk reduction measures do not always require a partner, they can be implemented unilaterally. For example, increasing transparency of doctrine and forces to reduce the likelihood of misunderstandings, or demonstrating operational restraint are traditionally seen as unilateral forms of risk reduction. Another difference is that risk reduction puts a high premium on preventing undesired outcomes, while arms control is about seeking limits on military capacity.

Schelling saw both of these mechanisms as tools to stabilize competition, and he did not see them in the context of disarmament. He was generally skeptical about the feasibility and desirability of nuclear abolition for two main reasons. First, he thought that it was possible to stabilize nuclear

15 Deb Fischer, "The Future of Arms Control: Keynote Address by Senator Deb Fischer," Center for Strategic and International Studies (April 3, 2019). https://www.csis.org/analysis/future-arms-control-keynote-address-senator-deb-fischer-r-ne. Accessed October 14, 2024.

16 Corentin Brustlein, *Strategic risk reduction between nuclear-weapons possessors*, p. 13.

deterrence between the two superpowers under certain conditions.[17] And second, he was worried about the risk of cheating and the threat of creeping rearmament.[18] Therefore, instead of advocating for complete disarmament, Schelling emphasized the importance of a gradual approach that builds on incremental steps of arms control and risk reduction. He believed that reducing stockpiles and banning certain types of weapons was a less risky, more realistic, and overall better strategy to manage nuclear dangers.[19]

His greatest intellectual contribution to this topic was the core argument that nuclear risks can be managed. As he noted in 1961, "Man's capability for self-destruction cannot be eradicated—he knows too much! Keeping that capability under control—providing incentives that minimize recourse to violence—will require eternal skill and vigilance."[20] In his writings, he contended that military strategy was basically bargaining strategy, and he viewed arms control as a "proper part of" national military strategy since the "purposes of arms control are not different from the purposes of a national military strategy."[21] Thus, in his view, arms control was not contradictory to the notion of deterrence. In fact, he saw a role for both arms control and deterrence in reducing nuclear risks. On the arms control side, Schelling's main focus was on stabilization instead of pure numbers. He argued that while reductions would potentially make sense in certain areas, greater

17 He identified this balance as "a situation in which the incentives on both sides to initiate war are outweighed by the disincentives" and the relationship is "reasonably secure against shocks, alarms and perturbations." Thomas C. Schelling and Morton H. Halperin, *Strategy and Arms Control*, p. 50.

18 As he wrote in 1961, "Just as the absence of war today does not make war impossible tomorrow, total disarmament tomorrow would not make rearmament impossible the next day." He was afraid that abolition would only increase nuclear risks because those who rebuild first would be able to secure significant advantages, and they would be incentivized to use nuclear weapons for coercion and war termination. Thomas C. Schelling, "The future of arms control," *Operations Research* 9, no. 5 (1961), p. 724; and Thomas C. Schelling and Morton H. Halperin, *Strategy and Arms Control*, p. 61.

19 Ibid., pp. 49–61.

20 Thomas C. Schelling, "The future of arms control," p. 731.

21 Ibid., p. 727.

stability could require a build-up in others.[22]

On the deterrence side, he argued that the "deliberate creation of a recognizable risk of war, a risk that one does not completely control, deliberately letting the situation get somewhat out of hand, harassing and intimidating an adversary by exposing him to a shared risk"[23] could help to keep conflicts under control and compel the adversary to capitulate. This strategy, that came to be known as brinkmanship, advocated for the deliberate manipulation of risks to control escalation and to reduce the dangers of an all-out nuclear war.[24] Schelling acknowledged that the practice of nuclear deterrence carried grave dangers, but he also believed that it was possible to achieve stability and manage risks through a mix of cooperation and competition. Although nuclear abolition provided a path to eliminate those dangers, Schelling was concerned that it would only introduce new and different threats. On balance, he concluded that managing nuclear deterrence was more realistic and feasible than pursuing complete nuclear disarmament.

His thinking made a lasting impact on U.S. nuclear policy in two major ways. First, the core idea that a well-crafted deterrence strategy is a possible tool to reduce nuclear risks remains an influential theme even today. And second, the premise that effective nuclear deterrence requires the presence of certain risks became a generally accepted truth about the nature of nuclear deterrence. As a result, security in the nuclear age became inherently tied to continuous risk management. Due to Schelling's theoretical work, by the

22 He was primarily interested in the qualitative aspects of arms control that was built on the recognition of common interests, and driven by the ultimate goal of "reducing the incentives that may lead to war or that may cause war to be the more destructive in the event it occurs." His central idea of the "balance of terror" was built on the premise that if both sides had the capacity for a devastating retaliation, the risk of mutual annihilation would deter states from attacking each other. Therefore, he argued that the most stable types of forces are "secure, slow-reacting retaliatory forces with minimal capabilities for preclusive attack." In the meanwhile, arms control efforts should focus on banning first-strike forces that pose a high risk of accidental or uncontrolled escalation. He also emphasized the importance of establishing effective verification mechanisms to ensure compliance with arms control measures and advocated for transparency and communication measures to build trust and facilitate a better understanding of each other. Thomas C. Schelling and Morton H. Halperin, *Strategy and Arms Control*, p. 3; and Thomas C. Schelling, "The future of arms control," p. 724.

23 Thomas C. Schelling, "The Threat that Leaves Something to Chance," RAND Corporation Historical Documents (August 10, 1959), p. 18. https://www.rand.org/content/dam/rand/pubs/historical_documents/HDA1600/HDA1631-1/HDA1631-1.pdf.

24 The paradox of this concept, however, is that it requires states to bring any crisis to the brink of war to coerce the other side to de-escalate, which creates an inherent tension between the ultimate goals (pursuing stability and trying to avoid wars) and the means (a strategy that is built on extreme risk-taking). Partly due to this controversy, the United States never truly embraced brinkmanship as an official strategy.

early 1960s arms control and risk reduction became the new organizing principle to replace general disarmament.[25] Schelling's work was influential in U.S. policy circles because he was a close advisor of Secretary of Defense Robert McNamara, and also because it was the right time to make a shift in the debate. First, the disarmament project was not moving forward after the failure of the Baruch Plan. Second, the United States was on the cusp of major force structure changes (for example, the forward deployment of non-strategic nuclear weapons in Europe, or the deployment of submarine-launched ballistic missiles) that introduced new types of risks that required some mitigation. And third, there was growing public pressure to end nuclear testing in the atmosphere. In light of these trends, a new approach was needed that held the promise of success even under the conditions of competition and was able to address the gravest dangers associated with the possible use of nuclear weapons and the ongoing arms race.[26]

The Big Comeback of Nuclear Risk Reduction

Since 2014, the most dominant feature of the security environment has been major power rivalry. Both Russia and China have emerged as direct competitors to the United States with revisionist ambitions in the U.S.-backed regional security orders. In addition to these problems, the United States also must deal with a nuclear-armed North Korea, and the challenge of Iran on the threshold of acquiring nuclear weapons. The United States has never faced so many nuclear competitors. In this multipolar environment, it has become much harder to devise a strategy that can address all these threats, and account for the possibility that nuclear escalation might emerge simultaneously in multiple theaters. These problems are compounded by emerging multi-domain challenges that have weakened the firebreaks between conventional and nuclear warfighting and introduced several new slippery slopes towards nuclear escalation.[27] As a result of these trends, nuclear risks are on the rise, and analytical work on risk reduction has exploded in the past few years. Although there is a lot of interest in the topic, there is no

25 Michael Krepon, *Winning and Losing the Nuclear Peace,* p. 60.

26 Ibid.

27 James N. Miller Jr. and Richard Fontaine, "A New Era in U.S.-Russian Strategic Stability: How Changing Geopolitics and Emerging Technologies are Reshaping Pathways to Crisis and Conflict," Center for a New American Security (September 2017). https://s3.amazonaws.com/files.cnas.org/documents/CNASReport-ProjectPathways-Finalb.pdf?mtime=20170918101504. Accessed October 9, 2024.

general consensus on what role nuclear risk reduction can play in this new environment.

In general, there are three main factors that have contributed to the growing demand signals for risk reduction solutions: 1) the renewed competition between great powers; 2) the demise of "traditional" arms control mechanisms; and 3) the polarization of the nuclear debate.

The renewed competition between great powers

Currently, great power relations are at their lowest point since the end of the Cold War. Both Russia and China are actively trying to challenge the U.S.-led international order, hoping to disrupt and ultimately displace it. Their long-term goal is to create a system that is more accommodating to their authoritarian regimes and their revisionist agendas.[28] A central element of Russia's and China's approach to competition with the United States is a major expansion of their military capabilities that includes both nuclear and non-nuclear assets. Their successful modernization campaigns have increased their willingness to take risks, and also led to more provocative actions in their respective regions. Given the growing assertiveness of their foreign policy conduct, direct confrontation between the great powers has become more likely.

In this competitive security environment, great powers are primarily focused on seeking strategic advantages over each other, and the willingness to cooperate is extremely low. They are also generally suspicious of each other's intentions, and there is a lack of trust in all directions. Under these circumstances, the international community has recognized the need for action, and most multilateral arms control forums have put nuclear risk reduction on their agenda. While increased attention on the topic in diplomatic circles has played an important role in the growing prominence of the risk reduction framework, the menu of feasible options remains very limited.

28 See more about this in Madelyn R. Creedon, Jon L. Kyl et al., *America's Strategic Posture—The Final Report of the Congressional Commission on the Strategic Posture of the United States,* Institute for Defense Analyses (October 2023), https://www.ida.org/research-and-publications/publications/all/a/am/americas-strategic-posture (accessed October 10, 2024); and Brad Roberts, *On Theories of Victory, Red and Blue,* Livermore Paper No. 7 (Livermore, CA: Lawrence Livermore National Laboratory, 2020), https://cgsr.llnl.gov/sites/cgsr/files/2024-08/CGSR-LivermorePaper7_0.pdf (accessed October 10, 2024).

The demise of "traditional" arms control mechanisms

The second factor is the crumbling of the traditional treaty-based arms control architecture. In the past few years, it has become fashionable to talk about the death of arms control.[29]

After Russia's annexation of Crimea in 2014, it became clear that President Putin was losing interest in upholding the European security order, which included a number of political commitments and formal arms control arrangements. Moscow's violation of a neighboring country's sovereignty, and its disregard of the security assurances it promised in the 1994 Budapest Memorandum were a clear indicator that Russia's national security objectives were increasingly in tension with many of its legal obligations. As a result, Russia has gradually dismantled almost all arms control agreements.

In the case of the Intermediate-Range Nuclear Forces Treaty (INF), Russia started its covert program in the mid-2000s to develop a missile that later became a compliance concern. Starting in 2014, the United States officially raised concerns about the SSC-8 ground-launched cruise missile in the Special Verification Commission and tried to pursue a diplomatic path to bring Russia back to full and verifiable compliance. Since these efforts did not lead anywhere, and Russia decided to openly deploy multiple battalions of the new SSC-8 missile (which was a clear violation of the agreement), the United States withdrew from the INF Treaty in 2019.[30]

Although the 1991-1992 Presidential Nuclear Initiatives (PNIs) are not legal agreements, they have led to the most dramatic reductions in U.S. and Russian nuclear forces. Russia, however, never fully implemented its promises under these political commitments, and it continues to deploy

29 See, for example, Ward Wilson, "Why nuclear arms control is dead," *The Hill* (July 9, 2021), https://thehill.com/opinion/national-security/561786-why-nuclear-arms-control-is-dead/ (accessed October 10, 2024); Ulrich Kühn, "Why Arms Control is (Almost) Dead," Carnegie Europe (March 5, 2020), https://carnegieeurope.eu/strategiceurope/81209 (accessed October 10, 2024); Alexei Arbatov et al., "Expert Survey: Is Nuclear Arms Control Dead or Can New Principles Guide It?" Belfer Center for Science and International Affairs, Harvard Kennedy School (July 30, 2019), https://www.belfercenter.org/publication/expert-survey-nuclear-arms-control-dead-or-can-new-principles-guide-it (accessed October 10, 2024); and Christopher A. Ford, "Dead or Deferred? Nuclear Arms Control in an Age of Revisionism," in Michael Albertson, ed., *Aligning Arms Control with the New Security Environment* (Livermore, CA: Lawrence Livermore National Laboratory, 2024), https://cgsr.llnl.gov/content/assets/docs/2024-0528-cgsr-cccasional-paper-aligning-arms-control.pdf (accessed October 9, 2024).

30 Christopher A. Ford, "Dead or Deferred? Nuclear Arms Control in an Age of Revisionism;" and U.S. Department of State, "Russia's Violation of the Intermediate-Range Nuclear Forces (INF) Treaty," Office of the Spokesperson—Fact Sheet (December 4, 2018), https://2017-2021.state.gov/russias-violation-of-the-intermediate-range-nuclear-forces-inf-treaty/ (accessed December 16, 2024).

nuclear warheads on ground-launched tactical missiles.[31]

In the case of the Conventional Forces in Europe Treaty (CFE), Russia has partially suspended the agreement in 2007, and then it fully suspended implementation in 2015 because NATO refused to ratify the Adapted CFE Treaty until disputes over Georgia and Moldova were fully settled.[32] Finally, in May 2023, Russia announced its withdrawal from the CFE Treaty.

Since 2011, Russia has also blocked any attempt to update the Vienna Document, and in March 2023, Russia announced that it is no longer sharing any information about its armed forces, which is a clear violation of its obligations under Chapter 1.[33]

In the case of the Open Skies Treaty (OST), Russia has used its territorial disputes over Abkhazia and South Ossetia to prevent certain verification flights by NATO members, and restricted flights over Kaliningrad. The Trump administration argued that these violations reduced the overall value of the agreement and announced the U.S. withdrawal from the agreement in 2020.[34]

In 2023, Russia has also suspended the New Strategic Arms Reduction Treaty (New START—NST), citing hostile U.S. policy towards Moscow and threats against its national security.[35] Despite the suspension of the agreement, the United States and Russia have both announced their intent to continue adhering to the quantitative central limits of New START.[36] However, the treaty is going to expire in February 2026, which means that unless a new treaty is concluded, U.S. and Russian strategic nuclear forces will no longer be under any legally-binding limit.

31 U.S. Department of State, "Report to the Senate on the Status of Tactical (Nonstrategic) Nuclear Weapons Negotiations Pursuant to Subparagraph (a)(12)(B) of the Senate Resolution of Advice and Consent to Ratification of the New START Treaty" (April 16, 2024). https://2009-2017.state.gov/t/avc/nrrc/c26272.htm. Accessed October 10, 2024.

32 Kingston Reif, "Russia Completes CFE Treaty Suspension," *Arms Control Today* 45, no. 3 (2015), p. 5.

33 Gabriela Iveliz Rosa-Hernández, "How Russia's retreat from the Vienna Document information exchange undermines European security," *Bulletin of the Atomic Scientists* (March 24, 2023). https://thebulletin.org/2023/03/how-russias-retreat-from-the-vienna-document-information-exchange-undermines-european-security/. Accessed October 10, 2024.

34 Kingston Reif and Shannon Bugos, "U.S. Completes Open Skies Treaty Withdrawal," *Arms Control Today* 50, no. 10 (2020), pp. 27–28.

35 Shannon Bugos, "Russia Suspends New START," *Arms Control Today* 53, no. 2 (2023), pp. 24–25.

36 Arms Control Association, "New START to Expire in Two Years as Russia Refuses Talks," ACA Nuclear Disarmament Monitor (February 2024). https://www.armscontrol.org/blog/2024-02/nuclear-disarmament-monitor. Accessed December 19, 2024.

Similarly, Russia has withdrawn its ratification[37] of the Comprehensive Nuclear Test-Ban Treaty (CTBT) in 2023, arguing that the lack of U.S. ratification created an imbalance between the two states, and accusing the United States of violating its testing moratorium. This step has followed years of U.S. concerns about Russian non-compliance with the CTBT's zero-yield standard and Moscow's own nuclear testing moratorium.

According to the U.S. State Department's annual Compliance Report, Russia is also in violation of the Chemical Weapons Convention (CWC), and the Biological Weapons Convention (BWC) by maintaining illegal chemical and biological weapons programs and using illegal chemical agents in assassination attempts worldwide.[38]

As a result of these deliberate steps to undermine the global arms control architecture and the European security order, there is barely any legal framework left to govern conventional and nuclear armaments. Given the increasingly hostile relations between great powers, Russia's poor track record in treaty compliance, and China's refusal to join any official arms control negotiations, it is going to be incredibly difficult to conclude new formal arms control mechanisms in the near term. And even if a new agreement was concluded, domestic divisions in the United States and the general lack of trust towards adversaries might still sink the agreement in the ratification phase. Therefore, a new approach is needed to control the increasingly risky competition between the United States, Russia, and China. Many believe that less formal risk reduction measures are more suited for this environment, and they could provide much-needed practical solutions to the most stressing nuclear dangers. As William Alberque noted after the adoption of the 2022 NATO Strategic Concept, "Arms-control optimism is now gone; pessimism has set in; Russia is a threat; China is a challenge; and risk reduction and crisis prevention are the preferred tools, alongside deterrence

37 Maxim Starchak, "Russia's Withdrawal From the Nuclear Test Ban Treaty Is an Own Goal," Carnegie Politika (October 24, 2023). https://carnegieendowment.org/russia-eurasia/politika/2023/10/russias-withdrawal-from-the-nuclear-test-ban-treaty-is-an-own-goal?lang=en. Accessed October 10, 2024.

38 U.S. Department of State, "Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments," Bureau of Arms Control, Deterrence, and Stability (2024). https://www.state.gov/adherence-to-and-compliance-with-arms-control-nonproliferation-and-disarmament-agreements-and-commitments/. Accessed October 10, 2024.

and defence, for safeguarding the Alliance."[39]

The polarization of the nuclear debate

The third reason why nuclear risk reduction is trending again is the increased polarization of the nuclear debate. With the end of the Cold War, there was a lot of optimism that disarmament might become achievable. The conclusion of the first START Treaty, the success of the PNIs, the opening for signature of the CTBT, the entry into force of the CWC, and the beginning of negotiations for a Fissile Material Cut-Off Treaty (FMCT) were all promising signs that the tides were turning. The 2000 NPT Review Conference laid out an ambitious 13-step agenda[40] to advance non-proliferation and global disarmament. The following years, however, did not live up to the promise of the 1990s. The 2005 NPT Review Conference failed, the United States withdrew from the Anti-Ballistic Missile Treaty (ABM) in 2002, and momentum has generally slowed.

There was another short wave of optimism followed by the 2007[41] and 2008[42] *Wall Street Journal* op-eds of George P. Shultz, William J. Perry, Henry A. Kissinger, and Sam Nunn who came out in support of making practical measures towards global zero. This brief moment of optimism persisted through the first two years of the Obama administration, but it ran into major roadblocks after 2010. Despite the new administration's commitment to reduce the role of nuclear weapons, the conclusion of the New START Treaty and the success of the 2010 NPT Review Conference, the dismay of disarmament advocates started to grow again as they saw the Obama administration's commitment to a comprehensive nuclear modernization effort, the only modest reductions of the New START Treaty,

39 William Alberque, "The new NATO Strategic Concept and the end of arms control," International Institute for Strategic Studies (June 30, 2022). https://www.iiss.org/online-analysis/online-analysis/2022/06/the-new-nato-strategic-concept-and-the-end-of-arms-control/. Accessed October 10, 2024.

40 "2000 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons Final Document," United Nations Office of Disarmament Affairs (May 19, 2000). https://disarmament.unoda.org/wmd/nuclear/npt2000/. Accessed October 10, 2024.

41 George P. Shultz, William J. Perry, Henry A. Kissinger, and Sam Nunn, "A World Free of Nuclear Weapons," *The Wall Street Journal* (January 4, 2007). http://online.wsj.com/news/articles/SB116787515251566636. Accessed October 10, 2024.

42 George P. Shultz, William J. Perry, Henry A. Kissinger, and Sam Nunn, "Toward a Nuclear-Free World," *The Wall Street Journal* (January 15, 2008). https://www.wsj.com/articles/SB120036422673589947. Accessed October 10, 2024.

and the crumbling chances of the U.S. CTBT ratification after the painfully long New START process.

In response, non-governmental organizations were searching for new ways to influence the debate and put pressure on nuclear weapon states. In this regard, civil society pressure and campaigning have always weighed asymmetrically on nuclear weapon states. While authoritarian regimes managed to stay mostly immune to these types of pressures, the leaders of Western democracies have always had to be more responsive to popular demand. Accountability of political leaders in open societies generally means that democracies make a better target for grassroots campaigns and civil society pressures. This was no different in the case of the abolition movement that largely focused on pressuring the United States and its allies all over the world.

After 2010, civil society efforts have led to a series of conferences[43] on the humanitarian effects of nuclear weapons, and they have eventually paved the way to the adoption of the Treaty on the Prohibition of Nuclear Weapons (TPNW)[44] in 2017, with 122 states voting in favor of the agreement.[45] The effort to adopt the agreement was led by the International Campaign to Abolish Nuclear Weapons (ICAN) that aimed to use the ban treaty to stigmatize nuclear weapons, and mobilize public opinion against nuclear weapons.[46]

At the core of this approach is the belief that sooner or later nuclear deterrence will fail that could lead to devastating consequences for everyone, and in a competitive environment like the current one this outcome is more likely to occur.

Nuclear weapon states and their allies have repeatedly opposed the

43 So far, there have been four conferences on the Humanitarian Impact of Nuclear Weapons (HINW): Oslo, Norway (2013), Nayarit, Mexico (2014), Vienna, Austria (2014), and Vienna, Austria (2022). See more about this in Rebecca Davis Gibbons, "The humanitarian turn in nuclear disarmament and the Treaty on the Prohibition of Nuclear Weapons," *The Nonproliferation Review* 25, no. 1–2 (2018), pp. 11–36; Tom Sauer and Joelien Pretorius, "Nuclear Weapons and the Humanitarian Approach," *Global Change, Peace & Security* 26, no. 3 (2014), pp. 233–250; and Marianne Hanson, "Normalizing Zero Nuclear Weapons: The Humanitarian Road to the Prohibition Treaty," *Contemporary Security Policy* 39, no. 3 (2018), pp. 464–486.

44 "Treaty on the Prohibition of Nuclear Weapons," United Nations Treaty Collection (July 7, 2017). https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVI-9&chapter=26. Accessed October 10, 2024.

45 Rebecca Davis Gibbons, "The humanitarian turn in nuclear disarmament and the Treaty on the Prohibition of Nuclear Weapons."

46 Ibid.

approach of the TPNW, and their engagement with the process remained limited and sporadic. As NATO member states publicly stated, the ban treaty is "at odds with the existing nonproliferation and disarmament architecture, risks undermining the NPT, is inconsistent with [NATO's] nuclear deterrence policy and will not enhance any country's security."[47]

The frustration of ban supporters about the lack of progress on the disarmament project (that is enshrined in Article VI of the NPT) has also trickled into the broader NPT fora, and it has deepened the divisions among the different camps. While nuclear weapon states remain committed to the NPT and continue to advocate for a gradual disarmament approach, skepticism is growing whether these promises can be believed and if the NPT is the right framework to advance the disarmament project.[48] In the long run, these growing divisions could become very problematic as they could derail future non-proliferation and disarmament efforts in the NPT review cycles. This could also lead to defectors from the agreement and ultimately undermine the whole NPT regime.[49]

In this highly polarized environment, nuclear risk reduction emerged as a possible tool that could help to build bridges between the different communities by the promise of reducing the most stressing nuclear dangers and pulling arms control out of the current deadlock, without forcing nuclear weapon states to abandon nuclear deterrence. As Gareth Evans, former Australian Foreign Minister and co-chair of the International Commission on Nuclear Non-proliferation and Disarmament, argued

> In an environment where the achievement of "Global Zero" remains manifestly out of reach for the indefinitely foreseeable future, it makes sense for those advocating a nuclear-weapon-free world not to make the best the enemy of the good. Rather, we should focus on nuclear risk reduction, finding common ground with those policymakers who may be uncomfortable abandoning what they still see as the ultimate deterrent and security guarantor, but

47 North Atlantic Treaty Organization, "Brussels Summit Declaration" (July 11, 2018). https://www.nato.int/cps/en/natohq/official_texts_156624.htm. Accessed October 10, 2024.

48 Joelien Pretorius and Tom Sauer, "Is it time to ditch the NPT?" *Bulletin of the Atomic Scientists* (September 6, 2019). https://thebulletin.org/2019/09/is-it-time-to-ditch-the-npt/. Accessed October 11, 2024.

49 Rebecca Davis Gibbons, "Addressing the Nuclear Ban Treaty," *The Washington Quarterly* 42, no. 1 (2019), pp. 27–40.

> nonetheless understand all the risks involved with nuclear weapons possession and want to minimise them.[50]

The message that "the moment is not right for abolition but given the intense competition, something needs to be done to reduce risks" is strikingly similar to the arguments of Schelling in the 1960s.

Nuclear Risk Reduction in the Eye of the Beholder

Despite the growing prominence of the concept, nuclear risk reduction remains a loosely defined term that means different things to different people. It is generally accepted that the goals of nuclear risk reduction are to reduce the possibility that nuclear weapons are used, either intentionally or inadvertently, and if they are used, then the goal is to minimize the damage caused by these weapons.[51] However, there is no agreement about which measures and mechanisms are most useful to achieve these goals, which nuclear risks are the most dangerous, and what is the primary source of these dangers. In general, there are two main problems with the term that make it extremely difficult to create a universally accepted understanding of nuclear risks. First, nuclear risks are subjective, and second, measuring nuclear risks is extremely difficult. As a result of these challenges, several different risk reduction approaches emerged.

The challenge of subjectivity

Regarding the problem of subjectivity, states perceive a different set of risks based on their geographic location, regional power structure, their own military strength, their alliances, and a number of other historical, cultural, and domestic political factors. A country like South Korea, which is in the crosshairs of two antagonistic nuclear powers, is going to have a fundamentally different perception of nuclear risks compared to a country like Argentina, which is situated in the middle of a nuclear-weapon-free zone. Based on these factors, states also have a different sense of the nature of risks. States in an antagonistic relationship with a nuclear power are more likely to prioritize the risks of intentional use, while others might worry more about accidental use scenarios. What types of risk a state judges to be the

50 Gareth Evans, "Framing Paper prepared for ANU Crawford Leadership Forum Panel Discussion," Australian National University (September 6, 2021). https://www.gevans.org/journals/ACLFSept2021FramingPaperFinRev28vi21.pdf. Accessed October 10, 2024.

51 Wilfred Wan, *Nuclear Risk Reduction: The State of Ideas.*

most urgent really affects how it prioritizes the necessary risk reduction measures.

Thus, it is no surprise that nuclear risk perceptions are strikingly different among great power rivals (and sometimes they are also misaligned between the United States and its own allies).[52] In many cases, these states have a different view of what actions carry the gravest dangers of nuclear escalation, and they also disagree over who is responsible for generating nuclear risks. While a country may think that it is taking unilateral measures to reduce nuclear risks, it might be perceived by others as a deliberate step to undermine their deterrence credibility. Each nuclear weapon state developed its own policies and practices in nuclear operations, and they are not equally transparent about these, which in itself could generate nuclear risks.[53]

A global view of nuclear risks is also difficult to formulate because the terms "risks," "dangers," and "threats" are often used interchangeably, but they sometimes mean different things to different actors.[54] Each nation looks at these problems through the lens of their own security perspective, national objectives, and strategic culture. As a result of increased interest in risk reduction, numerous proposals have been put forward by academics and politicians as well. But in light of these diverse perspectives, risk reduction approaches must be adaptable, and they must account for these different strategic circumstances.

The challenge of measuring the likelihood of nuclear use or nuclear war

The second issue with nuclear risk reduction is measuring the likelihood of nuclear use or nuclear war. In a quantitative approach, "risk" can be understood as a function of probability and consequence of an adverse event—in this sense, nuclear risks are generally considered to be "low probability-high consequence" risks.[55]

52 Brad Roberts, "Introduction," in Brad Roberts, ed., *Major Power Rivalry and Nuclear Risk Reduction: Perspectives from Russia, China, and the United States* (Livermore, CA: Lawrence Livermore National Laboratory, 2020). https://cgsr.llnl.gov/content/assets/docs/Major-Power-Rivalry-and-Nuclear-Risk-Reduction.pdf. Accessed October 11, 2024.

53 Wilfred Wan, *Nuclear Risk Reduction: The State of Ideas.*

54 Brad Roberts, "Introduction."

55 Wilfred Wan, *Nuclear Risk Reduction: The State of Ideas*; Benoît Pelopidas and Kjølv Egeland, "The false promise of nuclear risk reduction;" and Richard K. Betts and Matthew C. Waxman, "The president and the bomb: reforming the nuclear launch process," *Foreign Affairs* 97, no. 2 (2018), pp. 119–128.

Probability can be described in a qualitative way (unlikely, very likely, highly probable, remote possibility, etc.), or in many cases it can be quantified. In terms of consequence, the adverse event includes fatalities, injuries, physical damage to structures, economic damage, psychological effects, etc.[56]

There have been some notable attempts to quantify nuclear risks. For example, the *Lugar Survey on Proliferation Threats and Responses*[57] tried to measure the likelihood of nuclear risks through surveying a group of experts. The results were published in 2005, and surprisingly, the answers span across the whole spectrum from 0-100%. Considering that statistically only one range can be the right answer, this wide distribution shows that most experts were actually wrong about their pick. This is partially explained by the lack of bias control in the survey, and also by some mistakes in the design of the survey.[58] Another well-known example in the nuclear community is the *Bulletin of the Atomic Scientists*' Doomsday Clock.[59] The clock was established in 1947, and it has become a symbolic indicator of the likelihood of nuclear war. The clock was originally set at seven minutes to midnight, and it has been periodically set back or forth, depending on the strategic environment. Although the organization publishes some explanation for why the clock is set a certain way, an actual scale has never been defined. In recent years, its risk assessment has also been broadened to include climate change and developments in life sciences. Thus, the Doomsday Clock is rather a metaphor, not a mathematically sound indicator of nuclear risks.

Practitioners and academics have also occasionally talked about probability estimates. For example, John F. Kennedy in 1962 said that there was a 1 in 3 chance that the Cuban missile crisis could have escalated to nuclear war. Graham Allison in 2004 said that the probability that terrorists will detonate a nuclear bomb was "more likely than not." The same year, William Perry said that the odds were 50-50 that this would happen within the next decade. Matthew Bunn in 2007 estimated this threat to be 29% within

56 James Scouras, "Framing the Questions," in James Scouras, ed., *On Assessing the Risk of Nuclear War* (Laurel, MD: Johns Hopkins Applied Physics Laboratory, 2021), p. 5.

57 Richard G. Lugar, *The Lugar Survey On Proliferation Threats and Responses*, report available at the Federation of American Scientists (June 2005). https://irp.fas.org/threat/lugar_survey.pdf. Accessed October 11, 2024.

58 James Scouras, "Framing the Questions," pp. 6–7.

59 *Bulletin of the Atomic Scientists*, "A moment of historic danger: It is still 90 seconds to midnight" (January 23, 2024). https://thebulletin.org/doomsday-clock/. Accessed October 11, 2024.

the next decade, while David Albright put the number to be less than 1%.[60] The wide range of these estimates suggests that most of these analyses suffer from the same shortcomings as the Lugar survey—they are intuitive, or they are based on simple analysis. In a more recent attempt, Martin Hellman used probabilistic risk assessment to provide a more objective judgement of the risk of major nuclear war.[61] He concluded that the probability of a full-scale nuclear war was on the order of 1% per year. At the same time, he also noted that this is only the beginning of the process of applying probabilistic risk assessment to nuclear deterrence, and there is still room for future refinement.

Given all the difficulties associated with the objective quantification of nuclear risks, analysts generally trend towards a qualitative assessment of nuclear dangers and simply judge whether nuclear risks are high or low, or whether they are rising or declining in a certain period. A good example is President Biden's argument that "the risk of nuclear Armageddon is at the highest level since the 1962 Cuban Missile Crisis."[62]

Within the U.S. government, there are many agencies that conduct nuclear risk assessment. For example:

- The Defense Threat Reduction Agency (DTRA) maintains the Department of Defense's nuclear war consequence models.
- U.S. Strategic Command recently developed a qualitative tool, called the "Risk of Strategic Deterrence Failure" (RoSDF) to assess the estimated impact of diplomatic, informational, military, and economic factors on the risk of deterrence failure.
- The Department of Homeland Security's (DHS's) Science and Technology Directorate (S&T) is responsible for developing and maintaining the capability to perform terrorism risk assessments of weapons of mass destruction.
- The Intelligence Community (IC) provides analysis to characterize

60 James Scouras, "Framing the Questions," pp. 11–12.

61 Martin E. Hellman, "Probabilistic Risk Assessment," in James Scouras, ed., *On Assessing the Risk of Nuclear War* (Laurel, MD: Johns Hopkins Applied Physics Laboratory, 2021), pp. 85–100.

62 Zeke Miller, "Biden says nuclear 'Armageddon' at highest risk since Cuban Missile Crisis," *PBS News* (October 7, 2022). https://www.pbs.org/newshour/politics/biden-says-nuclear-armageddon-at-highest-risk-since-cuban-missile-crisis. Accessed October 11, 2024.

and understand threats to the United States. Those responsible to develop strategy may use these intelligence reports to develop their own "intel-driven assessments" or "intelligence-informed leadership judgment."[63]

According to a recent report by the National Academy of Sciences (NAS), many federal agencies hold relevant expertise and authority to contribute to a better analytic approach to nuclear risks, but certain changes are needed to fully exploit these competencies. While risk analysis is a useful tool to develop strategy and guide policy and decisions, much more could be done to capture a wider range of consequences and vulnerabilities. For example, nuclear risk assessments should include escalatory risks from other types of threats, such as chemical, biological, and cyber weapons. Responding to an imminent nuclear crisis, and planning for future crises also requires better coordination among federal agencies. Thus, the NAS report made a recommendation to establish an interagency integrated deterrence risk analysis capability "to guide the implementation and management of integrated deterrence, especially as it relates to nuclear war."[64]

Altogether, there have been many attempts to quantify nuclear risk, but they all have their shortcomings due to the blinders and biases in the communities looking at these problems. Objective quantification in this increasingly complex environment has become much harder, which makes it more challenging for nuclear possessors to devise the right strategies and avoid mistakes in a future crisis.

The different approaches to nuclear risk reduction

Although the problems of subjectivity and measurement have made it challenging to clearly define the parameters of nuclear risk reduction, conceptual fuzziness might have contributed to the popularity of the framework. Paradoxically, the lack of definitional clarity has allowed a lot of freedom to interpret nuclear risk reduction in different ways, which made this approach popular in very different camps. Along these lines, there are four main approaches to nuclear risk reduction.

63 National Academy of Sciences, *Risk Analysis Methods for Nuclear War and Nuclear Terrorism* (Washington, DC: National Academies Press, 2023), pp. 12–13.

64 Ibid., p. 14.

The Different Approaches to Nuclear Risk Reduction
1. Risk reduction is an interim step towards complete disarmament
2. Risk reduction is a bridge solution towards arms control
3. Risk reduction is a tool to stabilize deterrence
4. Risk reduction skeptics

The first approach emphasizes that nuclear risk reduction is an interim step towards complete disarmament, and it generally takes a long-term view, focusing on the end goal. The logic of this approach is that risk reduction is essential to address the most pressing nuclear dangers, but at the same time, these measures are just stepping stones towards disarmament. For example, in a 2021 strategic framework released by the Council on Strategic Risks, the authors developed a 21-step roadmap towards irreversible nuclear disarmament, arguing that "Individually, each of the 21 actions presented in this paper would help reduce nuclear risks that are growing ever more dangerous. Together, they form a clear but flexible path forward that states can and should pursue immediately. [...] Their successful pursuit will pave the way for further future steps toward disarmament, such as the eventual elimination of strategic nuclear weapons."[65] Generally, this approach sees weapons themselves as inherent risks, so risk reduction focuses on reducing weapons stockpiles.

While many advocates of disarmament judge that risk reduction is a useful tool to advance their agenda, not everyone shares this view. Influential members of the ban movement see risk reduction as a stalling tactic by nuclear possessors who are only interested in maintaining their deterrence postures, and do not have any intention of living up to their Article VI

65 Christine Parthemore and Rear Admiral John Gower, "BRIEFER: A Practical Strategy for Nuclear Risk Reduction and Disarmament," Council on Strategic Risks (April 19, 2021). https://councilonstrategicrisks.org/2021/04/19/briefer-a-practical-strategy-for-nuclear-risk-reduction-and-disarmament-fulfilling-the-code-of-nuclear-responsibility/. Accessed October 11, 2024.

commitment under the NPT.[66] Thus, they are rather skeptical about the utility of the risk reduction framework.

The next approach generally adopts a short-term view that looks at nuclear risk reduction as a bridge solution that helps to rebuild trust among adversaries and paves the way for more traditional arms control mechanisms. While there is an expectation that risk reduction will lead to more ambitious measures, the emphasis here is on the short-term goal to return to treaty-based arms control mechanisms and the focus is on finding interim steps that improve relations between countries. Ulrich Kühn, for example, contends that "Activities to increase transparency and verification, even absent specific treaties, are possible and essential to reducing risk perception asymmetries and could create a modicum of trust needed for more ambitious cooperative undertakings."[67] In a similar vein, Névine Schepers and Oliver Thränert argue that "Unilateral initiatives, ranging from declarations of restraint to the suspension of certain systems, could help break the current deadlock and pave the way for treaty negotiations."[68]

66 In 2020, for example, Austrian Ambassador Alexander Kmentt argued that nuclear possessors generally understand strategic risk reduction "as countering risks that could undermine nuclear deterrence relationships. Consequently, risk reduction measures are geared towards avoiding or managing crises and achieving a better understanding of the intentions of adversaries, so as to maintain more stable and less risky deterrence relationships. In short, the focus of this perspective of risk reduction is to make nuclear deterrence work better, rather than consider the risks of the practice of nuclear deterrence itself." Alexander Kmentt, "Nuclear deterrence perpetuates nuclear risks: the risk reduction perspective of TPNW supporters," European Leadership Network (December 4, 2020). https://europeanleadershipnetwork.org/commentary/nuclear-deterrence-perpetuates-nuclear-risks-the-risk-reduction-perspective-of-tpnw-supporters/. Accessed October 11, 2024. This skepticism about risk reduction is also shared by many supporters of the Ban Treaty. Dell Higgie from the New Zealand Ministry of Foreign Affairs and Trade and Beatrice Fihn, former executive director of ICAN, both spoke at the 2017 Carnegie International Nuclear Policy Conference, and clearly rejected the notion of discussing nuclear risks as a means of building common ground with nuclear possessors. Instead, they emphasized that nuclear disarmament is the only way to reduce nuclear risks. Carnegie International Nuclear Policy Conference, "Small Steps or a Giant Leap for Disarmament? NPT Article VI," Conference Transcript (March 21, 2017). https://carnegie-production-assets.s3.amazonaws.com/static/files/2017-03-21_Small_Steps_Transcript_LD1.pdf. Accessed February 5, 2025.

67 Ulrich Kühn, *Perceptions in the Euro-Atlantic,* UNIDIR Nuclear Risk Reduction Policy Brief No. 3 (Geneva: United Nations Institute for Disarmament Research, 2020), p. 2. https://unidir.org/publication/perceptions-in-the-euro-atlantic/. Accessed October 11, 2024.

68 Névine Schepers and Oliver Thränert, "Arms Control Without Treaties," CSS Policy Perspectives vol. 9/3, Center for Security Studies (CSS), ETH Zürich (March 2021), p. 1. https://css.ethz.ch/en/center/CSS-news/2021/03/arms-control-without-treaties.html. Accessed October 11, 2024.

The last approach[69] is that nuclear risk reduction is about stabilizing the competition and deterrence relationship between nuclear possessors, and it has nothing to do with arms control or disarmament. Generally, this group advocates for risk reduction proposals that focus on finding ways to reduce the likelihood of accidental use of nuclear weapons or unintentional escalation between nuclear-armed states. As Benjamin Hautecouverture notes, "depending on the definition one adopts and the scope one allows, [strategic risk reduction] SRR can be seen as a means of endorsing the possession of nuclear weapons backed by deterrence doctrines."[70] This approach is based on the premise that as long as political tension are present, deterrence is the best way to avoid nuclear war, and risk reduction measures can be a useful tool to stabilize deterrence relationships. Colin Gray's work aligns well with this approach. Although he was critical of most arms control agreements, he acknowledged that cooperative mechanisms that are set with realistic expectations, limited objectives, and a clear understanding of the political and strategic context can help to avoid inadvertent or accidental war and manage the arms race.[71]

One important implication of these diverse approaches is that the different endgames and time horizons created different preferences in risk reduction mechanisms. Disarmament supporters usually advocate for very ambitious risk reduction measures, like for example, retiring the ground-based missile leg of the nuclear triad, removing presidential authority for the use of nuclear weapons, removing hair-trigger alert, and adopting a no-first-use (NFU) policy.[72] These policy recommendations not only include significant force reductions, but they also involve important operational changes. They are

69 The work of Thomas C. Schelling and Morton H. Halperin would probably align best with the last approach, although it has elements of the previous one as well. Schelling was skeptical about nuclear abolition, and he thought that cooperative mechanisms were crucial to stabilize deterrence with the Soviet Union and to reduce nuclear dangers. At the same time, he also saw additional benefits in pursuing arms control mechanisms. Given how closely intertwined arms control and risk reduction were during the Cold War (risk reduction measures were very often codified in arms control agreements), his work can also be tied to the approach that emphasizes arms control.

70 Benjamin Hautecouverture, "Is there a need to think differently about strategic risk reduction?" Fondation pour la Recherche Stratégique (August 1, 2022). https://www.frstrategie.org/en/publications/notes/there-need-think-differently-about-strategic-risk-reduction-2022. Accessed October 14, 2024.

71 Colin S. Gray, *House of Cards: Why Arms Control Must Fail* (Ithaca, NY: Cornell University Press, 1992).

72 James E. Cartwright, chair, *Global Zero Commission on Nuclear Risk Reduction: De-Alerting and Stabilizing the World's Nuclear Force Postures*; Bruce G. Blair, *The End of Nuclear Warfighting: Moving to a Deterrence-Only Posture* (Washington, DC: Global Zero, 2018). https://sgs.princeton.edu/sites/default/files/2021-02/Blair-et-al-2018.pdf. Accessed February 5, 2025.

geared towards making it more difficult to formulate credible nuclear threats, and they are also designed to make first use less likely.

In stark contrast with this approach, the five nuclear weapon states recognized by the NPT (P5)[73] have repeatedly emphasized that they prefer a step-by-step mechanism that considers the realities of the broader security environment.[74] In their view, a more gradual approach is the only realistic path forward, which is often criticized by the abolitionist movement for not being ambitious enough. In January 2022, the P5 issued a joint statement[75] that reaffirmed the Reagan-Gorbachev formula that "a nuclear war cannot be won and must never be fought," re-iterated their commitment to de-targeting, and promised to further strengthen national measures to prevent unauthorized or unintended nuclear use.

While these measures are modest, it does not mean that nuclear weapon states see risk reduction as a substitute for their disarmament obligations under the NPT. In fact, U.S. diplomats have made it clear on numerous occasions that the United States sees risk reduction as a tool to advance its disarmament obligations. In an April 2024 briefing, Assistant Secretary of State Mallory Stewart made this point by emphasizing that

> From the U.S. perspective, we see very broad-based nuclear risk reduction as something that can go hand in hand with

73 The P5 process was launched in 2009 as a dedicated forum to bring together the five nuclear weapon states (China, France, Russia, the United Kingdom, and the United States) to discuss their responsibilities under the NPT.

74 U.S. position: "As a conclusion, the only approach to disarmament that has any meaningful chance of success is one that takes into account and tries to address the problematic, the worsening, geopolitical conditions of the present day." Russian position: "The process of reducing and limiting nuclear weapons should be based on a step-by-step approach and the principle of equal and indivisible security. It cannot be conducted in isolation from realities and without establishing prerequisites contributing to gradual steps towards the ultimate goal of a world free of nuclear weapons." Chinese position: "It is more important to underline the conductive role that the consistent nuclear disarmament progress could play in improving international security environment. It is necessary to take fair and reasonable nuclear disarmament steps of gradual reduction towards a downward balance. The three pillars of NPT, i.e. nuclear disarmament, nuclear non-proliferation and peaceful use of nuclear energy are complementing each other and should not be partially neglected." UK position: "We believe that further progress towards a world without nuclear weapons can only be made through gradual multilateral disarmament within existing international frameworks, negotiated using a step-by-step approach which takes into account the wider global security context." French position: "France will continue its present resolute and determined action in favour of realistic and gradual next steps in nuclear disarmament." Quoted in Mitsuru Kurosawa, "The U.S. Initiative on Creating an Environment for Nuclear Disarmament," *Journal for Peace and Nuclear Disarmament* 3, no. 2 (2020), pp. 283–298.

75 "Joint Statement of the Leaders of the Five Nuclear-Weapon States on Preventing Nuclear War and Avoiding Arms Races," The White House Briefing Room (January 3, 2022). https://www.whitehouse.gov/briefing-room/statements-releases/2022/01/03/p5-statement-on-preventing-nuclear-war-and-avoiding-arms-races/. Accessed October 11, 2024.

> our Nuclear Non-Proliferation Treaty requirements under the NPT to work towards disarmament. We do not see risk reduction—nuclear risk reduction as a substitute for [...] the NPT's obligation to work towards disarmament. But we see risk reduction as consistent with that requirement and that obligation.[76]

Altogether, risk reduction is in the eye of the beholder. Nuclear risks are subjective, and they are difficult to measure. While many different camps in the international community judge that nuclear risk reduction can be a useful tool, there are very diverse opinions about the way forward, and the kind of measures that should be pursued.

The Sources of Nuclear Risk

From the beginning of the nuclear age, it has been clear that the mere possession of nuclear weapons comes with a certain amount of risk. Opinions, however, have widely differed whether the security benefits of nuclear possession outweigh the potential dangers of it and how the number of nuclear weapons in an arsenal influence nuclear risks. Abolitionists see the answer in reducing stockpiles and getting rid of these weapons as quickly as possible, others argue that it is possible to manage these risks while reaping the security benefits of deterrence and that the number of weapons a state possesses is not the key factor. Despite these different views, both camps acknowledge that a successful risk management strategy is part of the solution. Developing such a strategy requires, first and foremost, a clear understanding of the sources of risk.

Over the past seven decades, a rich literature has emerged on the different sources of nuclear risk. These include accidents[77] involving nuclear

76 Mallory Stewart, "Nuclear Risk Reduction in the Hemisphere," Foreign Press Centers Briefing, U.S. Department of State (April 24, 2024). https://www.state.gov/briefings-foreign-press-centers/nuclear-risk-reduction-in-the-hemisphere. Accessed October 21, 2024.

77 See, for example, Eric Schlosser, *Command and Control: Nuclear Weapons, the Damascus Accident, and the Illusion of Safety* (New York, NY: Penguin Books, 2014); or Scott D. Sagan, *The Limits of Safety—Organizations, Accidents, and Nuclear Weapons* (Princeton, NJ: Princeton University Press, 1995).

weapons, risks associated with nuclear proliferation,[78] unauthorized[79] use or theft[80] of nuclear weapons and fissile materials, risks emerging from arms racing,[81] risks of miscalculation or inadvertent escalation, and risks associated with deliberate[82] nuclear use in a war. Categorizing these sources is challenging because the issues involved span from poor training of nuclear operators to misunderstandings emerging from attacks on dual-use platforms. Some of these risks come from technical glitches, while others are organizational, strategic, or behavioral in nature. Very often, the only common theme across these risks is that they are somehow relevant for nuclear weapons and have the potential to cause adverse consequences. But each of these threats requires a distinct toolkit and approach. Some of them can be resolved through unilateral measures, others require cooperation with adversaries which may or may not be realistic in the given scenario.[83]

In general, the international community remains divided over which sources of risk are most important. Unsurprisingly, the different interpretations of the goals of nuclear risk reduction have led to different perceptions of the main sources of nuclear risks. While the conferences on the Humanitarian Impact of Nuclear Weapons and the ban movement have emphasized that the main sources of risk are associated with the possession of nuclear weapons, the deterrence community adopted a broader view and looks at nuclear dangers through the lens of the security environment. Thus, categorizing and prioritizing risks without the influence of one's own biases is extremely difficult.

78 See, for example, Scott D. Sagan and Kenneth N. Waltz, *The Spread of Nuclear Weapons: A Debate Renewed,* Second Edition (New York, NY: W.W. Norton, 2002); or Vipin Narang, *Seeking the Bomb: Strategies of Nuclear Proliferation* (Princeton, NJ: Princeton University Press, 2022).

79 See, for example, Bruce G. Blair, *Strategic Command and Control: Redefining the Nuclear Threat* (Washington, DC: Brookings Institution Press, 1984).

80 See, for example, Matthew Bunn, "Reducing the Greatest Risk of Nuclear Theft & Terrorism," *Dædalus* 138, no. 4 (Fall 2009), pp. 112–123; or Graham Allison, *Nuclear Terrorism: The Ultimate Preventable Catastrophe* (New York, NY: Times Books, 2004).

81 See, for example, Colin S. Gray, "The Arms Race Phenomenon," *World Politics 24,* no. 1 (October 1971), pp. 39–79; Thomas Mahnken, Joseph Maiolo, and David Stevenson, eds., *Arms Races in International Politics From the Nineteenth to the Twenty-First Century* (Oxford: Oxford University Press, 2016).

82 See, for example, Brad Roberts, *On Theories of Victory, Red and Blue;* or John K. Warden, *Limited Nuclear War: The 21st Century Challenge for the United States,* Livermore Paper No. 4 (Livermore, CA: Lawrence Livermore National Laboratory, 2018). https://cgsr.llnl.gov/content/assets/docs/CGSR_LP4-FINAL.pdf. Accessed October 11, 2024.

83 Corentin Brustlein, *Strategic risk reduction between nuclear-weapons possessors,* pp. 27–28.

One way out of this problem is to find a different approach. UNIDIR has been actively engaged in the debate during the past decade, and it developed a risk analysis framework that puts the emphasis on the possible pathways to nuclear use. Based on this, Wilfred Wan distinguishes between four main pathways: doctrinal use, escalatory use, unauthorized use, and accidental use.

Table 1 – Pathways to Nuclear Use[84]

Pathway	Definition	Examples
Doctrinal Use	In accordance with declaratory policies and ambiguities thereof.	• Following nuclear attack • Existential threat to the state
Escalatory Use	Linked to ongoing conflict or crisis, rising to nuclear use.	• Pre-emptive strike • Battlefield situations
Unauthorized Use	Non-sanctioned use or use by non-state actors.	• Rogue domestic actors • Nuclear terrorism
Accidental Use	Linked to error.	• Technical malfunction • Driven by false alarm

In terms of doctrinal use, most nuclear possessors have some form of an official doctrine or strategy that outlines the possible scenarios under which they would consider using nuclear weapons. These generally include retaliation in response to a nuclear attack, or other scenarios when the supreme national interests of a state are at stake.

Escalatory use means that a conflict or war is already underway, and nuclear use is the consequence of the rising tensions and the growing intensity of the fight. In adversarial relationships, it has often been the case that the conventionally weaker state has a stronger reliance on nuclear weapons to control and win a conflict. Thus, when these states have already exhausted the conventional options, or lost the conventional battle, they are confronted with the difficult choice to cross the nuclear threshold or accept defeat and de-escalate.

In the case of unauthorized use, there are two separate scenarios. First, the lines of authority could become blurred, and someone could order a nuclear strike without the knowledge and/or consent of the national authority. The most obvious practical examples include the case of a coup, or a misjudgment of a pre-delegated authority. The second scenario is when non-

84 Wilfred Wan, *Nuclear risk reduction—A framework for analysis,* p. 8.

state actors acquire a nuclear weapon and use it to advance their cause.

And lastly, accidental use entails cases where nuclear use was not intentional, and it happened due to unforeseen circumstances such as human error, technical malfunction, or even natural events.[85]

Although categorizing nuclear risks based on the different pathways provides a useful analytical framework to approach the problem, it is important to note that these categories are not mutually exclusive, and there is no hierarchy among them. One or more of these could materialize at the same time, or they could trigger each other. The same underlying factor could feed into different pathways, like for example, the lack of adequate safety measures could allow non-state actors to acquire a nuclear weapon, or it could also be the cause of an accident. The most likely pathway in a given scenario will largely depend on the broader context, the underlying risk conditions, the stage of the conflict, and other political and cultural factors. Thus, there is no one-size-fits-all solution. One must also consider that there might be certain trade-offs since not all nuclear risk reduction measures are compatible, and as a result of these incompatibilities, each nuclear possessor will approach risk reduction with their own prioritization.[86]

In the current security environment, experts tend to argue[87] that given the growing animosity among great powers, and the rising instabilities introduced by their expanding strategic toolkit, the most likely pathways to nuclear use are doctrinal or escalatory. A common theme is that both pathways could occur as a result of deliberate action based on the risk calculus of a national leader, or due to a misunderstanding of enemy intentions, capabilities, and likely responses.

Altogether, the sources of nuclear risks are as diverse as the strategies to deal with them. In different periods of the nuclear age, different pathways were considered the most likely. Each of these pathways required the development of distinct solutions and approaches. At the same time, some amount of risk is inherent in the practice of nuclear deterrence. Deterrence works because of the fear that nuclear use is possible, and that escalation could get out of control. Therefore, completely eliminating risks would mean

85 Ibid., pp. 8–16.

86 Corentin Brustlein, *Strategic risk reduction between nuclear-weapons possessors,* p. 29.

87 Ugne Komzaite, Anna Péczeli, Benjamin Silverstein, and Skyler Stokes, "Nuclear Risk Reduction in an Era of Major Power Rivalry," Workshop Summary, Center for Global Security Research (February 20, 2020). https://cgsr.llnl.gov/sites/cgsr/files/2024-08/Nuclear-Risk-Reduction-Workshop-Summary.pdf. Accessed October 14, 2024.

that states do not get the deterrence benefit of nuclear weapons. At same time, having policies, postures, and capabilities that make uncontrolled escalation more likely also comes with the risk that that type of escalation could occur in a high-end conflict. So nuclear possessors are confronted by the policy choice of how to balance between the good and bad aspects of nuclear risk. The main problem today is that as the tensions and complexities have increased, nuclear risks have accumulated to dangerous levels, which requires some form of action.

Building a Realistic Approach to Nuclear Risk Reduction

In order to use risk reduction as a framework of analysis, more definitional clarity is needed. Conceptually, arms control, risk reduction and even deterrence are intertwined. As Schelling and Halperin envisioned arms control in the 1960s, it was not antagonistic to deterrence, in fact, it was seen as a tool to stabilize deterrence. As Donald G. Brennan, another member of the "Charles River Gang" argued

> It is useful to think generally of arms control as a cooperative or multilateral approach to armament policy—where "armament policy" includes not only the amount and kind of weapons and forces in being, but also the development, deployment, and utilization of such forces, whether in periods of relaxation, in periods of tension, or in periods of shooting wars … The basic goal of arms control… is to reduce the hazards of present armament policies by a factor greater than the amount of risk introduced by the control measures themselves.[88]

NATO even institutionalized this connection in its 1967 Harmel Report[89] that proposed a dual-track approach as a framework for NATO's relationship towards the Soviet Union. Thus, in Western thinking there is a long history of looking at arms control and deterrence as the two sides of the same coin—arms control is about stability through cooperation, while deterrence is about stability through competition. Although risk reduction is closer to the concept

88 Donald G. Brennan, "Setting the Goals of Arms Control," in Donald G. Brennan, ed., *Arms Control, Disarmament, and National Security* (New York, NY: George Braziller, Inc., 1961).

89 North Atlantic Treaty Organization, "Future Tasks of the Alliance–Harmel Report" (1967). https://www.nato.int/cps/en/natohq/topics_67927.htm. Accessed October 14, 2024.

of arms control, it can also include competitive elements, therefore it is somewhere between these two concepts.

While these conceptual connections are generally accepted, a clear definition of nuclear risk reduction is still lacking, mainly stemming from the different meanings of nuclear risk reduction to different constituencies. Pelopidas and Egeland, for example, provide a definition of nuclear risk reduction that reflects the original ideas of Schelling and Halperin but it also criticizes the results of these measures: "The concept of nuclear risk reduction has for decades been used as a shorthand for limited policy changes geared towards lessening the chances of misinterpretation, escalation and accidents involving nuclear arms."[90] This judgmental tone is generally reflective of the view of disarmament advocates who believe that risk reduction is just a stalling tactic used by nuclear weapon states to stabilize deterrence. But it ignores that over the past decades there has been a long list of unilateral and cooperative restraints that great powers have taken (outside of the traditional treaty framework) that had more than "limited" effects on their nuclear operations and force structures.

While the above definition is somewhat dismissive of the results of risk reduction, there are other definitions. In a UNIDIR paper, Wan argues that "Nuclear risk reduction is about decreasing the possibility that nuclear weapons are used, whether deliberately or inadvertently."[91] This definition is certainly inclusive of every aspect of nuclear risk reduction, but it is not specific enough to distinguish risk reduction from other forms of cooperative security. Arguably, arms control, confidence- and security-building measures (CSBMs), and even disarmament would fit into this broad framework.

A better definition is provided in a Nuclear Threat Initiative paper, where Rear Admiral John Gower argues that "risk reduction can be defined as any action, statement, or agreement, whether unilateral, bilateral, multilateral or omnilateral, which reduces the risk of use of a nuclear weapon."[92]

However, an overarching problem with the approach of nuclear risk reduction that only focuses on nuclear weapons is that it misses the importance of the broader security environment. As Brustlein observes, the

90 Benoît Pelopidas and Kjølv Egeland, "The false promise of nuclear risk reduction," p. 348.

91 Wilfred Wan, *Nuclear Risk Reduction: The State of Ideas*. p. 2.

92 Rear Admiral John Gower, "Discussion Paper: Nuclear Risk Reduction," Nuclear Threat Initiative (January 2019). https://www.nti.org/wp-content/uploads/2021/09/Discussion_Paper-Nuclear_Risk.pdf. Accessed October 14, 2024.

"risks of nuclear use cannot be properly understood or tackled as long as they are thought of in isolation from the broader security context and from the dynamics that affect non-nuclear capabilities."[93] During the Cold War period, the risk reduction agenda was inclusive of broader non-nuclear constraints, recognizing the fact that most nuclear use scenarios would probably originate from some form of conventional conflict,[94] and leadership perceptions of the conventional balance would have a significant influence over any decision about nuclear use. These connections between the conventional and nuclear domains are even stronger today, given the growing entanglement[95] of conventional and nuclear forces, and the increasing significance of non-nuclear strategic capabilities in modern warfare. Considering these linkages leads to two separate categories: 1) risk reduction measures that focus on the conventional-nuclear interaction, and 2) risk reduction measures that generally focus on conventional crisis or conflict that has the potential to escalate to nuclear conflict. While both types of measures can help to reduce nuclear risks, I primarily refer to the first category when I advocate for a broader risk reduction framework.

Keeping in mind these linkages, some analysts prefer to use the term, "strategic risk reduction," which is meant to signal that measures addressing non-nuclear capabilities and doctrines could also have a beneficial effect on nuclear stability. This approach has also been favored by great powers. For example, the 2019 G7 Statement on Non-Proliferation and Disarmament talks about the importance of pursuing strategic risk reduction:

> Efforts towards strategic risk reduction constitute important contributions to regional and international security. In

93 Corentin Brustlein, *Strategic risk reduction between nuclear-weapons possessors*, p. 14.

94 For more on this, see the seminal work of Barry R. Posen, *Inadvertent Escalation: Conventional War and Nuclear Risks* (Ithaca, NY: Cornell University Press, 1991).

95 On the problem of entanglement, see James M. Acton, "Escalation through Entanglement: How the Vulnerability of Command-and-Control Systems Raises Risks of an Inadvertent Nuclear War," *International Security* 43, no. 1 (Summer 2018), pp. 56–99; James M. Acton, ed., *Entanglement: Russian and Chinese Perspectives on Non-Nuclear Weapons and Nuclear Risks* (Washington, DC: Carnegie Endowment for International Peace, 2017). https://carnegieendowment.org/research/2017/11/entanglement-chinese-and-russian-perspectives-on-non-nuclear-weapons-and-nuclear-risks (accessed October 14, 2024); and Benjamin Bahney and Anna Péczeli, "The Role of Nuclear-Conventional Intermingling on State Decision-making and the Risk of Inadvertent Escalation," Strategic Multilayer Assessment study series, USSTRATCOM (November 2021), https://nsiteam.com/the-role-of-nuclear-conventional-intermingling-on-state-decision-making-and-the-risk-of-inadvertent-escalation/. (accessed October 14, 2024).

> particular, transparency and dialogue on nuclear doctrines and postures, military-to-military dialogues, hotline agreements among nuclear weapon possessors, "accident measure" agreements, transparency, and notification exercises, as well as missile launch notification and other data exchange agreements, can constitute important elements of strategic risk reduction and can help avoid misunderstanding and miscalculation.[96]

The same term was used by the 2022 joint statement of the P5,[97] and the U.S. forum Creating the Environment for Nuclear Disarmament (CEND) has also dedicated a subgroup[98] to strategic risk reduction. Even the NPT had risk reduction on its agenda under various names.[99] Depending on how one defines risk reduction, member states agreed that the concept could be useful to all three pillars of the NPT—disarmament, non-proliferation, and peaceful uses of nuclear energy.

Whether one uses the term "strategic risk reduction" or "nuclear risk reduction" is not that important. However, it is necessary to look at the risk reduction framework in a broad sense that does not handle nuclear risks in isolation. Since only a portion of nuclear risks originate from the nuclear domain and others are the result of conflict dynamics in the conventional domain, one cannot ignore the security environment. This broader perspective also means that instead of focusing on the weapons themselves and their evolution, my analytical framework is rather centered around the behaviors associated with nuclear possession and the risks emerging from those behaviors. Among the four main nuclear pathways, this logic mostly correlates with the doctrinal and escalatory use scenarios.

96 "2019 G7 Statement on Non-Proliferation and Disarmament," official website of the President of France (April 6, 2019). https://www.elysee.fr/admin/upload/default/0001/05/2ffa826926cd72354b90a05f7de765bfcc9908b6.pdf. Accessed October 14, 2024.

97 "Joint Statement of the Leaders of the Five Nuclear-Weapon States on Preventing Nuclear War and Avoiding Arms Races."

98 "U.S. Leadership in Strategic Risk Reduction: working paper / submitted by the United States of America," United Nations, 2020 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons (May 19, 2022). https://digitallibrary.un.org/record/3977404/files/NPT_CONF.2020_WP.55-EN.pdf?ln=en. Accessed October 14, 2024.

99 See more about this in Benjamin Hautecouverture, "Is there a need to think differently about strategic risk reduction?"

Lastly, it is also important to develop realistic expectations of what risk reduction measures can and cannot achieve. Even Schelling and Halperin noted in the 1960s that

> We have no expectation that by working on weaponry alone, or military deployments or expectations, we can eliminate the political, economic and ideological differences that genuinely underlie present international antagonism.[100]

Arms control, risk reduction, and deterrence are different tools that work in tandem to stabilize great power relations and reduce the likelihood of nuclear war. But none of these tools can achieve these goals alone. For example, risk reduction cannot prevent great powers from engaging in wars with each other, but these measures could reduce the likelihood that such wars would escalate to nuclear use by either making it a less beneficial pathway for the attacker, or by reducing the dangers of miscalculation and inadvertent escalation.[101] While most risk reduction measures are built on the assumption that in any crisis there are common goals and mutually beneficial ways to address nuclear dangers, not all nuclear risks can be handled in a cooperative way. This is why many nuclear possessors, including the United States, have adopted the view that improving the credibility of deterrence should be seen as a key part of a broader risk reduction agenda.

My Approach to Nuclear Risk Reduction	
Goals	Reduce the risks of nuclear war, close the most likely pathways to nuclear use, and stabilize great power relations
Mechanisms	A broad set of actions, statements or agreements (for example, dialogue, direct communication links, notifications, data exchanges, transparency measures or different forms of restraint)
Format	Primarily informal (but there have been a few examples for formal measures as well)
Participation	Unilateral, bilateral, regional, or multilateral
Scope	Nuclear risks or dangers that emerge from the interaction of nuclear weapons with other domains

100 Thomas C. Schelling and Morton H. Halperin, *Strategy and Arms Control*, p. 4.

101 Corentin Brustlein, *Strategic risk reduction between nuclear-weapons possessors*, p. 15.

Key Takeaways
Conceptually, risk reduction is tied to arms control and deterrence theory: • These are mutually reinforcing concepts that share many of the same objectives. • Some amount of risk is inherent in the practice of deterrence, which means not all risks can be eliminated.
In the current security environment, nuclear risks are on the rise which increased global interest in risk reduction solutions.
However, there is a lack of agreement about the role risk reduction should play today. This is partly because risks are subjective and difficult to measure, and partly because there are many different approaches to risk reduction.
The sources of nuclear risk are extremely diverse, which requires flexibility and tailored solutions. • Some problems necessitate cooperation, others can be addressed unilaterally. • Due to the diverse set of problems, a holistic approach to risk reduction is the best pathway forward. • Such a holistic approach should incorporate a broad set of measures focusing on nuclear risks and dangers that emerge from the interaction of nuclear weapons with other domains.

Lessons of Past Risk Reduction Efforts

There are two main reasons why looking at past lessons is important. First, this overview is meant to validate one of my main arguments that risk reduction is not a static concept, and its success rests on continuously adapting to the changes of the security environment. In this chapter, I demonstrate how the highly antagonistic bipolar context presented fundamentally different problems than the rather benign post-Cold War environment. In response to the shifts in the security environment, risk reduction approaches have evolved, which led to new priorities and solutions. Thanks to these adaptations, risk reduction was generally seen as a feasible and useful framework to mitigate nuclear dangers. The second goal of looking at the past is to learn from it. The current security environment is unique in many respects, but it also shares some characteristics with both the Cold War (i.e., intense competition between great powers) and the post-Cold War context (i.e., rising multipolarity and emerging new challenges). Therefore, the enduring lessons of the past can provide some useful guidance for the present.

The Cold War Experience

During the Cold War period, most nuclear risk reduction measures shared a few general characteristics. First, the bilateral relationship between the two superpowers was the driving force behind nuclear risk reduction

efforts.[102] Second, it was part of the larger arms control agenda—sometimes this led to stand-alone agreements that complemented the U.S.-Soviet bilateral arms control treaties which focused on limits and reductions in nuclear forces, while at other times risk reduction was directly built into those treaties.[103] And third, risk reduction was seen through the lens of nuclear deterrence, which meant that the primary motivation behind these measures was to stabilize the deterrence relationship between the United States and the Soviet Union.[104]

The emergence of risk reduction both as a concept and a practice was closely tied to the emergence of arms control. Schelling's focus on the mutual fear of surprise attack laid out in the early 1960s how misunderstandings could incentivize escalation, and how suspicion and mistrust towards each other could contribute to crisis instabilities. Thus, he advocated for increased transparency and direct communication channels years before the two superpowers were willing to act on these problems. The main reason why practice was lagging behind theory was that implementing these measures required some form of shared recognition among the superpowers that despite their antagonistic relationship, there were common goals and mutual action was possible to advance those goals. In this case, the shared recognition was that nuclear risks have reached an unacceptable level—yet this realization only came after the superpowers got a taste of a real nuclear crisis. During those crucial 13 days of the 1962 Cuban missile crisis, miscalculation and misunderstanding almost led to a direct nuclear

102 On the one hand, this entailed a number of cooperative mechanisms and agreements, and on the other hand, it also included different forms of unilateral restraint that the two superpowers undertook to improve their bilateral relationship and reduce nuclear threats. See more about these unilateral measures in John T. McNaughton, "Arms Restraint in Military Decisions," *Journal of Conflict Resolution* 7, no. 3 (1963), pp. 228–234.

103 The SALT II, START, and New START agreements have all included risk reduction measures that were previously codified in separate agreements. For example, the SALT II had a provision for advance notification of certain ICBM test launches, and the New START Treaty included a commitment not to interfere with each other's national technical means of verification.

104 See more about this in Wilfred Wan, "Wither Nuclear Risk Reduction?" in Rebecca Davis Gibbons, Stephen Herzog, Wilfred Wan, and Doreen Horschig, *The Altered Nuclear Order in the Wake of the Russia-Ukraine War* (Cambridge, MA: American Academy of Arts and Sciences, 2023), pp. 37–60; and Névine Schepers, "Heightened Nuclear Risks and the Risk Reduction Agenda," CSS Analyses in Security Policy no. 339, Center for Security Studies (CSS), ETH Zürich (April 2024), https://css.ethz.ch/content/dam/ethz/special-interest/gess/cis/center-for-securities-studies/pdfs/CSSAnalyse339-EN.pdf (accessed October 16, 2024).

war between the United States and the Soviet Union.[105] In the aftermath of the crisis, President Kennedy and Premier Khruschev both agreed that they must prevent such brinkmanship in the future. In the coming years, the two superpowers initiated a series of risk reduction measures to minimize the likelihood of losing control in a crisis, and to avoid worst-case outcomes through communication, increased predictability, and mutual restraint.[106]

The first step was the 1963 bilateral memorandum of understanding that established a direct communications link between Washington and Moscow (the so-called Hot Line Agreement). This was followed by four additional risk reduction measures that all emerged from the same détente era negotiations that concluded the Strategic Arms Limitations Talks (SALT) I and ABM Treaties:

- The 1971 Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War. This arrangement had three main pillars: 1) taking measures to improve organizational and technical safeguards against accidental or unauthorized nuclear use, 2) immediate notification of each other if a risk of nuclear war would arise from the detection of unidentified objects on early warning systems, or in the case of any other accidental, unauthorized or unexplained incident, and 3) missile launch notifications that happen beyond the territory of the launching party.[107]

- The 1971 Agreement on Measures to Improve the U.S.-USSR Direct Communications Link (DCL). This agreement updated the original Hot Line Agreement and provided for the addition of two satellite circuits (which became operational in 1978).[108]

- The 1972 Agreement on the Prevention of Incidents On and Over the

105 See more about this in Graham T. Allison, *Essence of Decision: Explaining the Cuban Missile Crisis* (Boston, MA: Little, Brown and Company, 1971); and Svetlana V. Savranskaya, "New Sources on the Role of Soviet Submarines in the Cuban Missile Crisis," *Journal of Strategic Studies* 28, no. 2 (2005), pp. 223–259.

106 Corentin Brustlein, *Strategic risk reduction between nuclear-weapons possessors,* pp. 19–20.

107 U.S. Department of State, "Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War Between The United States of America and The Union of Soviet Socialist Republics (Accidents Measures Agreement)," Bureau of International Security and Nonproliferation (September 30, 1971). https://2009-2017.state.gov/t/isn/4692.htm. Accessed October 16, 2024.

108 U.S. Department of State, "Agreement Between The United States of America and The Union of Soviet Socialist Republics To Expand the U.S.-USSR Direct Communications Link," Bureau of International Security and Nonproliferation (September 30, 1971). https://2009-2017.state.gov/t/isn/4786.htm. Accessed October 16, 2024.

High Seas (INCSEA).[109] This accord focused on naval restraint, informational signals, and notification exchange to reduce the risks of escalation by avoiding collisions and limiting interference with each other.[110]

- The 1973 Agreement on the Prevention of Nuclear War. The goal of this agreement was to "remove the danger of nuclear war and of the use of nuclear weapons" through the practice of restraint, and a commitment to pursue a policy dedicated to stability and peace.[111]

In the case of the 1971 and 1973 agreements, the measures were mostly inward focused, trying to strengthen each state's control over their own nuclear forces, and trying to establish best practices about transparency and information exchange to minimize risks emerging from misunderstandings. In the meanwhile, the 1972 agreement was rather focused on behavioral restraint in the naval domain, which later became a model framework for the 1990 Vienna Document.

Despite the successes of the SALT negotiations, by the end of the 1970s progress has slowed as the détente collapsed, and the Soviet Union invaded Afghanistan. In the United States, this period also overlapped with the emerging narrative[112] that the U.S. intercontinental ballistic missile (ICBM) arsenal was vulnerable to Soviet missiles. In response to this perceived vulnerability, the Reagan administration initiated a massive military buildup in U.S. nuclear forces and launched a substantial development in nuclear command, control, and communications (NC3). The administration's 1981

109 U.S. Department of State, "Agreement Between the Government of The United States of America and the Government of The Union of Soviet Socialist Republics on the Prevention of Incidents On and Over the High Seas," Bureau of International Security and Nonproliferation (May 25, 1972). https://2009-2017.state.gov/t/isn/4791.htm. Accessed October 16, 2024.

110 Although INCSEA was not strictly dedicated to the prevention of nuclear war, it is included here because it had a direct connection to the nuclear domain. Article VI of the agreement required both parties to provide advance notification of "actions on the high seas which represent a danger to navigation or to aircraft in flight." This obligation included notification of ballistic missile launches that had a projected impact area over the high sea.

111 U.S. Department of State, "Agreement Between The United States of America and The Union of Soviet Socialist Republics on the Prevention of Nuclear War," Bureau of International Security and Nonproliferation (June 22, 1973). https://2009-2017.state.gov/t/isn/5186.htm. Accessed October 16, 2024.

112 See more about this in Janne E. Nolan, *Guardians of the Arsenal—The Politics of Nuclear Strategy* (New York, NY: Basic Books, 1989), p. 136; and Kaplan, *The Wizards of Armageddon*, pp. 386–389.

nuclear guidance[113] stated that the United States must prepare for a possible Soviet attack and build a force structure that is sufficient to prevail if such an attack occurs. While U.S. policy under Ronald Reagan's first term adopted a more competitive and confrontative tone towards the Soviet Union, the administration maintained its commitment to risk reduction measures. In June 1982 President Reagan delivered a speech to the UN General Assembly's Special Session on Disarmament, emphasizing that "steps should be taken to improve mutual communication, confidence, and lessen the likelihood of misinterpretation."[114] He made specific proposals for better communication, information exchange on major strategic exercises, advance notification of ICBM launches, and expanded exchange of data on strategic forces.

In 1982, Senator Sam Nunn introduced an amendment to next year's National Defense Authorization Act, requiring the administration to think more about nuclear risk reduction. The amendment also laid out several bilateral (improve DCL, exchange information on risks from third parties, lengthen warning time, etc.) and multilateral (establish a joint control center to monitor risks by third parties and terrorist groups, etc.) measures to strengthen crisis stability.[115] This initiative led to a number of official and unofficial studies[116] on risk reduction, and some of the proposals that emerged from these studies were later incorporated in the official negotiations between President Reagan and Premier Gorbachev. One of the most noteworthy proposals was the establishment of two risk reduction centers to streamline communication, exchange information, and notify each other about military activities. The idea was initially discussed at the 1985 Geneva summit, then during the 1986 Reykjavik Summit Reagan and Gorbachev agreed to start formal negotiations,

113 "National Security Decision Directive 13," Nuclear Weapons Employment Policy, National Security Archive (October 13, 1981). https://nsarchive.gwu.edu/document/20309-national-security-archive-doc-24-national. Accessed October 17, 2024.

114 Ronald Reagan, "Remarks in New York, New York, Before the United Nations General Assembly Special Session Devoted to Disarmament," Ronald Reagan Presidential Library and Museum (June 17, 1982). https://www.reaganlibrary.gov/archives/speech/remarks-new-york-new-york-united-nations-general-assembly-special-session-devoted. Accessed October 17, 2024.

115 "Department of Defense Authorization Act, 1983," 97th Congress (1981-1982), S.2248 (August 16, 1982), https://www.congress.gov/bill/97th-congress/senate-bill/2248. Accessed October 17, 2024.

116 Barry M. Blechman, *Preventing nuclear war: A realistic approach* (Bloomington, IN: Indiana University Press, 1985); Graham T. Allison, Albert Carnesale and Joseph S. Nye Jr., eds., *Hawks, Doves, and Owls: An Agenda for Avoiding Nuclear War* (New York, NY: W. W. Norton and Co., 1985).

which eventually led to the 1987 agreement[117] on establishing Nuclear Risk Reduction Centers in Washington, DC and Moscow. These centers became the main channel of communication regarding the implementation of crucial elements of the arms control and confidence- and security-building architecture, including the 1987 INF Treaty, the 1988 agreement on notifications of launches of ICBMs and submarine-launched ballistic missiles (SLBMs),[118] and the post-Cold War START I Treaty, the CFE Treaty, the Vienna Document, the Open Skies Treaty, and the New START Treaty.[119]

Nuclear Risk Reduction after the Cold War

During the early years of the post-Cold War period, some elements of the traditional risk reduction pathway endured. For example, the bilateral process between the United States and the Russian Federation continued through the 1991-1992 PNIs,[120] which were a series of reciprocal unilateral measures that included significant cuts in nuclear forces and many risk reduction elements as well. Similarly, in the conventional domain the 1990 Vienna Document was deliberately crafted to include several CSBMs that complemented the CFE Treaty.

But despite some degree of continuity, risk reduction approaches had to evolve in the post-Cold War period, and they have gone through several major changes. First, risk reduction was no longer an exclusively bilateral business between the United States and the Soviet Union. Important new participants appeared on the scene, like for example India and Pakistan, and even a number of non-nuclear weapon states became active in this field. Second, the modalities of nuclear risk reduction have also changed. The largely bilateral and cooperative framework was replaced by a broader framework that included regional and multilateral mechanisms as well. These efforts were also complemented by a number of unilateral measures. Third, the scope of risk reduction has also expanded to include non-proliferation efforts,

117 U.S. Department of State, "History of the NRRC."

118 U.S. Department of State, "Agreement Between The United States of America and The Union of Soviet Socialist Republics on Notifications of Launches of Intercontinental Ballistic Missiles and Submarine-Launched Ballistic Missiles (Ballistic Missile Launch Notification Agreement)," Bureau of Arms Control, Verification, and Compliance (May 31, 1988). https://2009-2017.state.gov/t/avc/trty/187150.htm. Accessed October 17, 2024.

119 Corentin Brustlein, *Strategic risk reduction between nuclear-weapons possessors*, pp. 22–23.

120 Susan J. Koch, "The Presidential Nuclear Initiatives of 1991-1992," National Defense University, Center for the Study of Weapons of Mass Destruction (2012). https://ndupress.ndu.edu/portals/68/documents/casestudies/cswmd_casestudy-5.pdf. Accessed October 17, 2024.

nuclear security and nuclear disarmament. And lastly, the changing scope and participation in risk reduction also meant a conceptual shift away from the traditional risk reduction approach that was anchored in the logic of nuclear deterrence and strategic stability. Consequently, nuclear risk reduction was disassociated from arms control and deterrence, and many different camps emerged in the international community that were driven by different agendas and advocated for different measures. This polarization made it very difficult to develop a systemic approach to nuclear risk reduction.[121]

These trends were also driven by the changing security environment where the existential threats from an all-out nuclear war were generally decreasing, and new types of threats were on the rise that shifted the focus to the safety and security of nuclear weapons and materials.[122] The dissolution of the Soviet Union led to an urgent need to regain control over the former Soviet arsenal.[123] In the aftermath of the 9/11 terrorist attacks, a new priority emerged and U.S. attention turned towards weapons of mass destruction (WMD) threats[124] from terrorist organizations and rogue states.[125] These new threats rapidly gained prominence over the more traditional Cold War threats of inadvertent escalation and surprise attack, and they led to a number of new risk reduction initiatives. These include:

121 Névine Schepers, "Heightened Nuclear Risks and the Risk Reduction Agenda."

122 See more on nuclear safety and security measures in Matthew Bunn, Martin B. Malin, Nickolas Roth, and William H. Tobey, "Advancing Nuclear Security: Evaluating Progress and Setting New Goals," Belfer Center for Science and International Affairs, Harvard Kennedy School (March 2014). https://scholar.harvard.edu/files/matthew_bunn/files/advancingnuclearsecurity.pdf. Accessed October 9, 2024.

123 See more about threat reduction efforts in Siegfried S. Hecker, ed., *Doomed to Cooperate: How American and Russian Scientists Joined Forces to Avert Some of the Greatest Post-Cold War Nuclear Dangers* (Los Alamos, NM: Bathrub Row Press, 2016); and Kenneth N. Luongo and William E. Hoehn III, "Reform and Expansion of Cooperative Threat Reduction," *Arms Control Today* 33, no. 5 (2003), pp. 11–15.

124 See more on this in Paul I. Bernstein, John P. Caves, Jr., and John F. Reichart, "Countering Weapons of Mass Destruction: Looking Back, Looking Ahead," Institute for National Strategic Studies, National Defense University, CSWMD Occasional Paper 7 (October 1, 2009). https://inss.ndu.edu/Media/News/Article/693726/countering-weapons-of-mass-destruction-looking-back-looking-ahead/. Accessed October 9, 2024.

125 See more about these shifting threats and priorities in Brad Roberts, "The Next Chapter in U.S. Nuclear Policy," *The Washington Quarterly* 47, no. 2 (2024), pp. 7–21.

- The 1991 Nunn-Lugar Cooperative Threat Reduction (CTR) program[126] to secure and dismantle weapons of mass destruction and their associated infrastructure in the post-Soviet space.

- The 1540 UN Security Council Resolution that obligates all states to "refrain from providing any form of support to non-State actors that attempt to develop, acquire, manufacture, possess, transport, transfer or use nuclear, chemical or biological weapons and their means of delivery, in particular for terrorist purposes."[127]

- The Nuclear Security Summits in 2010, 2012, 2014, and 2016 that set the goal to reduce the threat of nuclear terrorism. To achieve this goal, the summit series focused on three main lines of effort: 1) securing all vulnerable nuclear material around the world, 2) enhancing international cooperation to prevent the illicit acquisition of nuclear material by non-state actors, and 3) taking steps to strengthen the global nuclear security system.[128]

- The 2006 Global Initiative to Combat Nuclear Terrorism (GICNT)[129] that aims to strengthen global capacity to prevent, detect, and respond to nuclear terrorism.

In addition to the global approach, regional efforts also intensified in the post-Cold War environment. Three new nuclear weapon-free zone arrangements were concluded: the 1995 Treaty of Bangkok on the South-East Asian Nuclear-Weapon-Free Zone, the 1996 Treaty of Pelindaba on the African Nuclear-Weapon-Free Zone, and the 2006 Treaty of Semipalatinsk on

126 "The Nunn-Lugar Cooperative Threat Reduction Program," Center for Arms Control and Non-Proliferation (2022). https://armscontrolcenter.org/fact-sheet-the-nunn-lugar-cooperative-threat-reduction-program-2/. Accessed October 17, 2024.

127 "UN Security Council Resolution 1540," United Nations Office for Disarmament Affairs (2004). https://disarmament.unoda.org/wmd/sc1540/. Accessed October 17, 2024.

128 Kelsey Davenport, "Nuclear Security Summit at a Glance," Arms Control Association Fact Sheets & Briefs (February 2023). https://www.armscontrol.org/factsheets/nuclear-security-summit-glance. Accessed October 17, 2024.

129 U.S. Department of State, "The Global Initiative To Combat Nuclear Terrorism," Bureau of International Security and Nonproliferation (undated). https://2017-2021.state.gov/the-global-initiative-to-combat-nuclear-terrorism/. Accessed October 17, 2024.

the Central Asian Nuclear-Weapon-Free Zone.[130] The parties of the NPT have also agreed to take measures to support the establishment of a Middle East WMD-Free Zone in a grand bargain to extend the NPT indefinitely in 1995.

Parallel with these efforts, several risk reduction measures have been adopted on the Indian subcontinent as well. Shortly after India and Pakistan concluded their nuclear tests in 1998, the Kargil War erupted, which demonstrated an urgent need to return to the "traditional" risk reduction approach. Similarly to the U.S.-Soviet history, India and Pakistan have gone through a learning process during their own crisis situations, which led to several region-specific mechanisms. They have also looked for lessons from the U.S.-Soviet experience and adopted some Cold War mechanisms. In 1988 they concluded an Agreement on the Prohibition of Attack against Nuclear Installations and Facilities,[131] in 1999 they adopted the Lahore Declaration[132] that required both sides to take steps to address nuclear risks associated with accidental or unauthorized use, in 2005 they concluded an Agreement on Pre-Notification of Flight Testing of Ballistic Missiles,[133] and in 2006 they created bilateral nuclear doctrine consultations.[134] While these measures have provided some crisis stability benefits, in the India-Pakistan context they have not led to more comprehensive arms control agreements, or a general improvement of relations. As Brustlein notes, "the South Asian case illustrates both the benefits of risk reduction measures and the limits of what they can achieve in the midst of active and intense rivalry between two nuclear-armed neighbors."[135]

130 See more about these in United Nations, "Overview of Nuclear-Weapon-Free Zones" (undated), https://www.un.org/nwfz/content/overview-nuclear-weapon-free-zones (accessed October 18, 2024); and Kelsey Davenport, "Nuclear-Weapon-Free Zones (NWFZ) At a Glance," Arms Control Association (March 2022), https://www.armscontrol.org/factsheets/nuclear-weapon-free-zones-nwfz-glanceccessed October 18, 2024.

131 "India-Pakistan Non-Attack Agreement," Nuclear Threat Initiative (December 1988). https://www.nti.org/education-center/treaties-and-regimes/india-pakistan-non-attack-agreement/. Accessed October 18, 2024.

132 "Lahore Declaration," Nuclear Threat Initiative (February 1999). https://www.nti.org/education-center/treaties-and-regimes/lahore-declaration/. Accessed October 18, 2024.

133 "Agreement between the Republic of India and the Islamic Republic of Pakistan on Pre-Notification of Flight Testing of Ballistic Missiles," Ministry of External Affairs, India (October 2005).

134 Michael Krepon, *Nuclear Risk Reduction in South Asia* (New York, NY: Palgrave Macmillan, 2004); Feroz Khan, Ryan Jacobs, and Emily Burke, eds., *Nuclear Learning in South Asia: The Next Decade in South Asia* (Monterey, CA: Naval Postgraduate School, 2014).

135 Corentin Brustlein, *Strategic risk reduction between nuclear-weapons possessors,* p. 26.

Besides these official diplomatic efforts on the bilateral, regional, and global levels, nuclear disarmament advocates and non-governmental organizations (NGOs) also became more active in setting the risk reduction agenda to advance the ultimate goal of nuclear abolition. These approaches generally adopted a dogmatic view that the mere existence of nuclear weapons was the main risk, trying to isolate the discussion from the realities of the broader security environment.[136] This also shifted the debate into new directions. Cold War efforts among the two superpowers were mainly focused on minimizing misunderstandings and managing the risks of losing control over nuclear weapons. But as a result of the declassifications and the re-examination of the Cold War experience, it came to light that the history of the Cold War was filled with dangerous incidents, near-misses, and false alarms that could have easily led to an inadvertent nuclear war.[137] In response to these revelations, the abolition movement centered in on issues associated with command and control, emphasizing the importance of relaxing alert postures and implementing declaratory restraint (such as no-first-use policies).[138]

Altogether, the post-Cold War environment brought several important shifts in the international community's approach to risk reduction. The next session will summarize the most important lessons of past practices, which provides some useful guidance on how to build a new framework for the current security environment.

Enduring Lessons

In earlier chapters, I show that objectively measuring nuclear risks is extremely difficult. Unfortunately, it is just as difficult to measure the success of risk reduction measures. While the history of the nuclear era has provided several crisis situations and incidents, there has not been a major nuclear war. But does this mean that the international community already figured out the right mix of nuclear deterrence, arms control, and risk reduction that

136 Ibid., pp. 24–25.

137 Bruce G. Blair, *The Logic of Accidental Nuclear War* (Washington, DC: The Brookings Institution, 1993); Patricia Lewis, Benoît Pelopidas, Heather Williams, and Sasan Aghlani, *Too Close for Comfort—Cases of Near Nuclear Use and Options for Policy* (London: Chatham House, 2014). https://www.chathamhouse.org/2014/04/too-close-comfort-cases-near-nuclear-use-and-options-policy (accessed October 17, 2024); and Scott D. Sagan, *The Limits of Safety—Organizations, Accidents, and Nuclear Weapons.*

138 See, for example Global Zero's fact sheet on no-first-use. Global Zero, "No First Use FAQs," (undated). https://www.globalzero.org/no-first-use-faqs/index.html. Accessed October 17, 2024.

will prevent nuclear use in the future? Certainly not. Since 1945, nuclear risks have been a persistent feature of international relations. However, they have dynamically changed in nature, so did the mechanisms that were implemented to reduce them. Therefore, judging whether a mechanism was successful or not is not necessarily a function of durability. While some measures were very resilient even against worsening major power relations (e.g., the Hot Line Agreement, or the ballistic missile launch notification agreement), others have fallen victim to renewed rivalry (e.g. the Vienna Document, or the Open Skies Treaty). This, however, does not mean that the former group is automatically more valuable or successful. While some agreements have endured because they provide general benefits that great powers have valued in many different circumstances, others might have been extremely valuable in a given context but simply became outdated as the security environment evolved. Therefore, endurance should not be considered a definitive measurement of success. There are many other factors that must be considered. For example, as Lewis and others observe, "Hotlines only work if both sides trust the person on the other end to have an interest in resolving the crisis and to take the agreed measures to reduce tensions."[139]

Thus, just because there is a hotline in place, effective crisis communication is not guaranteed. The first overarching lesson here is that nuclear risks simply cannot be understood in isolation from the broader security environment, and the success of risk reduction measures should always be judged in the given political context.

The second lesson is about the preconditions of cooperation. The history of the Cold War has demonstrated that nuclear risk reduction efforts have the potential to improve great power relations and incentivize less risky behavior. At the same time, implementing these measures usually required a traumatic first-hand experience with nuclear dangers that ultimately increased the appetite for action (this was true both in the case of the United States and the Soviet Union, and in the case of India and Pakistan). In these types of antagonistic relationships, risk reduction measures require mutual recognition that there are worst-case outcomes that each side wants to avoid. Given that all states have a different threshold for risk tolerance, and a different view of the utility of risk manipulation, the success of cooperative risk reduction rests on finding these overlapping areas of risk assessment and identifying

139 Patricia Lewis, Benoît Pelopidas, Heather Williams, and Sasan Aghlani, *Too Close for Comfort—Cases of Near Nuclear Use and Options for Policy*, p. 23.

the scenarios that everyone is worried about. Getting to this point requires a deep understanding of adversary thinking, which is only possible through analytic rigor and communication. Having some kind of regular dialogue on threat perceptions and doctrine can be very helpful in uncovering the areas of mutual interest.

Past experience has also shown that the success of bilateral nuclear risk reduction can lead to much broader benefits. First, there is the learning benefit for other regions. While most adversarial relationships have their own specific characteristics, normally there are some general lessons that can provide useful guidance in other scenarios. India and Pakistan, for example, learned a lot from the United States and the Soviet Union on how to manage nuclear risks through the establishment of launch notifications, direct communication, and domestic safeguards. Another example is the 1971 U.S.-Soviet Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War. This agreement has served as a model framework for other NATO nuclear powers—France concluded its own agreement with the Soviet Union in 1976, and the United Kingdom followed suit in 1977.

Besides the learning benefits to others, bilateral mechanisms can also pave the way to global measures. INCSEA, for example, started as a bilateral mechanism, but it slowly evolved into a much broader framework as several other NATO member states (the United Kingdom, Germany, France, Italy, Norway, Spain, the Netherlands, Canada, Portugal, Greece and Turkey) have also signed bilateral military agreements with the Soviet Union on the prevention of incidents at sea.[140]

The next lesson is about resilience. Skeptics of risk reduction measures often point out that risk reduction mechanisms are normally less formal political commitments, which are easier and less costly to reverse in a crisis. Thus, they can lead to misguided and dangerous expectations of good behavior from untrustworthy adversaries.[141] While it is certainly true that risk reduction measures cannot guarantee adversary restraint in the next major crisis, history suggests that some of these measures have still endured

140 "Bilateral military agreements between NATO member states and the Soviet Union on the prevention of incidents," European Leadership Network (undated). https://europeanleadershipnetwork.org/bilateral-military-agreements-between-nato-member-states-and-the-soviet-union-on-the-prevention-of-incidents/. Accessed October 17, 2024.

141 Jim E. Hinds, "The Limits of Confidence," in John Borawski, ed., *Avoiding War in the Nuclear Age* (New York, NY: Routledge, 2018), pp. 184–198.

despite the growing antagonism between states. DCL, for example, proved to be a valuable tool to ensure communication between Washington and Moscow, clarify intent, and exchange information even in times of crisis. In fact, since its inception, there is no public data on any attempt to use these channels for deliberate misinformation or deception. Thus, despite their limitations, risk reduction measures can sometimes overcome difficult periods of tension, and they can function reliably even when relations are generally suffering from mutual mistrust.[142]

The last lesson is about the conventional-nuclear nexus. Since the beginning of the Cold War, it has been clear that nuclear risks could emerge from the conventional domain. Barry Posen, for example, made the argument that NATO's approach to conventional warfighting in the late Cold War years carried a serious risk of inadvertent nuclear escalation, because it unintentionally put at risk vital components of the Soviet nuclear retaliatory capacity, including early-warning systems and the SSBN force.[143] The conventional-nuclear balance has also been an important factor in the two superpowers' thinking about nuclear use scenarios. For example, throughout most of the Cold War period, there was a widely held view[144] that NATO conventional forces were inferior to Warsaw Pact forces, which led to the pre-positioning of thousands of nuclear weapons in Europe, and the pre-delegation of launch authority to top commanders starting from the late 1950s.[145] These examples clearly demonstrate why the nuclear risk reduction framework cannot be isolated from the broader conventional context. Cold War leaders and strategists recognized the interconnected nature of these domains and implemented a wide range of conventional restraints to address the dangers of nuclear use. The 1972 INCSEA agreement, for example, included clear nuclear components (e.g., providing advance notifications of ballistic missile launches that have an impact area over the

142 See more about this in Corentin Brustlein, *Strategic risk reduction between nuclear-weapons possessors,* pp. 52–53.

143 Barry R. Posen, *Inadvertent Escalation: Conventional War and Nuclear Risks* (Ithaca, NY: Cornell University Press, 1991).

144 James A. Thomson, An Unfavorable Situation: NATO and the Conventional Balance (Santa Monica, CA: RAND Corporation, 1988). https://www.rand.org/pubs/notes/N2842.html. Accessed October 18, 2024.

145 William Burr, "First Declassification of Eisenhower's Instructions to Commanders Predelegating Nuclear Weapons Use, 1959-1960," National Security Archive Electronic Briefing Book (May 18, 2001). https://nsarchive2.gwu.edu/NSAEBB/NSAEBB45/printindex.html. Accessed October 17, 2024.

high seas), but it also included broader measures (e.g., a code for acceptable conduct in naval operations). By reducing the likelihood of accidental collisions and dangerous incidents at high seas, the United States and the Soviet Union managed to minimize the risks of inadvertent escalation emerging from conventional naval operations.[146] Paradoxically, this latter obligation might have had a more significant impact in terms of nuclear risk reduction than the INCSEA's notification mechanism that had a specific nuclear focus.

Key Takeaways
Nuclear risks cannot be understood in isolation from the broader security environment.
The success of risk reduction measures should always be judged in the given political context.
Cooperative risk reduction requires a mutual agreement over worst-case outcomes, and a desire to avoid them.
Bilateral risk reduction can lead to much broader benefits.
Risk reduction measures can function reliably even when relations are generally suffering from mutual mistrust.
Conventional restraint can play an important role in nuclear risk reduction.

146 Sean M. Lynn-Jones, "A Quiet Success for Arms Control: Preventing Incidents at Sea," *International Security* 9, no. 4 (Spring 1985), pp. 162–169.

Table 2 – Timeline of the Most Important Nuclear Risk Reduction Measures

1960

1963 U.S.-Soviet Memorandum of Understanding Regarding the Establishment of a Direct Communications Link

1970

1971 U.S.-Soviet Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War

1971 Agreement on Measures to Improve the U.S.-USSR Direct Communications Link

1972 U.S.-Soviet Agreement on the Prevention of Incidents On and Over the High Seas

1973 U.S.-Soviet Agreement on the Prevention of Nuclear War

1980

1987 U.S.-Soviet Agreement on Establishing Nuclear Risk Reduction Centers

1988 U.S.-Soviet Agreement on Notifications of Launches of ICBMs and SLBMs

1988 India-Pakistan Agreement on the Prohibition of Attack against Nuclear Installations and Facilities

1990

1990 Vienna Document

1991 U.S.-Russian Presidential Nuclear Initiatives

1991 Nunn-Lugar Cooperative Threat Reduction program

1999 India-Pakistan Lahore Declaration

2000

2004 1540 UN Security Council Resolution

2005 India-Pakistan Agreement on Pre-Notification of Flight Testing of Ballistic Missiles

2006 India-Pakistan Bilateral Nuclear Doctrine Consultations

2006 Global Initiative to Combat Nuclear Terrorism

2009 First P5 Process Conference

2010

2010 First Nuclear Security Summit in Washington, DC

2012 Second Nuclear Security Summit in Seoul

2014 Third Nuclear Security Summit in the Hague

2016 Fourth Nuclear Security Summit in Washington, DC

2020

2022 P5 Statement on Preventing Nuclear War

Nuclear Risk Reduction in the Current Security Environment

Global Efforts to Advance Risk Reduction

In response to the intensifying competition between great powers and the general sense that nuclear dangers are on the rise, most multilateral arms control forums put nuclear risk reduction on their agenda. In 2018, United Nations Secretary-General António Guterres launched a new initiative called *Securing our Common Future: An Agenda for Disarmament*, urging new thinking and calling for renewed cooperation among great powers towards disarmament. In that report, risk reduction is mentioned as an important part of the solution:

> In our current time of heightened tensions and global anxiety, risk reduction measures should be pursued with a new sense of urgency, pending the total elimination of nuclear weapons. These could include transparency in nuclear weapon programmes, further reductions in all types of nuclear weapons, commitments not to introduce new and destabilizing types of nuclear weapons, including cruise missiles, reciprocal commitments for the non-use of nuclear weapons and reduction of the role of nuclear weapons in security doctrines.[147]

The Secretary General tasked the United Nations Office for Disarmament Affairs (UNODA) and the United Nations Institute for Disarmament Research (UNIDIR) to support the pursuit and implementation of such measures. As a

147 United Nations, "Securing our Common Future: An Agenda for Disarmament," United Nations Office for Disarmament Affairs (2018), pp. 23–24. https://www.un.org/disarmament/sg-agenda/en/. Accessed October 21, 2024.

result, UNIDIR has published several reports, and a number of meetings and workshops have been convened with a risk reduction focus.[148] The United Nations Disarmament Commission (UNDC) has also put nuclear risk reduction on its agenda to facilitate deeper dialogue between the member states. Although the United Nations has been a champion of the global risk reduction effort in the past few years, it is important to note that official UN documents always emphasize that risk reduction is just an interim step towards the ultimate goal of disarmament.

Another notable forum of the global risk reduction dialogue is the NPT. Risk reduction efforts have always been part of the NPT discussions—the desire to reduce the dangers of nuclear war is codified in the treaty preamble, and most final documents included commitments to various risk reduction mechanisms. For example, in the 64-point action plan that was outlined by the 2010 NPT final document, member states called on the P5 to work towards "a diminishing role for nuclear weapons in security policies to minimize the risk that these weapons ever be used," and to "discuss policies that could prevent the use of nuclear weapons,"[149] especially accidental use cases. Risk reduction as a specific agenda item gained even more prominence in the 2020 review cycle. After the failure of the 2015 Review Conference and the collapse of several arms control agreements, risk reduction emerged as a promising alternative mechanism that could help to make incremental progress towards disarmament.[150]

The prominence of risk reduction was notable both in the working papers[151] that have been presented at the Review Conference, and in the final document. Although the 2020 Review Conference (which was postponed several times and eventually took place in 2022) failed to adopt a consensus

148 United Nations, "Preparing for a World Free of Nuclear Weapons—Action 6: Reduce the Risk of Any Use of Nuclear Weapons," United Nations Office for Disarmament Affairs (undated). https://www.un.org/disarmament/sg-agenda/en/action/6. Accessed October 21, 2024.

149 "2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons," Final Document NPT/CONF.2010/50 (May 28, 2010). https://www.un.org/en/conf/npt/2010/. Accessed October 21, 2024.

150 Wilfred Wan, Nuclear risk reduction—A framework for analysis, p. 34."Preparatory Committee for the 2020 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons," Document NPT/CONF.2020/PC.III/WP.49 (May 10, 2019). http://undocs.org/NPT/CONF.2020/PC.III/WP.49. Accessed October 21, 2024.

151 "Tenth Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)," Working papers (undated). https://www.un.org/en/conferences/npt2020/documents. Accessed October 24, 2024.

final document due to Russian objection,[152] risk reduction was an important element of the draft text.[153] Had it been accepted, it would have required the P5 to pursue concrete risk reduction measures, including more streamlined reporting on their progress towards disarmament, regular dialogue on nuclear doctrines and arsenals, measures to support trust and greater predictability, crisis prevention and management mechanisms, notifications and data exchanges, commitment to de-targeting, and enhanced political and military communication. Since Russian objection was unrelated to the risk reduction issue, all nuclear weapon states were ready to accept these measures.

Besides these global forums, the P5 has announced in December 2021 that they are going to create a dedicated "working group on nuclear doctrines and policies and strategic risk reduction,"[154] and they released a joint statement on several concrete risk reduction measures in January 2022.[155] The Group of Seven (G7) have also issued a "Statement on Non-Proliferation and Disarmament"[156] that emphasized the contribution of strategic risk-reduction measures to regional and international security. In addition, individual states have also put forward their own proposals, like for example the 2019 Stockholm Initiative for Nuclear Disarmament,[157] or the U.S. initiative for a new multilateral forum, the Creating an Environment for Nuclear Disarmament, with a designated subgroup to address nuclear risk

152 Gaukhar Mukhatzhanova, "10th NPT Review Conference: Why It Was Doomed and How It Almost Succeeded," *Arms Control Today* 52, no. 8 (October 2022), pp. 20–24.

153 "2020 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons," Draft Final Document NPT/CONF.2020/CRP.1/Rev.2 (August 25, 2022). https://app.unidir.org/sites/default/files/2023-08/2020NPTRevConDraft.pdf. Accessed October 24, 2024.

154 "Working paper submitted by China, France, the Russian Federation, the United Kingdom of Great Britain and Northern Ireland and the United States of America," 2020 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Document NPT/CONF.2020/WP.33 (December 7, 2021). https://daccess-ods.un.org/access.nsf/Get?OpenAgent&DS=NPT/CONF.2020/WP.33&Lang=E. Accessed October 11, 2024.

155 "Joint Statement of the Leaders of the Five Nuclear-Weapon States on Preventing Nuclear War and Avoiding Arms Races."

156 "2019 G7 Statement on Non-Proliferation and Disarmament."

157 The Stockholm Initiative was launched in June 2019 by ministers of 16 non-nuclear weapon states to reduce polarization between countries and take concrete steps towards a world free of nuclear weapons. For more on the adopted declarations and concrete proposals, see: Government Offices of Sweden, "Stockholm Initiative for Nuclear Disarmament" (April 25, 2024). https://www.government.se/government-policy/foreign-and-security-policy/stockholm-initiative-for-nuclear-disarmament/. Accessed December 16, 2024.

reduction.[158]

Lastly, there are a few other international forums that primarily focus on arms control and disarmament, but the discussions taking place here make an indirect contribution to the risk reduction agenda. These include the UN General Assembly (UNGA) First Committee, the Conference on Disarmament (CD), and the U.S.-led multilateral initiative, the International Partnership for Nuclear Disarmament Verification (IPNDV). In addition to these global and regional efforts, the great powers have also proposed a number of unilateral and bilateral measures to advance risk reduction (the next main chapter provides more detail about these proposals).

Altogether, the increased attention on the topic is a clear reflection of the international community's growing anxiety about nuclear dangers, and its strong desire to do something to address them. However, the practical results are still far behind the aspirational goals of these diplomatic efforts, which suggests that there is a disconnect between the proposed measures and the realities of the security environment. The following section is going to explore the most important issues that make risk reduction efforts incredibly challenging today. The goal of this exploration is twofold: first, to identify the key problems that can explain why implementation has been slow and limited, and second, to help build a more feasible approach for the future.

The Main Challenges of Developing a Feasible Risk Reduction Framework Today

There are many interconnected reasons why it is so hard to make real progress with the risk reduction agenda. Risk perception greatly depends on geographic location, regional power structure, one's own military strength, its alliances, and other historical, cultural, and domestic political factors. Each nation looks at these problems through the lens of their own security perspective, national objectives and strategic culture. Thus, what is risk reduction for one side could be perceived as an increase of risks by the other. Besides, not all risk reduction measures would bring equal benefits to all

158 The Creating an Environment for Nuclear Disarmament initiative was launched in Washington in 2019 as an informal and inclusive approach with cross-regional representation of nuclear armed and non-nuclear armed states. In May 2024, Subgroup 3 on Interim Measures to Reduce the Risks Associated with Nuclear Weapons has published the conclusions of its work stream: Creating an Environment for Nuclear Disarmament, "CEND Subgroup 3: Interim Measures to Reduce the Risks Associated with Nuclear Weapons," U.S. Department of State (June 7, 2024). https://www.state.gov/cend-subgroup-3-on-interim-measures-to-reduce-the-risks-associated-with-nuclear-weapons/. Accessed December 16, 2024.

states. Certain mechanisms would primarily favor one side, while the other side might only see limited or no benefit at all. This chapter identifies eight key challenges that contribute to these problems.

Challenge 1: Renewed competition by adversaries

The first major challenge is renewed competition by adversaries. The post-Cold War era started with a lot of optimism about the prospects of cooperation with former adversaries. Following the collapse of the Soviet Union and (what was perceived as) the end of the nuclear arms race, the United States has significantly reduced the size and diversity of its nuclear forces, and it also limited their role in U.S. national security policy. But despite the expectation that adversary relations will evolve in a positive new direction, Russia has re-emerged as a competitor to the United States. Its 2014 annexation of Crimea and the 2022 war against Ukraine have put on display Russia's willingness to use military force to protect its national security objectives, and its growing reliance on nuclear manipulation to intimidate and coerce its adversaries.[159] Moscow's changing behavior and growing aggressiveness are fueled by its massive modernization efforts in strategic military capabilities (both nuclear and non-nuclear), and a fundamental reappraisal of Russia's approach to modern conflict, which involves the integration of all tools of national power across the entire spectrum of conflict.[160]

Similarly to Russia, China has also become more assertive[161] in its foreign policy conduct, and it has invested a lot of time and effort in developing the required capabilities and concepts to challenge the U.S.-backed regional security order in the Indo-Pacific. Since China embarked on a nuclear modernization effort, it has more than doubled its nuclear arsenal (to over 500 nuclear weapons), and in the next decade, it is expected to continue

159 Janice Gross Stein, "Escalation Management in Ukraine: 'Learning by Doing' in Response to the 'Threat that Leaves Something to Chance,'" *Texas National Security Review* 6, no. 3 (2023), pp. 29–50.

160 See more on this in Brad Roberts, *Towards New Thinking about our Changed and Changing Word—A Five-Year CGSR Progress Report* (Livermore, CA: Lawrence Livermore National Laboratory, 2020), https://cgsr.llnl.gov/content/assets/docs/CGSRfiveDIGITAL.pdf. (accessed October 9, 2024); Jacek Durkalec, "Russia's Approach to Modern Strategic Conflict," in Brad Roberts, ed., *Getting the Multi-Domain Challenge Right* (Livermore, CA: Lawrence Livermore National Laboratory, 2021), pp. 36–51, https://cgsr.llnl.gov/content/assets/docs/CGSR_Getting-the-Multi-Domain-Challenge-Right.pdf (accessed October 9, 2024).

161 This includes, for example, harassing and attacking other nations' vessels and conducting military exercises that completely surround Taiwan, publicly emphasizing the possibility of military conflict.

the modernization, diversification, and expansion of its nuclear forces.[162] This means that China has become a near-peer to the United States in the nuclear domain, and it is expected to become a peer in the coming years. As a result, for the first time in its history, the United States is faced with two major nuclear competitors, both of which have demonstrated their willingness to take on more risky forms of behavior, and they have also increased their reliance on nuclear weapons to achieve their national security objectives.

This two-peer challenge is further complicated by the threats posed by North Korea and Iran. Over the past decade, North Korea has successfully expanded its nuclear forces and is on track to deploy enough nuclear weapons on intercontinental-range ballistic missiles that could potentially overwhelm U.S. homeland missile defense. This would increase its ability to use nuclear coercion in a regional crisis and credibly threaten key U.S. and allied interests. Iran is also committed to maintaining a nuclear program that includes a capacity to build missile-deliverable nuclear weapons, which is a clear threat to the stability of the Middle East, and in the long run, it could also threaten the U.S. homeland.[163]

The key implication of this renewed competition is that nuclear risks have increased. U.S. adversaries see nuclear coercion as a useful tool to achieve their goals, and any regional conventional confrontation would most likely include direct nuclear threats from the early onset of the war.

Challenge 2: Multipolarity

Growing multipolarity has created an extremely complex and difficult security environment for the United States and its allies. Since the beginning of the nuclear era, the United States has never faced so many nuclear challengers. Multipolarity complicates risk reduction because measures that fit one context might not be feasible in another adversarial relationship. For example, there are many advocates of reducing reliance on launch on warning (LOW) and launch under attack (LUA) as a potential risk reduction

162 U.S. Department of Defense, "Military and Security Developments Involving the People's Republic of China, the People's Liberation Army (PLA)," Annual Report to Congress (October 19, 2023). https://media.defense.gov/2023/Oct/19/2003323409/-1/-1/1/2023-MILITARY-AND-SECURITY-DEVELOPMENTS-INVOLVING-THE-PEOPLES-REPUBLIC-OF-CHINA.PDF. Accessed October 9, 2024.

163 Madelyn R. Creedon, Jon L. Kyl et al., *America's Strategic Posture—The Final Report of the Congressional Commission on the Strategic Posture of the United States*, p. 10.

measure.[164] During the Cold War, the Joint Chiefs of Staff defined these two terms identically, "as a launch of forces between the detection of an attack and the arrival of the first warhead."[165] In the Cold War context, the aim of these policies was to ensure that (vulnerable) ICBMs would be launched rapidly enough to destroy time urgent targets, before an enemy attack could destroy them. Critics of these policies argue that LOW and LUA are dangerous practices since early-warning systems can occasionally generate false alarms, which could lead to an accidental nuclear war.[166] Due to these dangers, the United States has taken steps to reduce reliance on such policies. For example, the Biden administration's *Nuclear Posture Review* in 2022 stated that "While the United States maintains the capability to launch nuclear forces under conditions of an ongoing nuclear attack, it does not rely on a launch-under-attack policy to ensure a credible response. Rather, U.S. nuclear forces are postured to withstand an initial attack."[167] Thus, in adversarial dyads where both sides have the capacity to withstand a nuclear attack, a commitment to reduce reliance on these policies makes sense as a risk reduction measure. This definitely includes the U.S.-Russia dyad, and in light of its nuclear buildup, it could also make sense in a U.S.-China dyad. At the same time, in highly asymmetric relationships like the one between the United States and North Korea, such proposals are unacceptable for the weaker side due to the vulnerability of their nuclear forces. In these cases, the inferior state is most likely motivated to maintain some form of LOW or LUA to make up for the lack of a secure second-strike capability and guarantee the credibility of its deterrent.

Each of these adversarial relationships are unique, not only because of the different composition of strategic forces, but also due to geographic, cultural, and historical factors. Therefore, escalatory pathways would look very different in a NATO-Russia conflict or a U.S.-China confrontation over Taiwan.

164 See a list of officials who have endorsed such a measure in Union of Concerned Scientists, "U.S. Military and Political Leaders Urge Taking Nuclear Weapons Off Hair-Trigger Alert," Fact Sheet (January 2015). https://www.ucsusa.org/sites/default/files/attach/2015/01/leaders-against-hair-trigger-alert.pdf. Accessed February 10, 2025.

165 William Burr, "The 'Launch on Warning' Nuclear Strategy and Its Insider Critics," National Security Archive Electronic Briefing Book (June 11, 2019). https://nsarchive.gwu.edu/briefing-book/nuclear-vault/2019-06-11/launch-warning-nuclear-strategy-its-insider-critics. Accessed February 10, 2025.

166 Bruce G. Blair, *The Logic of Accidental Nuclear War.*

167 U.S. Department of Defense, "National Defense Strategy, Nuclear Posture Review, Missile Defense Review" (2022), p. 13. https://media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-NATIONAL-DEFENSE-STRATEGY-NPR-MDR.PDF. Accessed October 28, 2024.

Due to these differences, risk reduction mechanisms must be adapted to the specific scenario. Besides, multipolarity is not only challenging because a risk reduction measure in one theater might not make sense in another, but a mechanism that helps in one dyad could actually have harmful effects on another dyad.

Challenge 3: Increasing multi-domain escalatory dangers

The fact that nuclear escalation can emerge from another domain is not new. Even during the Cold War years, there was a recognition that a conventional conflict could lead to a nuclear war.[168] What is new in the current context is the increased likelihood that such an escalation could occur, and the expansion of possible scenarios that could trigger nuclear use. This is due to two main factors. First, there is growing entanglement between the conventional and nuclear domains due to the increased co-location of conventional and nuclear forces, the rising prominence of dual-capable systems, and the great powers' decision to deploy dual purpose command and control and military situational awareness systems. These trends can undermine crisis stability by exacerbating the dangers of miscalculation and triggering inadvertent escalation.[169]

Second, there is an intensifying technology competition that could destabilize great power relations in various ways.[170] Since the end of the Cold War, all major powers have expanded their strategic toolkit and integrated a range of new, non-nuclear strategic assets. As a result, some of the traditional firebreaks between conventional and nuclear warfare have diminished. While all major powers are working to better integrate the new military domains, the mechanisms are not yet in place to address the new

168 Barry R. Posen, *Inadvertent Escalation: Conventional War and Nuclear Risks.*

169 Anna Péczeli and Benjamin Bahney, "The New Domains, Emerging Technologies, and Strategic Competition," in Brad Roberts, ed., *Getting the Multi-Domain Challenge Right* (Livermore, CA: Lawrence Livermore National Laboratory, 2021), pp. 59–71. https://cgsr.llnl.gov/content/assets/docs/CGSR_Getting-the-Multi-Domain-Challenge-Right.pdf. Accessed October 27, 2024.

170 In this regard, it is important to acknowledge that emerging technologies are not inherently destabilizing. There are many ways they could support stability between states. As Todd S. Sechser and others note, "the history of technological revolutions counsels against alarmism. […] the fear that emerging technologies will necessarily cause sudden and spectacular changes to international politics should be treated with caution […] new technologies can have multiple, conditional, and even contradictory effects on different aspects of strategic stability." Todd S. Sechser, Neil Narang, and Caitlin Talmadge, "Emerging technologies and strategic stability in peacetime, crisis, and war," *Journal of Strategic Studies* 42, no. 6 (2019), pp. 727–735.

dangers that these efforts have introduced.[171]

Innovation and technology competition—especially in space, cyber operations, artificial intelligence, information warfare, intelligence, surveillance and reconnaissance (ISR), and quantum technologies—can aggravate nuclear risks in many different ways.[172] First, these capabilities can increase the fog of war by shielding information and enabling deception and misinformation. Quantum computing,[173] for example, could allow a state to penetrate its adversary's sensitive communications, and outmaneuver and sabotage its military operations, potentially without the other side's knowledge. While past risk reduction measures emphasized the importance of creating transparency and direct communications, certain emerging technologies can make it harder to understand adversary intentions, assess the military balance, and read signals in a crisis. Thus, some applications of emerging technologies can contribute to unintended escalation due to the increased likelihood of misunderstandings or miscalculation.[174]

Second, these technologies can introduce new vulnerabilities and increase the pressures on decisionmakers. Enhancing command and control (C2) systems and improving ISR capabilities have traditionally been an important aspect of the great powers' approach to risk reduction. These measures reduce the likelihood of unauthorized and accidental use, and they promote transparency and predictability. However, with the rapid increases in the speed of warfare due to advancements in the cyber and space domains and the development of hypersonic weapons, decision times are shrinking to detect an attack and to take action. The loss of a deliberate and consultative decisionmaking process increases the likelihood of mistakes, and it also serves as an engine of further automation in certain military operations. Greater reliance on AI-enabled tools for information gathering, analytics, target recognition, and even automated responses may increase efficiency, but it

171 See more on this in Brad Roberts, ed., *Getting the Multi-Domain Challenge Right*.

172 Anna Péczeli and Benjamin Bahney, "The New Domains, Emerging Technologies, and Strategic Competition;" Harold A. Trinkunas, Herbert S. Lin, and Benjamin Loehrke, eds., *Three Tweets to Midnight: Effects of the Global Information Ecosystem on the Risk of Nuclear Conflict* (Stanford, CA: Hoover Institution Press, 2020).

173 Elsa B. Kania and John K. Costello, "Quantum technologies, U.S.-China strategic competition, and future dynamics of cyber stability," 2017 International Conference on Cyber Conflict, Washington, DC (2017), p. 95. https://ieeexplore.ieee.org/document/8167502. Accessed October 27, 2024.

174 Erik Gartzke and Jon R. Lindsay, "Thermonuclear cyberwar," *Journal of Cybersecurity* 3, no. 1 (March 2017), pp. 37–48; and Jon R. Lindsay and Erik Gartzke, "Politics by many other means: The comparative strategic advantages of operational domains," *Journal of Strategic Studies* 43, no. 5 (2020), pp. 743–776.

also introduces new vulnerabilities that adversaries can exploit in a crisis.[175]

Lastly, emerging technologies can also directly interfere with the nuclear domain. For example, offensive cyber capabilities that are designed to disable NC3 systems could create clear advantages in brinksmanship and crisis bargaining. At the same time, these capabilities would also introduce dangerous first-strike incentives—if one side acquired the capability to undermine its adversary's nuclear forces, that would give the weaker side every incentive to strike first in a crisis, because later on it might not have the ability to do so.[176]

From a risk reduction perspective, there are two main problems associated with emerging technologies. First, they have the potential to increase nuclear risks in various ways (as demonstrated above). Second, many traditional arms control, and risk reduction measures are ill-suited to address these problems.[177] The risks are also poorly understood,[178] and

175 Zachary S. Davis, *Artificial Intelligence on the Battlefield: An Initial Survey of Potential Implications for Deterrence, Stability, and Strategic Surprise* (Livermore, CA: Center for Global Security Research, Lawrence Livermore National Laboratory, 2019), https://cgsr.llnl.gov/content/assets/docs/CGSR-AI_BattlefieldWEB.pdf (accessed October 27, 2024); Beyza Unal and Patricia Lewis, "Cybersecurity of Nuclear Weapons Systems Threats, Vulnerabilities and Consequences," Chatham House (January 2018), p. 9, http://www.menacs.org/wp-content/uploads/2018/01/Beyza_Cybersecurity-nw.pdf (accessed October 27, 2024); Brad Roberts, "Emerging and Disruptive Technologies, Multi-domain Complexity, and Strategic Stability: A Review and Assessment of the Literature," Center for Global Security Research, Lawrence Livermore National Laboratory (February 2021), https://cgsr.llnl.gov/content/assets/docs/EDT_ST2_BHR_2021.3.16.pdf. (accessed October 27, 2024); and Michael C. Horowitz, "When speed kills: Lethal autonomous weapon systems, deterrence and stability," *Journal of Strategic Studies* 42, no. 6 (2019), p. 782.

176 Martin C. Libicki, *Crisis and Escalation in Cyberspace* (Santa Monica, CA: RAND Corporation, 2012), https://www.rand.org/pubs/monographs/MG1215.html (accessed October 27, 2024); Bruce W. MacDonald, "Deterrence and Crisis Stability in Space and Cyberspace," in Michael Krepon and Julia Thompson, eds., *Anti-satellite Weapons, Deterrence and Sino-American Space Relations* (Washington, DC: Stimson Center, 2013), pp. 81–100, https://www.stimson.org/wp-content/files/file-attachments/Anti-satellite%2520Weapons%2520-The%2520Stimson%2520Center.pdf (accessed October 27, 2024).

177 For example, existing verification mechanisms are not applicable to many new technologies, and the inclusion of private sector entities is also problematic in most cases. See more on this topic in Anna Péczeli, "Recalibrating Arms Control for Emerging Technologies," *The Washington Quarterly* 47, no. 4 (2024), pp. 155–175; Heather Williams, "Asymmetric arms control and strategic stability: Scenarios for limiting hypersonic glide vehicles," *Journal of Strategic Studies* 42, no. 6 (2019), pp. 789–813; James A. Lewis, "Emerging Technologies and Next Generation Arms Control," Center for Strategic and International Studies (October 21, 2019), https://www.csis.org/analysis/emerging-technologies-and-next-generation-arms-control (accessed October 27, 2024).

178 Michael P. Fischerkeller, "Cyber Signaling: Deeper Case Research Tells a Different Story," *Security Studies* 31, no. 4 (2022), pp. 772–782; Nivedita Raju and Wilfred Wan, "Escalation Risks at the Space-Nuclear Nexus," Stockholm International Peace Research Institute (February 2024), https://www.sipri.org/sites/default/files/2024-02/2402_rpp_space-nuclear_nexus.pdf (accessed October 27, 2024).

in some cases, grossly underappreciated[179] by the great powers. All of this implies that more analytical work is needed to examine the nature of these multi-domain escalatory dangers, and states should also make more effort to discuss these problems in the context of the nuclear risk reduction agenda.

Challenge 4: Worst-case assumptions and the different approaches to cooperative security

The fourth challenge of creating a cooperative risk reduction framework is that the United States, Russia, and China all operate in an environment of deep mistrust and worst-case assumptions about each other. Despite sporadic engagements on the Track 1 and Track 1.5 levels, U.S.-Russia relations are at their lowest since the end of the Cold War, and there is not much hope for cooperation with China either. When discussions eventually happen, they usually feature an exchange of long-held mutual grievances, without resolving anything. At the core of these problems are different interpretations of the post-Cold War experience, and a dangerous dynamic of tit-for-tat posturing.[180]

In the U.S.-Russia dyad, Russia's poor track record of arms control compliance has led many U.S. policymakers to believe that Moscow is not a trustworthy partner. The current Russian leadership has clearly turned away from the collective security system and tried to "weaponize" multilateral arms control regimes to advance its crusade against the United States.[181] This has

179 For example, Tong Zhao notes that "many Chinese nuclear experts do not think the risk of inadvertent nuclear escalation between Washington and Beijing is as high as many American experts seem to worry." Tong Zhao, *Political Drivers of China's Changing Nuclear Policy: Implications for U.S.-China Nuclear Relations and International Security* (Washington, DC: Carnegie Endowment for International Peace, 2024), p.53, https://carnegieendowment.org/research/2024/07/china-nuclear-buildup-political-drivers-united-states-relationship-international-security?lang=en. (accessed October 31, 2024). See also, Fiona S. Cunningham and Taylor M. Fravel, "Dangerous Confidence? Chinese Views on Nuclear Escalation," *International Security* 44, no. 2 (2019), pp. 61–109; Anya Fink and Michael Kofman, "Russian Strategy for Escalation Management: Key Debates and Players in Military Thought," Center for Naval Analyses (2020), https://www.cna.org/cna_files/pdf/DIM-2020-U-026101-Final.pdf (accessed October 27, 2024); and Michael Kofman, Anya Fink, and Jeffrey Edmonds, "Russian Strategy for Escalation Management: Evolution of Key Concepts," Center for Naval Analyses (2020), https://www.cna.org/CNA_files/PDF/DRM-2019-U-022455-1Rev.pdf. (accessed October 28, 2024).

180 Michael Albertson, *Closing the Gap: Aligning Arms Control Concepts with Emerging Challenges*, Livermore Paper no. 10 (Livermore, CA: Lawrence Livermore National Laboratory, 2022), p. 30. https://cgsr.llnl.gov/sites/cgsr/files/2024-08/CGSR_Livermore_Paper_10_Closing_the_Gap_0.pdf. Accessed October 28, 2024.

181 See, for example, how nuclear non-proliferation became a new battleground for U.S. and Russian diplomats in Toby Dalton, Mark Hibbs, Nicole Grajewski, and Ankit Panda, "Dimming Prospects for U.S.-Russia Nonproliferation Cooperation," Carnegie Endowment for International Peace (March 14, 2024). https://carnegieendowment.org/research/2024/03/dimming-prospects-for-us-russia-nonproliferation-cooperation?lang=en. Accessed December 23, 2024.

two main implications: first, the willingness to collaborate is low, and second, the burden for future arms control and risk reduction measures is extremely high. Having the necessary tools to detect potential Russian cheating and being able to punish non-compliance became the most important considerations for any future measure. Russian arms control violations have also led to many asymmetric capabilities that directly undermine the security of the United States and its allies. Shifting the military balance through these illegal actions does not only affect the diplomatic prospects of arms control; it also has serious security implications.

Despite the mounting difficulties, the United States has generally approached cooperative security with a positive attitude. From a U.S. perspective, arms control and risk reduction are a continuous process of enhancing trust and predictability where diplomacy plays a crucial role.[182] U.S. proposals are also often presented in the context of NPT obligations, with a long-term view of a world without nuclear weapons.[183] At the same time, similarly to its adversaries, the United States also shares the view that a step-by-step approach is the best way forward, where arms control and risk reduction are pursued in accordance with broader national security objectives. Therefore, there have been many instances where the United States left arms control agreements because it judged that they no longer serve its interests.

From a Russian perspective, cooperative security is a competitive sport. President Putin is not interested in arms control to build trust through diplomatic channels; he is also not interested in cooperative security to reduce risks or gain international recognition. Instead, pursuing these mechanisms is about advancing Russia's broader national security objectives.[184] The two primary reasons why Moscow has traditionally engaged in arms control negotiations are creating predictability in strategic forces

182 Michael Albertson, *Closing the Gap: Aligning Arms Control Concepts with Emerging Challenges*, pp. 53–54.

183 See, for example, President Obama's Berlin speech in 2013: "Peace with justice means pursuing the security of a world without nuclear weapons—no matter how distant that dream may be. And so, as president, I've strengthened our efforts to stop the spread of nuclear weapons, and reduced the number and role of America's nuclear weapons. [...] But we have more work to do. So today, I'm announcing additional steps forward." Barack Obama, "Remarks by President Obama at the Brandenburg Gate—Berlin, Germany," The White House, Office of the Press Secretary (June 19, 2013). https://obamawhitehouse.archives.gov/the-press-office/2013/06/19/remarks-president-obama-brandenburg-gate-berlin-germany. Accessed February 14, 2025.

184 The only good news is that Russia did not always think this way, and their attitude might change again in the future.

and limiting arms races.[185] Over the past few decades, Russia has built up a strongly held narrative that the United States cannot be trusted because it is working towards unilateral domination in the international system. Trying to acquire a disarming first strike capability against Russia is considered a key part of achieving that goal. In this narrative, the United States is deceptive about the true goals of its modernization efforts, especially when it comes to missile defense[186] and conventional prompt global strike,[187] and the United States is also often accused of engaging in preemptive actions and covert operations to instill domestic instability in Russia and achieve a regime change. These arguments are supported by a long list of grievances and criticisms that are regularly repeated in different international forums.[188] As a result, Russia is generally suspicious about U.S. arms control and risk reduction proposals, thinking that the United States is purposefully avoiding limiting the things that are most destabilizing from a Russian perspective, and it uses these mechanisms to lock in unilateral advantages.[189]

In the U.S.-China relationship, there are many similar threads. Given that among the three great powers China has the most opaque nuclear posture, the United States is generally worried about the future directions of the Chinese arsenal. China's open-ended modernization program has generated concern in the United States about the credibility of China's no-first-use policy, the strategic consequences of China's larger and more diverse arsenal, and the new escalation risks that China's buildup has introduced.[190] U.S. leaders are also worried about China's lack of willingness to engage in a strategic

185 Anya Fink, "The General Staff's Throw-Weight: The Russian Military's Role in and Views of U.S.-Russian Arms Control," Center for Naval Analyses (2024). https://www.cna.org/reports/2024/03/Russian-Military-Role-in-US-Russian-Arms-Control.pdf. Accessed December 23, 2024.

186 See more about this in Jacek Durkalec, *Russian Net Assessment and the European Security Balance*, Livermore Paper no. 14 (Livermore, CA: Lawrence Livermore National Laboratory, 2022), pp. 131–137. https://cgsr.llnl.gov/sites/cgsr/files/pubs/2024-08/CGSR_Livermore_Paper_13_Russian-Net-Assessment.pdf. Accessed October 28, 2024.

187 Ibid., pp. 138–139.

188 Michael Albertson, *Closing the Gap: Aligning Arms Control Concepts with Emerging Challenges*, pp. 54–55.

189 Some of these Russian concerns are not completely unfounded given occasional statements from senior U.S. officials who argue that one-sided agreements that benefit the United States are good treaties, and "arms control should be cost-imposing on our adversaries." Quoted in George Perkovich, "An Optimist Admits That It Is Difficult to See a Path Forward," *Arms Control Today* 52, no. 3 (April 2022), pp. 12–14.

190 See more about this in Brad Roberts, chair, *China's Emergence as a Second Nuclear Peer: Implications for U.S. Nuclear Deterrence Strategy*, Report of a study group convened by the Center for Global Security Research (Livermore, CA: Center for Global Security Research, 2023). https://cgsr.llnl.gov/content/assets/docs/CGSR_Two_Peer_230314.pdf. Accessed October 28, 2024.

stability dialogue, and its constant refusal of U.S. proposals for risk reduction and arms control measures (this, however, is partly explained by the fact that the United States has never put anything on the table that China might want). These attitudes feed into the U.S. paranoia about China's long-term objectives and reinforce the worries about China's revisionist agenda. As the U.S. Department of Defense has recently stated,

> "The PRC's national strategy is to achieve 'the great rejuvenation of the Chinese nation' by 2049. The strategy is a determined pursuit of political, social, and military modernity to expand the PRC's national power, perfect its governance, and revise the international order in support of the PRC's system of governance and national interests."[191]

On the Chinese side, leaders are also generally suspicious about the U.S. intentions in the region, and they approach U.S. initiatives with a deep mistrust. Just like Russia, China also defines strategic stability with a broad mindset that focuses on the general military balance. Therefore, they see U.S. military developments in nuclear weapons, missile defense, and conventional prompt global strike as collective proof of the U.S. search for absolute security to escape from a mutual vulnerability relationship with China, and to enhance the U.S. ability to use nuclear bullying and coercion.[192] As a result, China refuses to use Cold War concepts to define its relationship with the United States, and it generally views U.S. invitations for dialogue and arms control as a plot to increase Chinese vulnerabilities and put limits on its modernization efforts. China argues that a strategic stability relationship only exists between nuclear equals, which is not the case in the U.S.-China dyad. They contend that it is primarily the responsibility of the superior state to implement nuclear reductions and to advance transparency since the weaker state is already more vulnerable to hidden intentions.[193] Given this deeply held mistrust towards the United States, it is highly unlikely that China would join any formal arms control or risk reduction arrangement in the near

191 U.S. Department of Defense, "Military and Security Developments Involving the People's Republic of China, the People's Liberation Army (PLA)," p. 1.

192 Brad Roberts, ed., *Taking Stock: U.S.–China Track 1.5 Nuclear Dialogue*, CGSR Occasional Papers (Livermore, CA: Center for Global Security Research, 2020). https://cgsr.llnl.gov/sites/cgsr/files/2024-08/cgsr_us-china-paper.pdf. Accessed October 28, 2024.

193 Ibid.

future. At the same time, China sees itself as a responsible nuclear weapon state[194] that has demonstrated restraint for decades through its no-first-use commitment, thus it is possible that it would engage in broader risk reduction efforts to reinforce this image.

A further challenge is that general suspicion about each other is not only present at the state level, but it also transcends the interpersonal relations between heads of state. In the past, national leaders often played a constructive and stabilizing role in antagonistic dyads (see, for example, the Reagan-Gorbachev relationship, or the relationship between Indian Prime Minister Atal Bihari Vajpayee and Pakistani Prime Minister Nawaz Sharif). Mutual trust in these relationships has been an important engine of negotiating cooperative security measures in times of intense competition. In fact, Nicholas Wheeler argues that interpersonal trust between state leaders in adversarial relationships provides the greatest assurance of accurate signal interpretation, and it can play a key role in overcoming the obstacles of credibly signaling peaceful intent.[195] In the current context, however, these close trust-based interpersonal relationships are largely missing. Therefore, it is more likely that in a crisis or war, national leaders would believe the worst about the other side's intentions—and decisions would generally suffer from confirmation bias. These attitudes create a dangerous pathway for misunderstandings and inadvertent escalation, and they also stand in the way of meaningful progress on risk reduction.

Challenge 5: The ambiguous character of risk in strategy

The next big challenge emerges from the ambiguous character of risk in strategy. On the one hand, states can grow concerned about certain risks and decide to take action to reduce them, but on the other hand, states can also deliberately create and exploit risks to advance their national security. Thus, not all risks are created equal, and some actors will simply refuse to address certain risks if they judge that those risks can be beneficial. In his 1959 paper titled "The Threat That Leaves Something to Chance," Schelling argued that creating a risky situation in which neither side can fully control

194 Ministry of Foreign Affairs of The People's Republic of China, "China's Non-Proliferation Policy and Measures" (November 21, 2024). https://www.mfa.gov.cn/eng/wjb/zzjg_663340/jks_665232/kjlc_665236/fkswt_665240/202406/t20240606_11405135.html. Accessed December 19, 2024.

195 Nicholas J. Wheeler, *Trusting Enemies: Interpersonal Relationships in International Conflict* (Oxford: Oxford University Press, 2018).

the outcomes can help to reinforce deterrence and prevent escalation. In his words, the key is "the deliberate creation of a recognizable risk of war, a risk that one does not completely control. It is the tactic of deliberately letting the situation get somewhat out of hand, just because its being out of hand may be intolerable to the other party and force his accommodation."[196] Throughout the nuclear age, many nuclear possessors have effectively used the strategy of risk manipulation to coerce an adversary.

For example, during the Cold War period, the United States faced an immense credibility challenge in its extended deterrence commitments vis-à-vis European NATO allies. U.S. leaders at the time judged that the best way to overcome this problem was to deploy thousands of tactical nuclear weapons in the territory of allies (including nuclear artillery shells and mines) and pre-delegate launch authority which created what some analysts identified as a "regional doomsday machine."[197] This system was prone to "chaos, loss of political control […] and rapid nuclear escalation in the event of a serious crisis or conflict."[198] Building such a risky and unpredictable architecture was seen as the solution to address the inherent credibility problem of extended deterrence, namely whether any U.S. president would risk mutual destruction with the Soviet Union to protect its allies and partners in remote regions. Due to how nuclear weapons were based in Europe, if the Warsaw Pact tried to advance forward into the territory of U.S. allies, escalation was likely to happen even if national leaders tried to stop it, because military commanders on the ground would have been incentivized to use their nuclear launch authority to stop the enemy incursion.[199] This possibility instilled fear in the minds of Soviet leaders, and helped to avoid a hot war in Europe.

A more recent example of deliberate risk manipulation is provided by Russia's war in Ukraine. From the beginning, Russia has used intense nuclear signaling, which included the implementation of a "special nuclear regime" for Russian strategic deterrent forces, intense nuclear exercises, ICBM test launches, and aggressive leadership rhetoric with regular reminders

196 Thomas C. Schelling, "The Threat that Leaves Something to Chance," p. 18.

197 See more about this in Paul Bracken, *The command and control of nuclear forces* (New Haven, CT: Yale University Press, 1983); and Stephen D. Biddle and Peter D. Feaver, "Roles and missions of battlefield nuclear weapons," in Stephen D. Biddle and Peter D. Feaver, eds., *Battlefield nuclear weapons* (Lanham, MD: University Press of America, 1989), pp. 3–12.

198 Shaun R. Gregory, *Nuclear command and control in NATO* (London: Palgrave Macmillan, 1996), p. 194.

199 Benoît Pelopidas and Kjølv Egeland, "The false promise of nuclear risk reduction," p. 350.

of Russia's nuclear capacity. These signals were meant to prevent the Alliance from imposing a no-fly zone over Ukraine, to deter the West from sending lethal military aid to Ukraine, and to contain certain Western actions (including further sanctions and a direct military involvement in the conflict).[200] President Putin and his inner circle has issued many such warnings since February 2022, reinforcing the narrative that Russian leaders have a much higher risk tolerance, and they are ready to resort to nuclear use if Russia's national security is threatened. For example, in early 2023 President Putin warned that "the longer the range of the Western systems that will be supplied to Ukraine, the further we will have to move the threat away from our borders."[201] In January 2023, Dmitry Medvedev, deputy chairman of the Russian Security Council, wrote on Telegram that "the defeat of a nuclear power in a conventional war can provoke the outbreak of a nuclear war. Nuclear Powers have not lost major conflicts on which their fate depends."[202] Since the war began, the Center for Strategic and International Studies (CSIS) counted over 200 examples of Russian officials making a reference to nuclear risks.[203] Some of these were deliberate attempts to manipulate the risk of nuclear war and constrain the West, while others were aimed at pushing the narrative that the West is responsible for increasing nuclear risks while Russian doctrine remains defensive.

Due to this intense nuclear signaling, the war in Ukraine has unfolded under a long nuclear shadow. The results of nuclear intimidation, however, are mixed. On the one hand, Russia's nuclear rhetoric achieved its objectives because the West approached the problem with a clear desire to avoid escalation. Therefore, the United States and its allies decided against the

200 Anya Fink and Jeffrey Edmonds, "Russia's Nuclear Weapons: An Arsenal and a Doctrine in Transition?" in John Scott, ed., *Los Alamos National Laboratory Director's Strategic Resilience Initiative*, papers prepared for the LANL DSRI Policy and Strategy Workshop on the Role of Nuclear Weapons in U.S. National Security Strategy (Los Alamos, NM: Los Alamos National Laboratory, 2024), pp. 2–9. https://www.osti.gov/biblio/2337639. Accessed October 28, 2024.

201 Vladimir Putin, "Presidential Address to Federal Assembly," President of Russia (February 21, 2023). http://en.kremlin.ru/events/president/transcripts/70565. Accessed October 28, 2024.

202 Quoted in Guy Faulconbridge and Felix Light, "Putin ally warns NATO of nuclear war if Russia is defeated in Ukraine," Reuters (January 19, 2023). https://www.reuters.com/world/europe/putin-ally-medvedev-warns-nuclear-war-if-russia-defeated-ukraine-2023-01-19/. Accessed October 28, 2024.

203 Heather Williams, Kelsey Hartigan, Lachlan MacKenzie, and Reja Younis, "Deter and Divide—Russia's Nuclear Rhetoric & Escalation Risks in Ukraine," Project on Nuclear Issues, Center for Strategic and International Studies (undated). https://features.csis.org/deter-and-divide-russia-nuclear-rhetoric/#group-section-Key-Takeaways-MQpBQvqolu. Accessed October 28, 2024.

most escalatory measures such as imposing a no-fly zone, sending NATO troops to Ukraine, or inviting Ukraine to join the Alliance. On the other hand, NATO has also gradually increased its support to Ukraine and crossed many thresholds that Russia initially identified as highly escalatory. One of the key reasons why the Biden administration was successful in escalation management is that it managed uncertainty by signaling different kinds of restraint and then edged up to the threshold line while continuously monitoring Russian reactions and adjusting its approach as needed.[204]

Altogether, manipulating nuclear risks has been a strategy that great powers have successfully used in the past, and it is likely to remain part of their deterrence posture to varying degrees. While the United States has mostly demonstrated a risk averse behavior in the war in Ukraine and it refused to adopt nuclear brinkmanship,[205] Russia[206] and China[207] are moving in opposite directions. Their increased reliance on nuclear weapons comes with higher risk tolerance, and a growing likelihood of using nuclear risks for coercive purposes. As a result, the risk reduction framework is not equally suited to address all nuclear dangers. Where great power interests align, risk reduction has a chance to succeed, but in areas where certain great powers see a benefit in deliberate risk manipulation, cooperative mechanisms are likely to face significant roadblocks.

Challenge 6: Trading one risk for another

The next challenge is that some nuclear risk reduction measures can trigger unintended negative consequences which means that pursuing certain measures could force a state to make a costly trade-off. De-alerting, for example, has been a longstanding issue that has enjoyed widespread support among a large group of non-nuclear weapon states and arms control and disarmament advocates.

De-alerting was part of the 13 practical steps adopted by the 2000

204 Janice Gross Stein, "Escalation Management in Ukraine: 'Learning by Doing' in Response to the 'Threat that Leaves Something to Chance.'"

205 U.S. Department of Defense, "National Defense Strategy, Nuclear Posture Review, Missile Defense Review."

206 Anya Fink and Michael Kofman, "Russian Strategy for Escalation Management: Key Debates and Players in Military Thought;" and Jacek Durkalec, *Russian Net Assessment and the European Security Balance*.

207 Ashley J. Tellis, *Striking Asymmetries: Nuclear Transitions in Southern Asia* (Washington DC: Carnegie Endowment for International Peace, 2022). https://carnegieendowment.org/research/2022/07/striking-asymmetries-nuclear-transitions-in-southern-asia?lang=en. Accessed October 28, 2024.

NPT Review Conference as a necessary and practical measure towards disarmament. In 2007, the United Nations also adopted a nonbinding resolution on requiring the nuclear weapon states to reduce their alert levels, with 124 states voting in favor of the proposal. In a 2015 report, the Global Zero Commission also made the case for "an international norm that pressures nations to operate their nuclear forces at a low level of attack readiness" on the basis that de-alerting "can be effective in increasing warning and decision time and foiling the exploitation of nuclear command and control by unauthorized actors and hackers."[208]

Advocates of this solution argue that separating warheads from their delivery vehicles would reduce the risk of accidental, unauthorized, or mistaken use of nuclear weapons. These arguments, however, only gained limited traction among nuclear weapon states. In their view, the implementation of de-alerting would introduce a number of new problems and would basically trade one risk for another.[209] Implementing reversible physical modifications to reduce alert levels could potentially undermine both first-strike and crisis stability. In the face of mounting tensions, a re-alerting race could incentivize first strike for the faster side, and it could also create crisis stability risks by increasing the chances of misunderstandings about a state's decision to re-alert.

The tension between these two sides have been best captured by the so called "always/never dilemma."[210] While credible deterrence requires that the military is always able to use nuclear weapons at a moment's notice in any circumstance, it must also make sure that accidents and unauthorized use of nuclear weapons can never happen, and nuclear weapons are never used as a result of a miscalculation. These competing objectives have forced states to prioritize certain risk reduction solutions over others and accept difficult trade-offs. In this specific case, most nuclear weapon states chose to keep certain portion of their nuclear forces on high alert that was seen as necessary for deterrence effectiveness, but they also implemented several technical and procedural safeguards (such as Permissive Action Links) to

208 James E. Cartwright, chair, *Global Zero Commission on Nuclear Risk Reduction: De-Alerting and Stabilizing the World's Nuclear Force Postures*, p. 4.

209 Corentin Brustlein, *Strategic risk reduction between nuclear-weapons possessors*, p. 29.

210 Peter Feaver, *Guarding the Guardians: Civilian Control of Nuclear Weapons in the United States* (Ithaca, NY: Cornell University Press, 1992), p. 12.

prevent accidental, unauthorized, or mistaken use.[211]

Challenge 7: Asymmetric benefits

A closely related problem to the issue of trade-offs is the challenge of asymmetries. Not all risk reduction measures would bring equal benefits to all states. Certain mechanisms would primarily favor one side, while the other side might only see limited or no benefit at all. In this regard, a good practical example is transparency. Among the great powers, the United States is the most transparent state. This transparency transcends its nuclear doctrine, capabilities, decisionmaking procedures, and even its weaknesses. In contrast, Russia and (especially) China are rather opaque about many of these issues, and they deliberately want to maintain a certain degree of unpredictability and uncertainty because it serves them well in their coercive strategies.[212] Therefore, implementing transparency measures in a cooperative framework would primarily favor the United States, while Moscow and Beijing might not learn anything new about the United States. In light of these asymmetries, Russia sees a commitment to mutual transparency as a concession that should rather be traded away for something more valuable.[213]

In the Chinese case, there is a similar resistance to mutual transparency because the Communist Party leadership holds the belief that in asymmetric relationships, the weaker side is more vulnerable, therefore the burden of transparency falls exclusively on the stronger side to dispel misconceptions and demonstrate peaceful intent.[214]

In light of these asymmetries, each nuclear possessor has a different assessment of risk reduction priorities. Therefore, setting a global agenda that enjoys broad support among all nuclear possessors is unlikely. Instead, a more realistic approach is needed that accounts for these differences through

211 Andrew Brown and Jeffrey Lewis, "Reframing the Nuclear De-alerting Debate: Towards Maximizing Presidential Decision Time," Nuclear Threat Initiative (December 10, 2013). https://www.nti.org/analysis/articles/reframing-nuclear-de-alerting-debate-towards-maximizing-presidential-decision-time/. Accessed October 28, 2024.

212 While Russia reveals a lot about its nuclear strategy, it deliberately uses doctrinal ambiguity to maximize its own flexibility and confuse the West. (See more about this in the next chapter.)

213 Andrey Baklitskiy, "Mapping out an Agenda for U.S.-Russian Arms Control," in Brad Roberts, ed., *Major Power Rivalry and Nuclear Risk Reduction: Perspectives from Russia, China, and the United States* (Livermore, CA: Lawrence Livermore National Laboratory, 2020), p. 12. https://cgsr.llnl.gov/content/assets/docs/Major-Power-Rivalry-and-Nuclear-Risk-Reduction.pdf. Accessed October 31, 2024.

214 Brad Roberts, ed., *Taking Stock: U.S.–China Track 1.5 Nuclear Dialogue.*

a mix of unilateral, bilateral, and multilateral proposals. As it was noted earlier, there is no one-size-fits-all solution.

Challenge 8: Deterrence obligations can come into conflict with risk reduction and arms control

In the first chapter, I explored how arms control, risk reduction, and deterrence are different tools that work in tandem to stabilize great power relations and reduce the likelihood of nuclear war. At the same time, the prominence of these tools has continuously shifted, and different periods had a different take on which tool is most appropriate to advance the above goals. These shifts have primarily happened in response to changes in the security environment (and to a lesser extent, in response to domestic political changes). For example, in the early 1980s, the great powers were mostly focused on strengthening deterrence, while arms control and risk reduction were on a back burner. This has dramatically shifted with the end of the Cold War and the dissolution of the Soviet Union, when suddenly arms control and risk reduction measures came back to the forefront, and the two former superpowers both adjusted their nuclear postures to reduce reliance on nuclear weapons in their defense policy.

Given the renewed competition in the current era, and the lack of willingness to cooperate among great powers, strengthening deterrence regained prominence, while seeking cooperative solutions seems like a remote possibility. These shifting priorities can be highly consequential because they can lead to important policy choices. While deterrence, arms control, and risk reduction are all designed to advance the same goals, there are competing obligations[215] that are inherent in these tools. The international community generally attaches a positive value to arms control and risk reduction efforts, but as Rose Gottemoeller noted on many occasions, "arms control is not a good in and of itself, but because it contributes to our

215 These competing obligations usually manifest in the form of deterrence vs. arms control and risk reduction, and not between arms control and risk reduction, which are much closer to each other. A practical example for conflict between deterrence and arms control objectives would be the current two-peer challenge. The United States remains interested in continuing strategic arms control with Russia (as President Trump has recently confirmed), but in light of the open-ended nuclear modernization program of China, deterrence requirements might change, and bilateral arms control between the United States and Russia cannot proceed until there is more clarity about the endpoint of China's modernization efforts (or until China also agrees to join arms control discussions). International Security Advisory Board, "Report on Deterrence in a World of Nuclear Multipolarity," U.S. Department of State (October 2023). https://www.state.gov/wp-content/uploads/2023/11/ISAB-Report-on-Deterrence-in-a-World-of-Nuclear-Multipolarity_Final-Accessible.pdf. Accessed February 15, 2025.

security."[216] In this sense, not all arms control and risk reduction agreements are inherently good, and there are cases when these mechanisms can actually undermine stability. Therefore, depending on the security environment, states might have to deconflict these competing obligations, and pursue those measures that do less harm.

A good practical example for this problem is the case of no-first-use policy.[217] The issue of no-first-use policy has been in debate ever since nuclear weapons were invented. Presidential assurances on when nuclear weapons might be used (positive assurances) and in which situations they would not be considered (negative assurances) are important indicators of a state's reliance on nuclear weapons, and shifts in these declaratory policy statements have been widely considered to be an important element of the nuclear weapon states' progress towards disarmament. In the U.S. case, no-first-use policy has been heavily debated under the Obama and Biden administrations as a possible way to advance the goal of reducing reliance on nuclear weapons. At the same time, these administrations have also expressed a strong desire to deepen alliance relations and strengthen extended deterrence. In light of worsening relations with Russia after the 2014 annexation of Crimea and growing tensions with China, the goal of reducing reliance on nuclear weapons through a no-first-use policy came into sharp conflict with the goal of strengthening extended deterrence in an increasingly competitive security environment. Although U.S. allies remain committed to reducing nuclear dangers and generally welcome progress in arms control efforts, most of them judged that the deeper assurances they were seeking from the United States required that all options remained on the table to defend their vital interests. In fact, many anxious allies have openly argued against a U.S. no-first-use policy. In the Japanese context, government officials have expressed concerns that if the United States adopted a no-first-use policy "it would increase the security risk (of the U.S. allies) as it sends

216 Rose Gottemoeller, "Speech by NATO Deputy Secretary General Rose Gottemoeller at the Swedish Institute for International Affairs," NATO (September 12, 2019). https://www.nato.int/cps/en/natohq/opinions_168662.htm. Accessed October 29, 2024.

217 See more about this debate in Scott D. Sagan, "The Case for No First Use," *Survival 51*, no 3 (2009), pp. 163–182; Steve Fetter and Jon Wolfsthal, "No First Use and Credible Deterrence," *Journal for Peace and Nuclear Disarmament* 1, no. 1 (2017), pp. 102–114; Michael Krepon, "Not Just Yet for No First Use," Arms Control Wonk (July 31, 2016), https://www.armscontrolwonk.com/archive/1201722/not-just-yet-for-no-first-use/ (accessed October 29, 2024); Brad Roberts, "Debating Nuclear No-first-use, Again," *Survival* 61, no. 3 (2019), pp. 39–56; and James N. Miller, "No to no first use—for now," *Bulletin of the Atomic Scientists* 76, no. 1 (2020), pp. 8–13.

a wrong message that as far as an adversary offense remains conventional, it will not face nuclear attack."[218] In the European context, most allies were of the same opinion as Japan. During the last two years of the Obama administration, defense ministers of several allied countries have lobbied the White House against changing U.S. declaratory policy.[219]

In both cases, the White House understood these concerns and eventually concluded that the goal to strengthen extended deterrence was simply not compatible with a no-first-use policy. Thus, the Obama and Biden administrations have opted against adopting this policy change and explored other ways to reduce the role of nuclear weapons.

Altogether, deterrence, arms control, and risk reduction are interconnected, and they can mutually reinforce each other. For example, risk reduction measures involving military-to-military communication can lessen the likelihood of deterrence failure due to miscalculation. At the same time, deterrence can also come into conflict with risk reduction. While not many people would debate the merit of no-first-use in a benign environment, it is a risky choice in a competitive one. In situations like this, a pragmatic assessment of the security environment can help to identify which tools are better suited to advance national security objectives and which obligations deserve priority. As the security environment changes, priorities may also shift, and previously shelved initiatives could become feasible.

Key Takeaways

The risk reduction framework was born in the bilateral nuclear-focused Cold War environment, with a logic deeply rooted in deterrence and strategic stability. In the post-Cold War period, this approach had to evolve in several major ways. New actors entered the scene, the mechanisms were no longer primarily bilateral, and the scope of risk reduction has also expanded to include nonproliferation, nuclear security, and nuclear disarmament. As a result, risk reduction was disassociated from deterrence and arms control, and it came to mean different things to different communities.

In several respects, the current security environment is a mix of

218 Quoted in Abe Nobuyasu, "No First Use: How to Overcome Japan's Great Divide," *Journal for Peace and Nuclear Disarmament* 1, no. 1 (2018), pp. 137–151.

219 Josh Rogin, "U.S. allies unite to block Obama's nuclear 'legacy,'" *The Washington Post* (August 14, 2016). https://www.washingtonpost.com/opinions/global-opinions/allies-unite-to-block-an-obama-legacy/2016/08/14/cdb8d8e4-60b9-11e6-8e45-477372e89d78_story.html. Accessed October 29, 2024.

the worst characteristics of the previous two eras. On the one hand, it is characterized with intense great power competition and arms racing (just like the Cold War environment); on the other hand, it is multipolar with many new types of threats (like the post-Cold War environment). Furthermore, these problems are now present with greater intensity and augmented complexity. Increasing multipolarity is compounded by a growing number of multi-domain threats which have created new escalatory risks that are poorly understood and generally underappreciated. Adversarial relations suffer from deep-seated mistrust, and in many cases deliberate risk manipulation is an important part of the great powers' strategy to manage escalation. In this competitive environment, advancing risk reduction often comes into direct conflict with deterrence requirements. States also face difficult choices in risk reduction approaches given the growing asymmetries in great power military postures and capabilities and the inherent trade-offs among some risk reduction measures. Although these challenges have made it very difficult to design a risk reduction framework that is both feasible and useful, this chapter has outlined a few general guidelines that might help to overcome these problems:

- First, increasing multipolarity implies that flexible and adaptable solutions are needed that can be tailored to different adversarial relationships.

- Second, there is a lot of speculation and hype about the potential impact of emerging technologies on nuclear risks, but a deeper understanding of these risks is still largely missing. This implies that further analytical efforts are needed to examine the nature of multi-domain escalatory risks. A deeper understanding of these problems could help to raise awareness among great powers, and it could also help to identify what kind of innovations are needed in risk reduction approaches.

- Third, the great powers must do more to engage each other and dispel the riskiest misperceptions among themselves. Otherwise, they will be locked in an antagonistic mindset that is a dangerous recipe for inadvertent escalation.

- Fourth, since great powers have a different approach to risk manipulation, not all risks can be addressed through cooperative

mechanisms. In this regard, the most difficult area is putting limits on intentional escalation, and probably the most promising areas are reducing the dangers of accidental or unintended escalation. To identify where key interests are aligned, some kind of sustained dialogue is needed which could help to delineate where negotiated restraints are even an option.

- Fifth, due to possible unintended negative consequences, advancing risk reduction would most likely involve difficult trade-offs. This implies that a comprehensive multilateral framework is unlikely to succeed. Instead, an incremental approach could bring better results that identifies the most useful pathway forward for risk reduction on a case-by-case basis.

- Sixth, asymmetric benefits imply that if a country is proposing one or more risk reduction measure, it should probably be forthcoming about how it sees the advantages and disadvantages of each proposal to the pertinent party, and then explain how when added up, the result is equitable. Or, if what is being proposed is not equitable, try to make the case why others should still accept it.

- Lastly, risk reduction does not exist in a vacuum. Risks cannot be properly understood outside of the context of the given security environment, which means that arms control, risk reduction, and deterrence mechanisms, and the balance among them, must fit the realities of the given security environment. They all have a role to play in stabilizing great power relations and reducing the likelihood of war, but prioritization might be needed if they come into conflict with each other.

The following chapter focuses on operationalizing these principles and identifying the main policy implications. I start with an outline of the great powers' risk reduction proposals and approaches to highlight the key differences. Then I explore the conditions of risk reduction success and provide a few general recommendations on how to create these conditions in areas where they do not exist at the moment. Finally, I provide guidance on what kind of risk reduction mechanisms should be advanced through cooperative and unilateral measures.

Policy Implications for Setting a Risk Reduction Agenda

Different National Agendas in Risk Reduction

United States

Since the end of the Cold War, the United States has taken important measures to reduce the role of nuclear weapons. In the 2022 *Nuclear Posture Review*, the Biden administration has clearly stated that "the fundamental role of nuclear weapons is to deter nuclear attack on the United States, our Allies, and partners. The United States would only consider the use of nuclear weapons in extreme circumstances to defend the vital interests of the United States or its Allies and partners."[220] Additionally, the NPR also emphasized the need to continue to reduce reliance on nuclear weapons. These statements were meant to convey a restrained approach to nuclear use.

The United States has a long track record of supporting risk reduction measures as well as a rich history of concrete proposals that were put forward by different administrations. The United States very often refers to risk reduction as a broad framework that is connected to its NPT obligation to work towards disarmament.[221] Despite the growing tensions with Russia and China, the Biden administration maintained that risk reduction had an important role in U.S. national security strategy. The 2022 NPR stated that "The United States will pursue a comprehensive and balanced approach that places a renewed emphasis on arms control, non-proliferation, and risk reduction to strengthen stability, head off costly arms races, and signal our desire to reduce the salience of nuclear weapons globally."[222] Risk reduction was also mentioned in the context of allies as "Part of our assurance to Allies and partners is a continued and strengthened commitment to arms control,

220 U.S. Department of Defense, "National Defense Strategy, Nuclear Posture Review, Missile Defense Review," p. 9.

221 Mallory Stewart, "Nuclear Risk Reduction in the Hemisphere."

222 U.S. Department of Defense, "Nuclear Posture Review," p. 1.

nuclear nonproliferation, and nuclear risk reduction to improve collective security by reducing or constraining adversary capabilities."[223] In terms of practical measures, the administration committed to initiatives that limit destabilizing systems or postures and reduce the chances of miscalculation.

In a June 2023 speech, National Security Advisor Jake Sullivan laid out a "new strategy" to prevent an arms race, reduce the risk of misperception and escalation, and ensure safety and security from nuclear risks.[224] This strategy incorporated three main lines of effort: 1) a promise to engage in bilateral arms control discussions with Russia and China without preconditions; 2) a willingness to engage in new multilateral arms control efforts, including in the P5 format; and 3) a commitment to set norms and shore up values in this new nuclear era. Along these lines, Sullivan made a commitment to continue advance notifications of ballistic missile launches and major exercises as required by existing agreements and proposed extending these notifications to all P5 members. He also repeated the U.S. pledge to maintain a human-in-the-loop for command, control, and employment of nuclear weapons. In the P5 context he advocated for the establishment of crisis communication channels, a commitment to transparency in nuclear policy, doctrine, and budgeting, and the implementation of guardrails for managing the interplay between non-nuclear strategic capabilities and nuclear deterrence. He reiterated U.S. leadership in setting a normative framework for the military applications of AI and creating behavioral standards for responsible conduct in the space domain, emphasizing the U.S. commitment to not conduct destructive, direct-ascent anti-missile testing. These mechanisms, however, are only one side of the coin. Sullivan also emphasized that reducing nuclear risks and advancing strategic stability also requires strengthening deterrence through a continued commitment to nuclear modernizations and closer cooperation with allies.

The biggest challenge in the implementation of U.S. risk reduction proposals is that most of them require adversary collaboration. Russia and

223 Ibid., p. 8.

224 Jake Sullivan, "Remarks by National Security Advisor Jake Sullivan for the Arms Control Association (ACA) Annual Forum," The White House Briefing Room (June 2, 2023). https://www.whitehouse.gov/briefing-room/speeches-remarks/2023/06/02/remarks-by-national-security-advisor-jake-sullivan-for-the-arms-control-association-aca-annual-forum/. Accessed October 30, 2024.

China, however, have repeatedly rejected[225] these proposals which leaves the P5 risk reduction effort mostly stuck. While the United States sees an important value in setting the norms in these areas and putting the spotlight on Russian and Chinese resistance, the lack of adversary buy-in limits the practical benefits of these proposals. In the U.S.-China dimension, there are two minor exceptions. First, Presidents Biden and Xi made a joint statement that affirmed the need to maintain human control over the decision to use nuclear weapons (but despite the joint statement, China refused to officially sign up to the U.S. "Political Declaration on Responsible Military Use of Artificial Intelligence and Autonomy"). And second, China provided an ad hoc launch notification of its ICBM test in September 2024, which was reciprocated by the United States in November. While these are positive signals from China, their significance is symbolic at best.

Due to the lack of real progress with adversaries, the United States has also identified several unilateral measures to advance the goals of risk reduction. These include a Failsafe review to examine the safety, security, and reliability of nuclear weapons and related systems in the face of growing challenges posed by emerging and disruptive technologies,[226] and a commitment to deepen collaboration with allies in crisis communication, coordination, capacity building, and awareness raising about the drivers of nuclear risks and instabilities in a regional context.[227]

In general, the U.S. approach[228] to risk reduction reflects a rather pragmatic view of the security environment, and the new types of threats that have emerged over the past decade. While the proposed mechanisms might not be aggressive enough in the eyes of many non-nuclear weapon states,

225 Most recently, the Russian Chief of the General Staff Valery Gerasimov made a statement that "On the whole, the topic of arms control remains in the past, since a return to a minimum level of trust is impossible today due to the double standards of the West." Reuters, "Arms control is thing of the past, Russia's top general says" (December 18, 2024). https://www.reuters.com/world/europe/arms-control-is-thing-past-russias-top-general-says-2024-12-18/. Accessed December 23, 2024.

226 Alexandra Bell, "Remarks at NPT PrepCom Side Event on Technological Complexity and Nuclear Reduction: A Checklist and Guardrails Framework for EDTs in Nuclear Weapons Decision-making," U.S. Department of State (July 25, 2024). https://www.state.gov/remarks-at-npt-prepcom-side-event-on-technological-complexity-and-nuclear-reduction-a-checklist-and-guardrails-framework-for-edts-in-nuclear-weapons-decision-making/. Accessed October 30, 2024.

227 Mallory Stewart, "Nuclear Risk Reduction in the Hemisphere."

228 See more about this topic in Pranay Vaddi, "The U.S. Arms Control Agenda: A Discussion with NSC Senior Director Pranay Vaddi," Center for Strategic and International Studies (January 18, 2024). https://www.csis.org/analysis/us-arms-control-agenda-discussion-nsc-senior-director-pranay-vaddi. Accessed October 31, 2024.

they are pursued with the mindset that risk reduction is about living up to the enduring obligation under the NPT to work towards disarmament. At the same time, in this competitive environment the United States does not have the luxury to pursue risk reduction at the expense of its deterrence obligations. Therefore, the most important challenge in the coming years is to find the right balance between these two sides and continuously re-adjust it as the security environment changes.

Russia

Similarly to the United States, Russia has also tried to convey a restrained approach to nuclear use. For example, its most recent nuclear doctrine states that "The Russian Federation considers nuclear weapons as a means of deterrence, the employment of which is an extreme and compelled measure, and makes all the necessary efforts to reduce the nuclear threat and prevent aggravation of interstate relations that could trigger military conflicts, including nuclear ones."[229] At the same time, Russia's conduct and rhetoric[230] around the war in Ukraine, and some details of its 2024 doctrine[231] imply that Russia has a lower threshold for nuclear use than the United States, and it relies more heavily on nuclear weapons for escalation management and war termination.[232] As President Putin noted himself, "nuclear weapons are designed to ensure our security in a broader sense,"[233] which explains why Russia's nuclear threats in the past few years have gone way below the bar of the existential threats that Russia has traditionally

229 The Ministry of Foreign Affairs of the Russian Federation, "Fundamentals of State Policy of the Russian Federation on Nuclear Deterrence" (December 3, 2024). https://mid.ru/en/foreign_policy/international_safety/regprla/1434131/. Accessed December 23, 2024.

230 Heather Williams, Kelsey Hartigan, Lachlan MacKenzie, and Reja Younis, "Deter and Divide—Russia's Nuclear Rhetoric & Escalation Risks in Ukraine;" and Janice Gross Stein, "Escalation Management in Ukraine: 'Learning by Doing' in Response to the 'Threat that Leaves Something to Chance.'"

231 Heather Williams, "Why Russia Is Changing Its Nuclear Doctrine Now," Center for Strategic and International Studies (September 27, 2024). https://www.csis.org/analysis/why-russia-changing-its-nuclear-doctrine-now. Accessed November 4, 2024.

232 Michael Kofman, Anya Fink, and Jeffrey Edmonds, "Russian Strategy for Escalation Management: Evolution of Key Concepts;" and Jacek Durkalec, *Russian Net Assessment and the European Security Balance.*

233 Quoted in Tong Zhao, *Political Drivers of China's Changing Nuclear Policy: Implications for U.S.-China Nuclear Relations and International Security*, p. 27.

emphasized.[234] In a recent statement reflecting on the changes in Russia's nuclear doctrine, Sergei Karaganov, an influential Russian foreign policy advisor to President Putin, argued that these doctrinal measures were taken to "sober up our Western partners, especially the Europeans […] They must be stopped, including by going up the ladder of nuclear escalation and informing them in various ways—both military-technical and by changing the (Russian nuclear) doctrine—that they will be the first to die in this war."[235]

Russia has been using this dual messaging strategy for a long time. On the one hand, they try to reflect the image of a responsible nuclear possessor that is restrained,[236] but on the other hand, political and military leaders, and influential academics often make harsher statements that are meant to instill fear in Russia's adversaries. As Katarzyna Zysk argues, "This aligns with Russia's doctrinal objective of maintaining deliberate ambiguity regarding the circumstances for the use of nuclear weapons."[237] Due to these intentional efforts to confuse the West, it is sometimes difficult to distinguish between rhetorical manipulation and actual thresholds. These ambiguities are created to intimidate adversaries and allow Russian leaders maximum flexibility to adapt actions as needed. Thus, Russia does not have the same drivers to conclude risk reduction measures that try to close the pathways to limited nuclear use—in fact, they seem to be interested in keeping these threats credible and exploiting them for coercive gains.

From a Russian perspective, there are a few key considerations that influence their approach to risk reduction. First, as Andrey Baklitskiy notes, "The Russian strategic community considers a number of past bilateral arms

234 The Ministry of Foreign Affairs of the Russian Federation, "Basic Principles of State Policy of the Russian Federation on Nuclear Deterrence" (June 8, 2020). https://www.mid.ru/en/foreign_policy/international_safety/1434131/. Accessed November 4, 2024.

235 Quoted in Vladimir Soldatkin, "Security hawk says Russia will take more steps up nuclear ladder of escalation," Reuters (November 6, 2024). https://www.reuters.com/world/europe/security-hawk-says-russia-will-take-more-steps-up-nuclear-ladder-escalation-2024-11-06/. Accessed November 7, 2024.

236 This image is important because Russia is still a member of the NPT and expected to make progress towards complete disarmament. Since many Russia-friendly governments in the developing world are signatories to the ban treaty, Russia has an interest in maintaining the image of a state that intends to live up to its NPT obligations. Nicholas Adamopoulos, "The Uncertain Future of U.S.-Russia Arms Control," Center for Strategic and International Studies (February 14, 2024). https://www.csis.org/analysis/uncertain-future-us-russia-arms-control. Accessed October 31, 2024.

237 Katarzyna Zysk, "Russia's Nuclear Doctrine Amendments: Scare Tactics or Real Shift?" United States Institute of Peace (January 29, 2025). https://www.usip.org/publications/2025/01/russias-nuclear-doctrine-amendments-scare-tactics-or-real-shift. Accessed February 11, 2025.

control treaties one-sided in one way or another."[238] This means that they are generally suspicious about U.S. proposals for arms control and risk reduction, based on the argument that the United States is only interested in limiting the capabilities where Russia has an advantage. As Foreign Minister Sergey Lavrov noted, the United States was only interested in trying "to establish control over our nuclear arsenal and minimize nuclear risks for itself."[239] Second, in most cases Russia considers legally-binding measures preferable to informal approaches.[240] They make the case that these mechanisms are the only way to share classified information and provide immunity to inspectors. They also believe that forcing the United States to go through the painful domestic ratification process can help to build support for the agreement, which means that these mechanisms are usually more stable and longer lasting. Therefore, U.S. proposals for informal measures are generally approached with a mindset that Washington just wants less constraint and more freedom to walk away.[241] The last issue is timing. During the last year of the Biden administration, Foreign Minister Lavrov announced that Russia is not going to resume talks on arms control as long as the United States continues to offer military support to Ukraine.[242] Although Moscow has refined this position and expressed interest in talking about nuclear issues with the Trump administration, these discussions are likely to be conditional on what happens in Ukraine, which could slow down progress and complicate negotiations.

While Russian officials argue that they are interested in reducing

238 Andrey Baklitskiy, "Mapping out an Agenda for U.S.-Russian Arms Control," p. 9.

239 Quoted in Vladimir Isachenkov, "Russia's foreign minister rejects a U.S. proposal to resume talks on nuclear arms control," AP News (January 18, 2024). https://apnews.com/article/russia-united-states-lavrov-nuclear-ukraine-0065bdbf7aafb340df64a34800698cd4. Accessed October 31, 2024.

240 While they have repeatedly made this point about legally-binding agreements, there is some contradiction in their behavior. After Russia suspended the New START implementation, the Kremlin made a statement that as a political matter they will adhere to the central limits of the agreement. Similarly, they promised to continue providing ballistic missile launch notifications, despite the Foreign Ministry's 2023 statement that "all forms of notifications" were terminated. Thus, political commitments might still be acceptable as a means to advance certain trust-building measures. Francesca Ebel, "Russia says notifications of ballistic missile launches will continue," *The Washington Post* (March 30, 2023). https://www.washingtonpost.com/world/2023/03/30/russia-nuclear-start-treaty-notifications/. Accessed February 15, 2025.

241 This assumption is generally based on U.S. unilateral withdrawals from arms control agreements, such as the ABM Treaty, the INF Treaty, and the Open Skies agreement. Andrey Baklitskiy, "Mapping out an Agenda for U.S.-Russian Arms Control," p. 12.

242 Vladimir Isachenkov, "Russia's foreign minister rejects a U.S. proposal to resume talks on nuclear arms control."

real military risks that emerge from misunderstandings and the lack of communication, they also argue that certain risk reduction efforts (especially the normative and behavioral approaches) could be seen as legalizing other undesirable practices that are not covered by these mechanisms. Therefore, Moscow opposes U.S. risk reduction efforts in outer space[243] and cyberspace[244] primarily because those "would be seen as a green light to the militarization of those domains."[245]

Over the past few years, there have only been a few concrete Russian proposals to advance risk reduction and arms control. On December 17, 2021, the Russian Ministry of Foreign Affairs uploaded two draft agreements on its website—one was a U.S.-Russia and the other a NATO-Russia agreement.[246] These included a sweeping list of preconditions and demands, including no further enlargement of NATO, no deployment of forces or weapons in the territory of new NATO allies (those members that joined after 1997), withdrawal of all U.S. nuclear weapons from Europe, and a ban on NATO military activities in Ukraine, Eastern Europe, the Caucasus, and Central Asia. In exchange for these restraints, Russia proposed consultative mechanisms, a hotline between NATO and Moscow, voluntary exchange of threat assessments, information exchange on exercises and maneuvers, discussions about military doctrine, and a commitment to settle disputes through diplomatic channels.

The most prominent arms control proposal in these draft treaties was a freeze on INF deployments between Russia and the United States. This INF 2.0 proposal was quite ambiguous, but the core idea was to implement a

243 Clayton Swope and Makena Young, "Is There a Path to Counter Russia's Space Weapons?" Center for Strategic and International Studies (June 28, 2024). https://www.csis.org/analysis/there-path-counter-russias-space-weapons. Accessed December 23, 2024.

244 Janne Hakala and Jazlyn Melnychuk, "Russia's Strategy in Cyberspace," NATO Strategic Communications Center of Excellence (June 2021). https://stratcomcoe.org/cuploads/pfiles/Nato-Cyber-Report_11-06-2021-4f4ce.pdf. Accessed December 23, 2024.

245 Andrey Baklitskiy, "Mapping out an Agenda for U.S.-Russian Arms Control," p. 13.

246 The Ministry of Foreign Affairs of the Russian Federation, "Agreement on measures to ensure the security of The Russian Federation and member States of the North Atlantic Treaty Organization" (December 17, 2021), https://mid.ru/ru/foreign_policy/rso/nato/1790803/?lang=en. (accessed October 31, 2024); The Ministry of Foreign Affairs of the Russian Federation, "Treaty between The United States of America and the Russian Federation on security guarantees" (December 17, 2021), https://mid.ru/ru/foreign_policy/rso/nato/1790818/?lang=en. (accessed October 31, 2024); Patrick Reevell, "Russia makes sweeping demands for security guarantees from US amid Ukraine tensions," ABC News (December 17, 2021), https://abcnews.go.com/International/russia-makes-sweeping-demands-security-guarantees-us-amid/story?id=81821816. (accessed October 31, 2024).

mutual ban on deploying ground-launched INF-range missiles in areas where they could strike the other side's territory (possibly including U.S. military deployments in Japan or South Korea). This idea was initially floated by President Putin in 2019, then it returned to the agenda in 2021 and 2022. Russia also proposed several verification measures to enforce compliance, and advocated for an informal moratorium until negotiations are finalized.[247] Although the U.S. side agreed to a meeting on the moratorium proposal to explore areas of mutual interest, it refused to accept additional Russian demands that included a stop to NATO enlargement. Furthermore, in the eyes of the United States, Russia's moratorium proposal was neither a credible demonstration of Russian restraint (given that Russia already deployed such missiles in Europe) nor a feasible plan (given the unacceptable additional demands). While the United States has kept the door open to discuss INF-range weapons, it generally saw this proposal as an attempt to maintain Russian advantage in INF-range missiles in Europe.[248]

One important lesson that emerges from these draft treaty proposals is that—for the time being—the primary value of arms control mechanisms for Russia is the bargaining leverage that these treaties provide to achieve broader national security objectives.

During the past few years, Russia decided to halt all nuclear arms control and risk reduction negotiations. However, as the second Trump administration came into office, the Kremlin indicated that President Putin is interested in resuming discussions about arms control and risk reduction.[249] This renewed interest is a promising start to engage in a dialogue and explore what mutual areas of interest might emerge. At the same time, we should not expect that Russia will suddenly let go of its long-held preconditions and principles. Arms control discussions are still likely to be tied to other areas of national security, and any risk reduction or arms control agreement would probably be part of a bigger bargain.

247 Nikolai Sokov, "Assessing the Prospects for Russia's INF 2.0 Proposal," in *Evaluating Current Arms-control Proposals: Perspectives from the U.S., Russia, and China* (London: International Institute for Strategic Studies, 2024), pp. 12–18. https://www.iiss.org/research-paper/2024/10/evaluating-current-arms-control-proposals-perspectives-from-the-us-russia-and-china/. Accessed October 31, 2024.

248 Amy F. Woolf, "U.S. Author's Perspective on Russia's Proposal," in *Evaluating Current Arms-control Proposals: Perspectives from the U.S., Russia ,and China*, pp. 18–19.

249 Dmitry Antonov and Andrew Osborn, "Kremlin says Putin is ready to talk to Trump and is waiting for word from Washington," Reuters (January 24, 2025). https://www.reuters.com/world/kremlin-says-putin-is-ready-talk-trump-is-waiting-word-washington-2025-01-24/. Accessed February 11, 2025.

China

In the U.S.-China bilateral relationship, Washington has been trying to officially engage China on strategic issues for decades, but China has mostly rejected these U.S. initiatives. A promising turning point came in November 2021, when in a virtual meeting President Biden and President Xi agreed to talk about nuclear issues and explore ways to establish guardrails to avoid conflict and kick-start an official discussion on strategic stability. This was followed by their first in-person meeting in Indonesia in November 2022, and a bilateral summit in San Francisco in November 2023.[250] On the margins of this last summit, an array of lower-level bilateral meetings took place, including the U.S.-PRC Defense Policy Coordination Talks (DPCT)[251] on deepening direct military-to-military communication to reduce escalatory risks, and deconflicting potentially dangerous incidents at the local, theater, and strategic levels. While these are promising signs of opening, concrete arms control or risk reduction measures have not emerged from these discussions (and it is unlikely to change anytime soon given China's recent announcement to halt all arms control talks with the United States over its arms sales to Taiwan).[252] Discussions on the official and unofficial levels have also become less frequent and less substantial, conveying a key message from Chinese officials: "The United States and China should first stabilize their political relationship before taking on nuclear issues."[253]

Regarding China's general approach to risk reduction and arms control, the Communist Party leadership has long held the position that they have "no interest" in joining nuclear arms reduction talks with the United States and Russia, because of the huge gap between their arsenals, and also because nuclear issues cannot be separated from the broader political relationship. At the same time, China has emphasized that this refusal does not mean

250 "1949-2024: U.S.-China Relations," Council on Foreign Relations (2024). https://www.cfr.org/timeline/us-china-relations. Accessed November 4, 2024.

251 Lt. Col. Martin Meiners, "Readout of 2024 U.S.-PRC Defense Policy Coordination Talks," U.S. Department of Defense (January 9, 2024). https://www.defense.gov/News/Releases/Release/article/3639762/readout-of-2024-us-prc-defense-policy-coordination-talks/. Accessed October 31, 2024.

252 Michael Martina, David Brunnstrom, Jonathan Landay, and Simon Lewis, "China says it has halted arms-control talks with U.S. over Taiwan," Reuters (July 17, 2024), p. 1. https://www.reuters.com/world/china/china-says-it-has-halted-arms-control-talks-with-us-over-taiwan-2024-07-17/. Accessed October 31, 2024.

253 Tong Zhao, *Political Drivers of China's Changing Nuclear Policy: Implications for U.S.-China Nuclear Relations and International Security*, p. 1.

that they are not committed to their disarmament obligation under the NPT. In the P5 framework, China has been the one that proposed deepening the discussions on nuclear doctrine and extending the Reagan-Gorbachev statement to all P5 members. China also emphasizes that in multilateral frameworks (such as the P5 or the UN), they are ready to talk about strategic stability and risk reduction.[254] On a bilateral level, China has concluded a ballistic missile launch notification agreement with Russia in 2009.[255]

Apart from these measures, China's most prominent risk reduction proposal is a Treaty on Mutual No-first-use. This was most recently submitted as a working paper to the Preparatory Committee meeting of the 2026 NPT Review Conference, calling on all P5 members to conclude a treaty or issue a statement about their commitment to not be the first to use nuclear weapons.[256] China's core argument is that its no-first-use policy helps to avoid nuclear escalation,[257] and if all nuclear weapon states adopted a no-first-use policy, it would reduce the need to worry about first-use scenarios and plan for these contingencies. This proposal has been a longstanding item on the Chinese risk reduction agenda, and they managed to achieve a few incremental steps towards this end. In September 1994, China and Russia agreed to not be the first to use nuclear weapons against each other, and to not target their nuclear weapons against each other. A similar de-targeting agreement was reached between China and the United States in June 1998. In the current context, the abolition movement and many non-nuclear weapons states have welcomed China's NFU initiative as an important step towards

254 Ministry of Foreign Affairs of the People's Republic of China, "Department of Arms Control and Disarmament Holds Briefing for International Arms Control and Disarmament Issues" (July 8, 2020). https://web.archive.org/web/20211014015131/https:/www.fmprc.gov.cn/mfa_eng/wjbxw/t1795979.shtml. Accessed October 31, 2024.

255 Luke Champlin, "China, Russia Agree on Launch Notification," Arms Control Association (2009). https://www.armscontrol.org/act/2009-11/china-russia-agree-launch-notification. Accessed February 15, 2025.

256 People's Republic of China, "No-first-use of Nuclear Weapons Initiative," Working paper submitted by China to the Preparatory Committee for the 2026 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Document NPT/CONF.2026/PC.II/WP.33 (July 12, 2024). https://docs-library.unoda.org/Treaty_on_the_Non-Proliferation_of_Nuclear_Weapons_-Preparatory_Committee_for_the_Eleventh_Review_ConferenceSecond_session_(2024)/NPT_CONF.2026_PC.II_WP.33_-_33._ADVANCE_UNEDITED_VERSION_-_China_-_No-first-use_of_Nuclear_Weapons_Initiative-_ENG.pdf. Accessed October 31, 2024.

257 James M. Acton, Alexey Arbatov, Vladimir Dvorkin, Petr Topychkanov, Tong Zhao, and Li Bin, *Entanglement: Chinese and Russian Perspectives on Non-nuclear Weapons and Nuclear Risks* (Washington, DC: Carnegie Endowment for International Peace, 2017). https://carnegieendowment.org/research/2017/11/entanglement-chinese-and-russian-perspectives-on-non-nuclear-weapons-and-nuclear-risks?lang=en. Accessed November 4, 2024.

disarmament.[258]

While the United States has not issued an official response to this proposal, it has serious doubts about China's own adherence to its no-first-use policy, given its ongoing nuclear modernization efforts. The proposal also does not require any operational or force structure changes to demonstrate commitment to this pledge, which puts its seriousness into question. If states are not obligated to change their forces, plans, and procedures, then such a political statement could be easily reversed in a crisis, and it would remain advisable for each party to continue to prepare for the possibility of adversary first use, completely undermining the purpose of such a measure.[259]

Ignoring these practical issues in a mutual treaty proposal could actually indicate that China itself is not ready to address the credibility concerns about its own no-first-use policy.[260] Despite these shortcomings concerning the no-first-use proposal, I believe that the United States should take this opportunity to have a meaningful discussion with China. Even if a no-first-use policy is not feasible, a more detailed dialogue could explore if China is open to any operational or force structure changes to support its proposal. China's answer to these questions might point to a new direction where reciprocal restraint was possible and mutually beneficial.

Over the coming years, the challenge for China is twofold: first, it must find a way to deconflict its continued nuclear expansion with the desire to project an image of a responsible nuclear power, and second, it must figure out how to react to the risk reduction proposals from the West without undermining this image (especially now that China has officially taken over the role of coordinating the P5 process from Russia).

Altogether, the great powers are not equally committed to advancing risk reduction measures. They also disagree about the framework and the desired subject areas. This means that implementing cooperative risk reduction proposals is going to be incredibly difficult, and those who are truly devoted to advancing this agenda must first explore if the conditions for cooperative security even exist today. The next section outlines a new theory for risk

258 Dai Huaicheng, "China's Proposed Treaty on Mutual No-first-use: Meaningful and Achievable," in *Evaluating Current Arms-control Proposals: Perspectives from the U.S., Russia, and China*, pp. 21–23.

259 Amy F. Woolf, "U.S. Author's Perspective on China's Proposal," in *Evaluating Current Arms-control Proposals: Perspectives from the U.S., Russia, and China*, p. 24.

260 See more about this in Tong Zhao, *Political Drivers of China's Changing Nuclear Policy: Implications for U.S.-China Nuclear Relations and International Security.*

reduction success by identifying the three main conditions of cooperation and testing these conditions against the current security context.

Cooperative Risk Reduction in a Competitive Environment

Cooperative risk reduction rests on the assumption that in a crisis between nuclear possessors, there are still a few outcomes that everyone wants to avoid. In the Cold War period, the most important outcome that the two superpowers wanted to avoid was a major nuclear war that would annihilate both sides. This mutual goal served as the basis of most risk reduction and arms control efforts. However, after the collapse of the Soviet Union, the risks of a major nuclear war have dramatically decreased, and other types of threats emerged which called for different approaches and solutions. The security environment took another shift in 2014 when Russia's annexation of Crimea marked the beginning of a new era of great power competition, where the United States is faced with two nuclear peers for the first time in its history. The key challenge in this new two-peer environment is identifying which outcomes each state wants to avoid and examining whether there are any overlaps between them. Finding these overlaps is the foundation of developing cooperative strategies to address the main threats and implement appropriate measures.

Thus, the three key components of success in cooperative risk reduction correspond to the questions of *why*, *what,* and *how*:

- *Why* should states cooperate? This requires agreement over the most dangerous outcomes that everyone wants to avoid.
- *What* risks generate those dangerous outcomes? This is about developing a mutual understanding of the pathways to undesired outcomes and identifying the sources of escalatory risks.
- *How* to address the main risks? This is about finding the right tools and approaches to reduce the risks that each side is worried about.

There are many different definitions of success, and one might argue that gaining a better understanding of adversary threat perceptions and thresholds is a success in itself. While I agree that dialogue can lead to incremental benefits and reduce the dangers of miscalculation, I believe that dialogue is rather a necessary tool or precondition to achieve concrete risk reduction measures. Thus, my definition of success in this framework is more action-oriented where dialogue is a means to an end, not the desired end goal.

Applying this higher bar for success requires that great powers agree about all three of the above questions. While these are logically tied together and follow each other in a sequence, there is no hierarchy between them in terms of importance. Lack of agreement over any of these factors would undermine a cooperative risk reduction agenda. For example, states might agree about the most devastating outcomes that they want to avoid but if they do not agree about the risks that generate them, or the means to address them, negotiations are unlikely to yield concrete risk reduction measures.

Why should states cooperate?

The first condition of success is an agreement about undesired outcomes. Although the great powers do not agree about a number of issues and their relationship is burdened with a deep mistrust towards each other, there are still a few scenarios that all of them want to avoid. In principle, all P5 members have agreed that "a nuclear war cannot be won and must never be fought"[261] and they have all made a commitment to pursue risk reduction measures to avoid nuclear use. There are, however, a few important differences in their approaches, which implies that the P5 statement should not be seen as a blanket promise to pursue all types of risk reduction measures with equal enthusiasm in all capitals.

In general, there is strong convergence on two key points. First, to varying degrees, all nuclear weapon states have doubts whether a major nuclear war can be controlled or won. For example, despite Russia's belief that it can control escalation in a limited nuclear war, this confidence does not extend to major nuclear wars, where Russia's strategy shifts from dosing carefully calibrated damage to warfighting and retaliation at large scale.[262] Second, all major powers seem to agree that nuclear use due to misunderstandings and miscalculation is undesirable. In a joint working paper submitted to the recent NPT Review Conference, the P5 have reaffirmed that they "share the desire to limit the risks that nuclear weapons could be used based on or as a result of incorrect assumptions, by reducing the potential for

261 "Joint Statement of the Leaders of the Five Nuclear-Weapon States on Preventing Nuclear War and Avoiding Arms Races."

262 Michael Kofman and Anya Loukianova Fink, "Escalation Management and Nuclear Employment in Russian Military Strategy," War on the Rocks (September 19, 2022). https://warontherocks.com/2022/09/escalation-management-and-nuclear-employment-in-russian-military-strategy-2/. Accessed November 4, 2024.

misperception, miscommunication and miscalculation."[263]

Thus, the goal of avoiding major nuclear war and the desire to reduce the likelihood of inadvertent escalation due to misunderstandings are two key principles that could serve as the basis of collaboration among great powers and answer the "why" question. Besides, at least in rhetoric, all nuclear weapon states are committed to maintaining the image of a responsible nuclear possessor that is working to live up to its NPT obligations, which could also play a positive role in advancing a cooperative risk reduction framework.

What risks generate the most dangerous outcomes?

The second condition of success is a general awareness of and an agreement about the risks that can cause undesired outcomes. Unlike in the previous case, there is not much agreement between the great powers about these issues. There are three main factors that contribute to this problem:

1. ambiguities in nuclear doctrine
2. different threat perceptions about which behaviors and capabilities are likely to result in escalation
3. a general underestimation of certain risks of inadvertent escalation.

Ambiguities in nuclear doctrine

The first problem is that there are many ambiguities about escalatory thresholds,[264] especially in the new military domains. Among the P5, China is the only country that has a no-first-use policy, which in principle means that they would only consider the use of nuclear weapons in response to a nuclear attack on them. For a long time, this declaratory policy was reflected in China's limited nuclear arsenal, and low readiness levels. This meant that China's operational warheads were stored at central sites and in case of a conflict, regiments would have needed to disburse them to launch units and

263 "Working paper submitted by China, France, the Russian Federation, the United Kingdom of Great Britain and Northern Ireland and the United States of America."

264 Ambiguities about escalatory threshold in times of intense rivalry are problematic because the lack of information can lead to worst-case thinking, exacerbate the security dilemma, and foment arms races. These outcomes can undermine strategic stability and become the engines of deliberate or inadvertent escalation.
Thomas G. Mahnken and Gillain Evans, "Ambiguity, Risk, and Limited Great Power Conflict," *Strategic Studies Quarterly* 13, no. 4 (Winter 2019), pp. 57–77.

mate them with delivery platforms.[265] This practice was mostly seen as a credible signal that China intended to abide by its no-first-use policy. However, the recent expansion of China's nuclear arsenal and the operational changes that followed have led many to believe that its no-first-use commitment is weakening. The United States now believes that a portion of China's nuclear arsenal is kept on a higher readiness level, and it projects that most of the new silo-based and submarine-based nuclear weapons that China is currently developing will probably be prepared to launch on warning in response to an incoming attack.[266] These developments raise an array of questions about the future credibility of China's no-first-use policy, and introduce a lot of uncertainty into the calculation of great powers. As former Commander of U.S. Strategic Command Adm. Charles Richard said in a testimony to Congress, "I could drive a truck through that no first use policy."[267]

Even though there is more transparency around the U.S.[268] and Russian[269] nuclear doctrines, some degree of calculated ambiguity has been a key element of their declaratory policy since the dawn of the nuclear age. Both states maintain that in extreme circumstances they might use nuclear weapons first, in response to major conventional or non-nuclear strategic attacks. While this calculated ambiguity is designed to deter non-nuclear aggression by the promise of massive punishment, it also makes it more difficult to have a clear picture about nuclear thresholds. Compounding this problem is that these assurances are also extended to a number of allied countries on both sides.

265 Adam Mount, "No First Use Can Still Help to Reduce U.S.-China Nuclear Risks," *Journal for Peace and Nuclear Disarmament* 7, no. 1 (2024), pp. 131–142.

266 U.S. Department of Defense, "Military and Security Developments Involving the People's Republic of China, the People's Liberation Army (PLA)," p. 106.

267 Charles Richard, "U.S. Strategic Command and U.S. Northern Command SASC Testimony," Armed Services Committee, United States Senate (February 13, 2020). https://www.stratcom.mil/Media/Speeches/Article/2086752/us-strategic-command-and-us-northern-command-sasc-testimony/. Accessed November 5, 2024.

268 U.S. Department of Defense, "National Defense Strategy, Nuclear Posture Review, Missile Defense Review."

269 The Ministry of Foreign Affairs of the Russian Federation, "Fundamentals of State Policy of the Russian Federation on Nuclear Deterrence."

With the increasing significance of the new military domains[270] and the growing entanglement of conventional and nuclear systems, the potential escalatory pathways to nuclear use have multiplied. As this dynamic took shape, the chances of miscalculation and inadvertent escalation similarly increased. Since the great powers are only starting to grapple with the complexities of this new security environment, they do not have the ability to accurately judge in every situation whether an action will be perceived as escalatory or not by their adversaries.

Different threat perceptions about which behaviors and capabilities are likely to result in escalation

The second problem is that the great powers have different views of the sources of risks. In general, there are many ways to approach this problem. Risks are not only generated by capabilities. They can also emerge from behaviors, operational practices, and organizational structures, for example.[271] A further layer of complexity is that all of this is very context specific—that is, certain practices might be stabilizing in one theater, while they generate risks in another. The same is true for capabilities: the great powers generally understand that most capabilities are not inherently good, or dangerous. As Zhao and Bin explain, "many Chinese experts share the belief that military technologies, in and of themselves, do not necessarily make escalation more or less likely. Instead, they emphasize the importance of specific deployment and employment strategies and argue that, at the end of the day, those strategies are what really matter."[272] Despite all of this, great power grievances tend to focus on risks that are generated by capabilities

270 With regards to uncertain thresholds in the new military domains, Michael Fischerkeller notes that "states have little experience using cyber operations during crises, and thus no appreciable formal or informal mutual understandings exist among states of acceptable (de-escalatory or nonescalatory) cyber behaviors. This potentially increases the probability of inadvertent escalation from their use." Fischerkeller, "Cyber Signaling: Deeper Case Research Tells a Different Story."

271 James M. Acton, for example, makes a strong case that conventional-nuclear entanglement is a very dangerous source of inadvertent escalation among the great powers. "Entanglement could lead to escalation because both sides in a U.S.-Chinese or U.S.-Russian conflict could have strong incentives to attack the adversary's dual-use C3I capabilities to undermine its nonnuclear operations. As a result, over the course of a conventional war, the nuclear C3I systems of one or both of the belligerents could become severely degraded. It is, therefore, not just U.S. nonnuclear strikes against China or Russia that could prove escalatory; Chinese or Russian strikes against American C3I assets could also—a possibility that scholars have scarcely even considered since the end of the Cold War." James M. Acton, "Escalation through Entanglement: How the Vulnerability of Command-and-Control Systems Raises the Risks of an Inadvertent Nuclear War," p. 58.

272 James M. Acton, Alexey Arbatov, Vladimir Dvorkin, Petr Topychkanov, Tong Zhao, and Li Bin, *Entanglement: Chinese and Russian Perspectives on Non-nuclear Weapons and Nuclear Risks*, p. 67.

and doctrinal ambiguities.

From a U.S. perspective, the primary concerns are associated with the expansion and diversification of the Russian and Chinese nuclear arsenals, and their increasing reliance on nuclear weapons for various purposes. In the Chinese case, an additional source of concern is the opacity of this program and its open-ended nature. The United States is also worried that China's new intercontinental-range systems (including hypersonic, and fractional and multiple orbital bombardment systems) could be used in a preemptive attack on the United States or its allies and partners. China is also making advancements in non-nuclear capabilities in space, cyberspace, and electronic warfare that could create strategic effects and threaten U.S. NC3 systems and critical infrastructure (all of which have been listed as potential scenarios for a nuclear response in the 2018 and 2022 NPR documents).

In the Russian case, U.S. concerns are focused on their growing theater nuclear force that has further increased the numerical advantages over U.S. and NATO capabilities, potentially improving Russia's ability to coerce war termination in a conflict. In this regard, Russia's lowered threshold for nuclear first use is another source of concern for the United States, as well as its hot production lines that could allow Russia to rapidly build up its strategic forces above New START limits after its expiration in 2026. Similarly to the Chinese case, the United States is also worried about Russian advancements in space, cyberspace, and electronic warfare capabilities which could be used to disrupt U.S. operations and threaten NC3 and critical infrastructure.[273]

In contrast, the Russian and Chinese side have been worried that U.S. modernization efforts are primarily driven by a desire to undermine their secure second-strike capability and gain a dominant position in crisis bargaining. They both make the argument that the United States is responsible for undermining strategic stability, and its withdrawal from the ABM Treaty and the advancements in missile defense and conventional precision strike are the primary sources of risk. With regards to conventional precision strike, the main concern of Russian strategists is that the United States could use these capabilities to wage a large-scale air campaign against its adversaries and even attempt a de-capitating first strike without having to cross the nuclear threshold. In the initial phases of war, such a successful air campaign could prove to be decisive for the outcomes of

273 Madelyn R. Creedon, Jon L. Kyl et al., *America's Strategic Posture—The Final Report of the Congressional Commission on the Strategic Posture of the United States,* pp. 8–10.

the conflict and prevent a quick Russian fait-accompli on the ground.[274] As Russian leaders have argued, U.S. precision-guided weapons "combined with the time of delivery to an intended target become comparable with weapons of mass destruction" and "in the future, probably, will be no different from weapons of mass destruction."[275] With regards to missile defense, Russian strategists have long argued that U.S. missile defense is "a multipurpose system diversely affecting the military-political and strategic situation" and "the second echelon of offensive antimissile operations, implementing the concept of prompt global strikes."[276] Russia's worst-case assumption is that if the United States launched a surprise first strike against Russian nuclear forces, missile defense could neutralize their remaining retaliatory force and give the United States important escalation management benefits.

On the Chinese side, similar concerns have been echoed with regards to missile defense and conventional precision strike. In addition, China has also been anxious about the possibility that in a post-INF world, the United States could decide to deploy intermediate-range conventional systems in the Indo-Pacific that would expand its conventional counterforce strike options.[277] Advancements in U.S. ISR capabilities, especially the space-based components, are also seen by China as a threat to the survivability of its nuclear weapons.[278]

Between the United States and its adversaries, the areas of concern do not show much overlap, which is why agreeing on the subject of risk reduction is either impossible—or would involve very complicated trade-offs.

274 Jacek Durkalec, *Russian Net Assessment and the European Security Balance*, pp. 85–87.

275 "Prime Minister Vladimir Putin meets with experts in Sarov to discuss global threats to national security, strengthening Russia's defences and enhancing the combat readiness of its armed forces," Archive of the Official Site of the 2008-2012 Prime Minister of the Russian Federation (February 24, 2012). http://archive.premier.gov.ru/eng/events/news/18248/. Accessed November 5, 2024.

276 V.V. Sukhorutchenko and S.V. Kreydin, "Nuclear Deterrence Amid the Development of a U.S. Global Missile Defense System," *Military Thought* 31, no. 4 (2022), p. 112.

277 Henrik Stålhane Hiim, M. Taylor Fravel, and Magnus Langset Trøan, "The Dynamics of an Entangled Security Dilemma: China's Changing Nuclear Posture," *International Security* 47, no. 4 (2023), pp. 147–187.

278 Tong Zhao, *Political Drivers of China's Changing Nuclear Policy: Implications for U.S.-China Nuclear Relations and International Security*, p. 7.

A general underestimation of certain risks of inadvertent escalation

The third problem is that the strategic communities in Russia and China underestimate the potential dangers of inadvertent escalation due to a lack of awareness about certain risks and overconfidence in their ability to manage escalation. In the Chinese case, Tong Zhao and Li Bin argue that "Chinese strategists have traditionally not addressed escalation—especially inadvertent escalation. Even today, very few Chinese experts have written on the subject, let alone conducted in-depth research. China's lack of firsthand experience as a participant in serious nuclear crises has also hampered its appreciation of the risk of inadvertent nuclear escalation."[279] To a certain extent, this lack of attention is also fueled by wishful thinking about being able to control escalation in a conventional conflict. As Fiona S. Cunningham and M. Taylor Fravel have pointed out, "China's strategic community is relatively confident about the ability of China to avoid nuclear escalation in a conflict with the United States" because they "believe that once nuclear weapons are used, subsequent use by either side cannot be controlled," therefore "Chinese experts expect that these features of nuclear war will lead U.S. and Chinese decisionmakers to avoid any nuclear use and resolve any conflict at the conventional level."[280]

This belief is extremely dangerous because it creates a false sense of crisis stability, and it also presumes that nuclear escalation would only happen due to deliberate actions. In reality, however, there are numerous ways a conventional conflict could slip out of control,[281] and both of these factors distract the attention from taking the necessary actions to prevent inadvertent escalation.

Unfortunately, these problems are also present in the case of Russia. Alexey Arbatov, Vladimir Dvorkin, and Petr Topychkanov, for example, point to "a visceral assumption among contemporary Russian strategists that the decision to use force—including nuclear weapons—would be a rational step."[282] Thus, Russia also shares the prevailing assumption that escalation

279 James M. Acton, Alexey Arbatov, Vladimir Dvorkin, Petr Topychkanov, Tong Zhao, and Li Bin, *Entanglement: Chinese and Russian Perspectives on Non-nuclear Weapons and Nuclear Risks*, p. 67.

280 Fiona Cunningham and Taylor M. Fravel, "Dangerous Confidence? Chinese Views on Nuclear Escalation," p. 104.

281 Barry R. Posen, *Inadvertent Escalation: Conventional War and Nuclear Risks.*

282 James M. Acton, Alexey Arbatov, Vladimir Dvorkin, Petr Topychkanov, Tong Zhao, and Li Bin, *Entanglement: Chinese and Russian Perspectives on Non-nuclear Weapons and Nuclear Risks*, p. 11.

is a mechanism that happens deliberately. However, the irony of the situation is that disregarding the likelihood of inadvertent escalation can actually contribute to it. The Russian case is also unique in the sense that while China is confident that a conventional conflict would not escalate to a nuclear exchange because it would be impossible to control such a war, Russian leaders believe that escalation is manageable up to the level of major nuclear war. This confidence invites more risk taking in a crisis, and it could also trigger inadvertent escalation at much higher levels of the escalation ladder where the fog of war is expected to be much thicker.

As a result of these three problem areas (ambiguities in nuclear doctrine, different threat perceptions, and a general underestimation of certain escalatory risks), there is no agreement between the great powers over the types of risks that can lead to undesired outcomes, which means that they do not agree about the subject of potential risk reduction measures. Any future engagement between the great powers must address these issues and use the opportunity to raise awareness of overlooked risks, and correct assumptions that are misguided. Such a discussion could trigger unilateral decisions that have risk reduction implications, and it could also lead to more concrete cooperative actions.

How to address the main risks?

The third condition of success is an agreement about the right tools to reduce the risks that generate undesired outcomes. As a logical consequence of the great powers' lack of agreement about the sources of risks, they also have divergent views about the necessary approaches to reduce risks. On the arms control side, for example, Russia and China wants to put legal limits on the capabilities where the United States has a notable advantage (most importantly, missile defense), while they reject U.S. proposals for limiting strategic assets that they hold important for their national security (like for example, non-strategic nuclear weapons). But these are just symptoms of a much broader problem. While the United States tries to approach risk reduction with an emphasis on strengthening strategic stability, Russia and China have chosen a more competitive pathway.

Previously, I have listed the numerous risk reduction initiatives that the United States has recently put forward, none of which have been endorsed by Russia or China. Naturally, the general suspicion towards each other plays a huge role in the lack of engagement. Zhao and Bin note that in the Chinese

case, "Beijing worries that, by reducing U.S. concerns about the potential dangers of escalation during a crisis, it might embolden the United States to behave more aggressively in peacetime and to escalate crises when it sees fit, potentially even opening up China to nuclear coercion." They also show that from Beijing's perspective, "the U.S. stress on escalation risks is intended to undermine China's legitimate military modernization efforts, especially those that are focused on new military technologies that may exacerbate those risks."[283] As a result of this deeply engrained suspicion towards U.S. intentions, Chinese leaders have looked for other ways to address their insecurities and threat perceptions. China has spent the past decade trying to improve its own relative position vis-à-vis the United States by embarking on a massive modernization program that was aimed to make it harder for its adversaries to exploit China's vulnerabilities. China also expects that in light of these developments, the United States will finally be forced to pursue equitable arrangements that respect China's power, and regional interests.

The Russian approach to U.S. risk reduction proposals shows many striking similarities. Their rejection of U.S. cooperative proposals is fueled by past experiences with arms control that are largely seen as more beneficial to the United States, and the assessment that they do not need to cooperate because they have a strong hand.[284] Russia's approach to cooperative security has long been coupled with sustained nuclear modernizations which has led to a much better negotiating position, and—paradoxically—a reduced need to actually come to the table.[285] This approach is also reflective of "Russia's traditional worldview that interstate relations are inherently competitive in nature and the only reliable path to national security is the enhancement of state power."[286]

As a result of these different approaches, the U.S. desire to seek

283 Ibid., p. 67.

284 Since nuclear weapons are the primary source of Russia's strength vis-à-vis the West, they are motivated to get the most out of these capabilities, which makes it even harder to negotiate mutual constraints on them.

285 Michael Albertson, *Negotiating with Putin's Russia: Lessons Learned from a Lost Decade of Bilateral Arms Control*, Livermore Paper no. 9 (Livermore, CA: Lawrence Livermore National Laboratory, 2021). https://cgsr.llnl.gov/sites/cgsr/files/2024-08/CGSR-LivermorePaper9_0.pdf. Accessed November 5, 2024.

286 Forrest E. Morgan, *Dancing with the Bear—Managing Escalation in a Conflict with Russia* (Paris: Institut français des relations internationales, 2012), p. 33. https://www.ifri.org/en/publications/etudes-de-lifri/proliferation-papers/dancing-bear-managing-escalation-conflict-russia. Accessed November 5, 2024.

cooperation and address nuclear dangers through diplomacy is in stark contrast with the strategic choices of Russia and China that reflect a competitive mindset, coupled with a massive military buildup.

Altogether, there is some convergence with regards to the *why*, but there is not much agreement about the *what* and *how* questions. In general, great power interests align on two key issues: they all want to avoid a major nuclear war and limit the chances of inadvertent escalation (even if they do not find this threat equally serious). At the same time, they do not agree about what nuclear risks are the most dangerous, and they have also failed to develop a mutual understanding over how to handle the growing dangers. While one side prefers diplomatic solutions, others have opted for a more competitive approach.

Thus, in the current security environment, two of the three key conditions to advance cooperative risk reduction approaches are missing. Therefore, a practical agenda for risk reduction should first do something to create the conditions for success. The good news is that agreement about the first main question (why should states cooperate) provides a good foundation to start a conversation that should be geared towards bridging the gaps on the other two questions. If major powers want to make progress in cooperative security, they must work to build agreement over which practices and capabilities are the most dangerous, and what is the best way to deal with them.

Although it has been difficult to get Moscow and Beijing to the negotiating table, the United States should maintain a dual-track mindset. This means keeping an open door for cooperation with adversaries, while also hedging for the (very likely) possibility that these engagements might fail. The next section provides some recommendations on how to engage adversaries, followed by a section on what the United States can do without adversary buy-in.

Creating the conditions for cooperative risk reduction

Developing a mutual understanding of risks and working towards collaborative solutions requires some form of sustained dialogue. There are many different options to advance such a discourse. The United States could try to engage Russia and China separately in the Strategic Stability Dialogue framework, it could bring them together and have a trilateral discussion, or these discussions could also take place in a broader multilateral setting. There are advantages and downsides to each approach. Since escalatory risks and nuclear dangers are very specific to each region and a lot depends

on the adversarial dyad, having these discussions on a bilateral level could help to focus and discuss more substance. This format, however, makes it very easy for U.S. adversaries to reject the proposal (as it has been the case with both states for many years). Besides, it could also be seen as too much to begin with, especially for China.

While the increasingly connected nature of the international system—and the U.S. desire to approach the two-peer problem with a coherent and integrated mindset—calls for a trilateral discussion, this format could easily allow U.S. adversaries to "gang up" on Washington and derail the agenda. China has also traditionally argued that arms control and risk reduction is the primary responsibility of the United States and Russia, which, for the time being, possess a larger nuclear arsenal. Thus, they argued that they will only come to the table once rough parity is achieved.

Due to these difficulties, the most realistic starting point for discussion is the P5 format. This has the added benefit that it includes France and the United Kingdom which from a Russian perspective is already a requirement for future arms control agreements. The P5 also has the benefit that it is tied to the NPT framework; therefore, there is more pressure to produce results in this context and have something to show for progress towards disarmament. This also means that China is less likely to blatantly reject coming to the table.

Substantial dialogue in the P5 framework could help to alleviate the previously mentioned problems in many ways:

- Regular discussions about doctrine and forces could help to build a better understanding of the different national approaches, dispel misunderstandings about intentions, and also help to explain nuclear use thresholds. Achieving clarity about these issues would in itself limit the risks of inadvertent escalation.

- These discussions could also help to address the lack of awareness about certain dangers and drive greater attention to these problems.

- The P5 could also systematically assess escalatory risks and help to build a mutual sense of priority among the diverse dangers.

- Such long-term dialogue could also play an important role in rebuilding trust between the great powers that is the most important precondition of advancing cooperative security.

- Finally, utilizing the P5 framework could help to reinforce the legitimacy of the NPT and even rebuild the bridges with frustrated non-nuclear weapon states.

However, to reap these potential benefits, there are a few requirements that should be met. First, for such a dialogue to be sustainable, reciprocity will be key. These discussions are only going to continue in the long run if each great power has the impression that they get something out of it. For autocracies, this is important because they tend to look at arms control and risk reduction in a more transactional way. For democracies, it is crucial because government changes often come with shifts in priorities, and unless there are clear benefits of continued engagement, these dialogues could be sidelined by a new leadership.

Second, states should also consider who are the right people to sit at the table. The P5 discussions are usually conducted by NPT diplomats who are not necessarily the best people to address broader questions about deterrence and escalation. Thus, these dialogues would benefit from including people from the deterrence and strategic communities.[287] Additionally, diplomats of the P5 discussions have traditionally not come from the inner circles of leaders like Presidents Putin and Xi. To make these engagements more impactful, leaders in each state could designate personal envoys to lead the delegations and report back directly to the heads of state.

Third, achieving agreement on escalatory dangers requires that the scope of discussions is extended beyond the nuclear domain. Given the lack of agreement over what dangers are most pressing, this could involve a phased approach where the first phase is open-ended and exploratory, and the second phase could be more focused on conventional-nuclear linkages and emerging technologies. Since today the most likely pathway to nuclear use is an escalating conventional conflict, discussions cannot ignore the conventional domain and the risks of conventional-nuclear entanglement. It is equally imperative to explore the effects of emerging technologies and discuss thresholds and dangerous escalatory pathways originating from the new military domains.

Lastly, it is important to leave the door open for broader conversations. Periodic engagement with other forums (such as the OSCE in Europe or the

287 Ugne Komzaite, Anna Péczeli, Benjamin Silverstein, and Skyler Stokes, "Nuclear Risk Reduction in an Era of Major Power Rivalry."

ASEAN in the Indo-Pacific) and dialogue with non-nuclear weapon states that are in the crosshairs of nuclear threats could help to gain a better understanding of regional security issues. These exchanges could also provide valuable lessons about past experience with regional risk reduction efforts.

While these types of discussions would play an important role in building the conditions for cooperative risk reduction measures, they are only one piece of the bigger puzzle. Given the difficulties of the current security environment, and the great powers' general suspicion towards each other, such a meaningful dialogue is already a very optimistic expectation that may not be realistic in the short term. Even if the P5 followed all the above recommendations, it would not bring quick results, and might not bring good enough results. Therefore, cooperative efforts must be supplemented with unilateral measures to guarantee the safety of the United States and its allies in the current context. Unilateral measures also have the added benefit that they might not only supplement cooperative mechanisms, but they could also change the calculus of Russia and China and incentivize collaboration in areas where they did not show much willingness initially.

Risk Reduction Without Adversary Buy-In

Advancing risk reduction is not necessarily a cooperative endeavor. Historically, there has been a long list of measures that the great powers have taken individually to reduce nuclear dangers. These have included declaratory statements about doctrinal restraint, unilateral decisions about force structure changes, unilateral commitments to transparency, or changes in operational practices. When relations are strained due to intense competition, cooperation might not be possible. This, however, does not mean that risk reduction cannot be advanced unilaterally. This chapter explores three main lines of effort that the United States could take without its adversaries to advance risk reduction:

1. Pursuing unilateral restraint and safety measures
2. Adapting deterrence to reduce nuclear risks
3. Working with allies

Pursuing unilateral restraint and safety measures

In general, unilateral restraint is part of the risk reduction framework

because these measures can send valuable signals to adversaries about limited intentions and reduce the chances of accidental or inadvertent escalation. Transparency measures, for example, can help to dispel adversary misconceptions, and operational restraint (if done credibly) can affect how adversaries plan for nuclear employment. These mechanisms are especially valuable when formal arms control is deadlocked. However, a key limitation is that security cannot be achieved unilaterally.

The biggest selling point for unilateral measures is that they do not require adversary buy-in, and the United States can implement them without a painful bargaining process and without having to make much compromise. Additionally, arms control advocates often make the case that leading by example is the right thing to do and unilateral restraint will trigger reciprocal responses from adversaries. Vice-President Biden noted himself in 2017, "The United States is the strongest when we lead not only by the example of our power, but by the power of our example."[288] This approach is certainly aligned with the U.S. desire to position itself in the international system as a responsible actor that intends to take a leadership role in advancing arms control and risk reduction. Schelling himself made a comment in the late 1980s that

> If we unilaterally dismantled our land-based missiles, we would instantly deprive a large part of the Soviet land-based missile force for its *raison d'être*. It might look to them as if they had much less to preempt. They actually would not, because the U.S. missiles they might have preempted were redundant in the first place. […] So if we cannot dismantle their land-based missiles by negotiation, we may gain a lot by dismantling their targets instead.[289]

288 Joe Biden, "U.S. Vice President Joe Biden on Nuclear Security," Carnegie Endowment for International Peace (January 11, 2017). http://carnegieendowment.org/2017/01/11/u.s.-vice-president-joe-biden-on-nuclear-security-event-5476. Accessed November 7, 2024.

289 Thomas C. Schelling, "Abolition of Ballistic Missiles," *International Security* 12, no. 1 (Summer, 1987), pp. 179–183.

More contemporary proponents include Kingston Reif and Alicia Sanders-Zakre[290] and William Perry and Tom Collina.[291]

The main reference point for such arguments are the 1991-1992 Presidential Nuclear Initiatives (PNIs). As the Soviet Union was disintegrating, the U.S. intelligence community grew increasingly worried that Soviet nuclear weapons could end up in the wrong hands. Part of the reason that President George H.W. Bush decided to unilaterally reduce the U.S. stockpile of non-strategic nuclear capabilities was the hope that the Soviet Union was going to follow the United States, which could help address these threats.[292] This was a unique historic moment that worked in the sense that the Soviet Union—and later Russia—committed to reciprocal reductions. At the same time, Russia has never fully lived up to its commitments under the PNIs and continues to deploy several systems (including nuclear warheads for ground-launched tactical missiles and a non-strategic nuclear weapon in the navy) in violation of its PNI pledges. Thus, even these (otherwise very successful) mechanisms have only been partially implemented by Moscow.[293]

Similarly to the PNIs, the historical record suggests mixed results when it comes to unilateral restraint. In the post-Cold War environment, the United States has implemented a wide array of unilateral restraints. The list includes: the explicit commitment in Nuclear Posture Reviews to reduce the role of nuclear weapons, the nuclear testing moratorium, giving up the capacity to produce new nuclear weapons, keeping only a minimal

290 "Washington should not give Moscow veto power over the appropriate size and composition of U.S. nuclear forces. Nor should it give Moscow an easy excuse to maintain a similarly bloated arsenal aimed at the United States and its allies. A decision to reduce to 1,000 deployed strategic warheads would put the United States in a stronger position to pressure Russia to rethink some of its expensive nuclear recapitalization projects and reduce its deployed strategic nuclear warheads. Perhaps more intriguingly, a U.S. willingness to reduce its arsenal could lead China to take a less passive approach to nuclear disarmament and more openly discuss the size, composition, and operations of its nuclear forces." Kingston Reif and Alicia Sanders-Zakre, *U.S. Nuclear Excess: Understanding the Costs, Risks, and Alternatives* (Washington, DC: Arms Control Association, 2019), pp. 17–18. https://www.armscontrol.org/reports/2019/USnuclearexcess. Accessed November 7, 2024.

291 "Today, it is clear that the United States can maintain a credible deterrent at significantly lower levels of nuclear weapons than we currently have. There is no reasonable justification today for such high numbers. Further reductions to the U.S. nuclear stockpile would bring a variety of benefits, including the prospect of a smaller Russian arsenal." William J. Perry and Tom Z. Collina, *The Button: The New Nuclear Arms Race and Presidential Power from Truman to Trump* (Dallas, TX: BenBella Books, 2020), p. 144.

292 Susan J. Koch, "The Presidential Nuclear Initiatives of 1991-1992."

293 Matthew R. Costlow, "The Myth of U.S. Nuclear Leadership" National Institute for Public Policy, Information Series Issue no. 416 (February 14, 2017). https://nipp.org/information_series/costlow-matthew-r-the-myth-of-u-s-nuclear-leadership-information-series-no-416/. Accessed November 7, 2024.

non-strategic nuclear arsenal, generally refraining from nuclear threats and saber-rattling, voluntarily sharing information about the overall stockpile size, and revising nuclear planning to comply with the laws of armed conflict. The United States has also implemented restraints in its ballistic missile defense program. It designed a limited homeland missile defense system that is geared towards rogue state threats.[294] The Obama administration opted out of the third site protection for the U.S. homeland and decided to build up regional missile defense systems instead. In these regional frameworks, the United States has also repeatedly offered confidence- and security-building measures to alleviate adversary concerns. Similar restraints have been implemented in other related areas, such as keeping hypersonic missile developments to carry conventional payloads only and refraining from deploying fractional orbital bombardment systems.

While some mechanisms generated adversary response, most of the above measures have not been reciprocated by Russia and China. Both states have increased the size of their nuclear stockpile, have not implemented any voluntary transparency measures, are accused of violating the zero-yield standard under the nuclear testing moratorium, and have increased the prominence of nuclear weapons in their national defense strategy. Russia has also fielded an array of new exotic capabilities, and it maintains hot production lines that could potentially give Moscow the upper hand in a post-New START world. On most accounts, U.S. restraint has been met with a competitive response by adversaries. This seems to suggest that the words of former Secretary of Defense Harold Brown largely hold true even today: "Soviet spending has shown no response to U.S. restraint—when we build they build; when we cut they build."[295]

While both Russia and China react to changes in U.S. nuclear doctrine and forces, it is not the only factor in their decisions. There are other external

294 Recent developments under the Trump administration suggest that this restrained approach to homeland missile defense might be reversed as President Trump signed an executive order that calls for the deployment and maintenance of a next-generation missile defense shield that is expected to deter any attack on U.S. soil from a variety of threats, including ballistic, hypersonic, advanced cruise missile, and other next-generation aerial attacks. It is, however, too early to judge the strategic impact of this decision on risk reduction efforts as there are many questions about the feasibility of this plan, and it is unclear when and how it will be implemented.
Donald J. Trump, "The Iron Dome for America," Presidential Actions, The White House (January 27, 2025). https://www.whitehouse.gov/presidential-actions/2025/01/the-iron-dome-for-america/. Accessed April 7, 2025.

295 Harold Brown, "Prepared Statement," testimony before the House and Senate Budget Committees (January 31, 1979). http://www.bartleby.com/73/400.html. Accessed November 7, 2024.

and internal factors that play a role. Therefore, the expectation that U.S. unilateral restraint will automatically bring changes in the strategic posture and forces of its adversaries is not supported by past experience.

In light of this, the United States should focus on implementing unilateral forms of restraint that are beneficial for U.S. national security even if adversaries do not reciprocate.[296] There are many concrete examples that fall into this category of unilateral action. One example is the practice of failsafe reviews[297] of nuclear weapons and command-and-control systems to reduce the dangers of unauthorized, inadvertent, or accidental use by identifying vulnerabilities and strengthening safeguards against cyber and other threats. Another example is the commitment to maintain a human "in the loop" for all actions critical to informing and executing decisions about nuclear employment. In terms of operational practices, the U.S. commitment to reduce reliance on launch-under-attack[298] is another area where unilateral actions would bring risk reduction benefits even if adversaries do not follow suit.

The last major area for such mechanisms is force structure decisions. In general, U.S. strategy should be developed based on a pragmatic assessment of the security environment, and strategy should guide subsequent force structure decision. If such assessments point to a direction that certain capabilities or modes of deployment are too harmful for strategic stability,[299] then there is a value in publicly declaring those capabilities and behaviors in the form of a restraint and inviting others to join. First, this can help to strengthen the image of a responsible nuclear possessor, and it can provide some practical evidence to show that the United States is working in good faith to implement its NPT commitments even without the collaboration

296 John T. McNaughton, "Arms Restraint in Military Decisions."

297 Mark Melamed and Steve Andreasen, "Advancing Nuclear 'Fail-Safe,'" Nuclear Threat Initiative (undated). https://www.nti.org/about/programs-projects/project/advancing-nuclear-fail-safe/. Accessed February 12, 2025.

298 U.S. Department of Defense, "Report on the Nuclear Employment Strategy of the United States," submitted pursuant to 491(a) of Title 10, U.S. Code (November 7, 2024). https://media.defense.gov/2024/Nov/15/2003584623/-1/-1/1/REPORT-ON-THE-NUCLEAR-EMPLOYMENT-STRATEGY-OF-THE-UNITED-STATES.PDF. Accessed February 12, 2025.

299 States very often adjust their nuclear forces. Cancelling modernization plans or renouncing certain capabilities can happen due to a number of factors, such as budget constraints, changing military requirements, allied demands, or strategic stability considerations. Thus, not all of these force structure decisions fall under the category of risk reduction. In a risk reduction framework, the United States should focus on those types of force structure decisions where the primary concerns were related to strategic stability. In these cases, making a public declaration and trying to build a norm against a specific destabilizing system would be in line with broader risk reduction efforts.

of its adversaries.

Second, it can help to start a campaign to outlaw certain destabilizing behaviors. This was the underlying logic of announcing a "Political Declaration on Responsible Military Use of Artificial Intelligence and Autonomy."[300] In the declaration, the United States urged other states to join the pledge, and 57 states have already signed up. Trying to globalize these restraints is a useful path to formulate new norms, and it could eventually lead to the institutionalization of these mechanisms based on U.S. terms. The area of emerging technologies is specifically conducive to these types of normative approaches given the fact that many traditional arms control mechanisms that focus on counting rules and numerical limits are not appropriate to address these problems.

Lastly, declaring unilateral restraints and publicly calling on adversaries to reciprocate these measures can also help to put the spotlight on them. This forces Russia and China into an inconvenient situation where they are continuously on the defensive. Having to reject one U.S. proposal after the other could gradually undermine their rhetoric of being a responsible actor in the eyes of their partners (especially in the developing world), which could help to put more pressure on them to cooperate.

Altogether, in the current competitive environment, unilateral restraints by the United States are unlikely to provide a basis for major changes in adversary strategic postures and capabilities. At the same time, these tools can still play an important role in nuclear risk reduction. In the short term, they can put the spotlight on risk-prone actions and highlight best practices. In the long run, they can pave the way towards more meaningful international standards and norms.

Adapting deterrence to reduce nuclear risks

In the eyes of many nuclear possessors, improving the credibility of deterrence is seen as a key part of a broader risk reduction agenda, because it can help to reduce the incentives to use nuclear weapons by their adversaries and convince their allies not to develop their own nuclear capabilities. As Lewis Dunn argues, "effective nuclear deterrence is the necessary bedrock of policies and postures to reduce the risk of use of

300 U.S. Department of State, "Political Declaration on Responsible Military Use of Artificial Intelligence and Autonomy," Bureau of Arms Control, Deterrence, and Stability (November 1, 2023). https://www.state.gov/political-declaration-on-responsible-military-use-of-artificial-intelligence-and-autonomy/. Accessed November 7, 2024.

nuclear weapons—but with measured adaptations to today's realities."[301] Since the end of the Cold War, the United States has been trying to meet those obligations by continuously adapting its deterrence posture to respond to the changes of the security environment. In the period from 1991-2014, the United States has undertaken three main lines of effort to adapt its deterrence posture to reduce nuclear risks: 1) nuclear deterrence lost its prominent place in U.S. defense strategy, 2) the reliance on non-nuclear means of deterrence has significantly increased, and 3) the practice of U.S. nuclear deterrence has been tailored to a multipolar environment which required more flexibility and adaptability. These adjustments have been implemented to build a more stable form of deterrence, reducing the risk that the United States would need to rely on nuclear deterrence even when its nuclear threats are not credible.[302]

However, Russia's annexation of Crimea in 2014 and the renewed competition among great powers have marked the beginning of a completely new security environment that requires new approaches in deterrence adaptation to continue to reduce nuclear dangers. Brad Roberts identifies three main principles for this adaptation: 1) leave the door open for cooperative security and continue to seek progress through sustained dialogue, 2) focus on emerging nuclear risks, and 3) update the menu of potential options.[303] An additional principle that should be added to this list is 4) implement the adaptation of nuclear deterrence in a measured way.

Since cooperative security has already been addressed in the previous chapter, the focus here is on the other three lines of effort. With regards to emerging nuclear risks, the key task is to define these new risks and develop strategies to mitigate them. As the conventional military balance has shifted unfavorably both in Europe and the Indo-Pacific, great power confrontation has become more likely. With the growing salience of the new military domains, strategic unpredictability and arms race instability have increased, introducing new forms of nuclear risks. In light of these new risks, there are two key tasks. First, it is essential to modernize NC3 systems to ensure their responsiveness, effectiveness, and survivability—and increase the resilience of critical infrastructure across the United States. Second, the United States

301 Lewis A. Dunn, "Managing Nuclear Risks in an Era of Strategic Confrontation," p. 124.

302 Brad Roberts, "On Adapting Nuclear Deterrence to Reduce Nuclear Risk."

303 Ibid., p. 79.

must negate adversary advancements in emerging technologies. This could entail a more resilient space architecture, a new space strategy that includes both offensive and defensive elements, continued investments in long-range non-nuclear precision strike capabilities, and fielding more advanced integrated air- and missile defense (IAMD) systems to counter coercive threats from adversaries.[304]

The next line of effort in adaptation is updating the menu of possible options. In addition to increasing the diversity in non-nuclear strategic capabilities, the United States will have to explore if its nuclear forces are adequate to the task of deterring adversaries, reassuring allies, achieving U.S. objectives should deterrence fail, and hedging against adverse events. In this regard, there is a growing consensus in Washington that more needs to be done.[305] The 2023 bipartisan Strategic Posture Commission found that "the fundamentals of America's deterrence strategy remain sound, but the application of that strategy must change to address the 2027-2035 threat environment. Those changes drive necessary adjustments to the posture of U.S. nuclear capabilities—in size and/or composition."[306] The commission argued that the current Program of Record (POR) is absolutely needed but insufficient, and needs to be supplemented to ensure that deterrence remains effective in the new two-peer world. Commissioners also emphasized the need to recapitalize the nuclear enterprise to have sufficient capacity that will meet capability needs in a timely manner.

On the surface, investing in nuclear modernization and deploying new nuclear weapons seem counter to the goals of arms control and disarmament. At the same time, past experience suggests that U.S. nuclear modernizations have been a major inducement in bringing the Soviet Union to the negotiating table, have helped U.S. arms control negotiators find additional areas of agreement with their counterparts, and have also incentivized compliance with treaty commitments, due to the credible threat

304 Madelyn R. Creedon, Jon L. Kyl et al., *America's Strategic Posture—The Final Report of the Congressional Commission on the Strategic Posture of the United States,* pp. ix–x.

305 Jake Sullivan, "Remarks by National Security Advisor Jake Sullivan for the Arms Control Association (ACA) Annual Forum;" Vaddi, "The U.S. Arms Control Agenda: A Discussion with NSC Senior Director Pranay Vaddi;" and Vipin Narang, "Nuclear Threats and the Role of Allies: A Conversation with Acting Assistant Secretary Vipin Narang," Center for Strategic and International Studies (August 1, 2024). https://www.csis.org/analysis/nuclear-threats-and-role-allies-conversation-acting-assistant-secretary-vipin-narang. Accessed November 8, 2024.

306 Ibid., p. vii.

of counteractions.[307] Thus, modernization efforts could not only help to change adversary risk calculus and disincentivize aggression; they can also be helpful in building up the leverages to bring Russia and China back to the negotiating table. As Jake Sullivan argued, "Responsibly enhancing our deterrent capabilities allows us to negotiate arms control from a position of strength and confidence—and new arms control helps limit and shape our adversaries' decisions on nuclear capabilities."[308] Marshall Billingslea made a similar statement during the first Trump presidency: "In fact, U.S. deterrent modernization helps promote effective and verifiable arms control agreements."[309]

Broader arms control considerations are the reason why adding the last principle was important. As the United States adapts its deterrence posture to reduce nuclear risks, it must proceed with caution and pursue a measured adaptation, only implementing the necessary minimum buildup of U.S. nuclear forces. Relying to the greatest extent possible on the POR and trying to maximize the utility of non-nuclear strategic tools can be crucial in tempering adversary reactions and avoiding a new uncontrolled arms race. Adversaries are closely watching U.S. adaptations, and it is reasonable to expect that they would react to these changes. Therefore, any major upgrades in the U.S. strategic arsenal should also be measured against possible adversary reactions. As Zhao has warned in the China context, "Some U.S. military countermeasures, if not carefully calibrated in planning and implementation, risk feeding Chinese insecurity and increasing China's determination to further build up its nuclear capabilities."[310] To avoid spiraling into a reckless arms race and remind the world that the United States did not choose this path (rather, its adversaries chose this path for the United States), it would be beneficial to tie these deterrence adaptations to a positive public policy messaging strategy. This should convey two important messages: first, the

307 Matthew R. Costlow, "An Overlooked Aid to Arms Control: U.S. Nuclear Modernization," *Strategic Studies Quarterly* 15, no. 3 (Fall 2021), pp. 34–47.

308 Ibid.

309 Marshall Billingslea, "Transcript: Special Presidential Envoy Marshall Billingslea on the Future of Nuclear Arms Control," Hudson Institute (May 22, 2020). https://www.hudson.org/national-security-defense/transcript-special-presidential-envoy-marshall-billingslea-on-the-future-of-nuclear-arms-control. Accessed February 14, 2025.

310 Tong Zhao, *Political Drivers of China's Changing Nuclear Policy: Implications for U.S.-China Nuclear Relations and International Security,* p. 60.

United States continues to seek opportunities to advance risk reduction and implement its NPT obligations, and second, a reminder to adversaries that "competition is not a foregone conclusion—if our adversaries make different choices, so will we."[311]

Working with allies

The last mechanism that the United States can exploit to advance risk reduction without adversary buy-in is a closer collaboration with allies. Allies can play an important role in almost all the above-mentioned efforts. They can contribute by supporting and building momentum for U.S.-led behavioral arms control initiatives, and they can also take a leadership role in developing their own risk reduction proposals (successful examples for this include the Stockholm Initiative, or the UK-Norway Initiative on nuclear warhead dismantlement verification). In the nuclear domain, France and the United Kingdom are already participating in the P5 discussions, which gives them a unique opportunity to work with the United States on pursuing greater transparency and pushing for a deeper dialogue with Russia and China. Individually, both states have done important work[312] in advancing nuclear disarmament verification, taken measures to increase transparency in nuclear doctrine and forces, provided pre-launch notification of all space and ballistic missile launches, and have also worked with non-nuclear states and civil society to build bridges and advance strategic risk reduction.

Working with allies is also crucial with respect to deterrence adaptation. The daunting need to sustain effective regional deterrence architectures in at least three regions, and the erosion of deterrence due to the unfavorable shift in military balances have created a lot of pressure for U.S. allies to step

311 Vipin Narang, "Nuclear Threats and the Role of Allies: A Conversation with Acting Assistant Secretary Vipin Narang."

312 "National report pursuant to actions 5, 20, and 21 of the final document of the 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons: 2015–2022—Report submitted by France," 2020 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Document NPT/CONF.2020/42/Rev.1 (August 1, 2022), https://daccess-ods.un.org/access.nsf/Get?OpenAgent&DS=NPT/CONF.2020/42/Rev.1&Lang=E. (accessed November 8, 2024); and "National report of the United Kingdom of Great Britain and Northern Ireland pursuant to actions 5, 20, and 21 of the action plan of the 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons for the tenth Review Conference of the Parties to the Treaty—Report submitted by the United Kingdom of Great Britain and Northern Ireland," 2020 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Document NPT/CONF.2020/33 (November 5, 2021), https://daccess-ods.un.org/access.nsf/Get?OpenAgent&DS=NPT/CONF.2020/33&Lang=E. (accessed November 8, 2024).

up and take a bigger role in their own defense. These changes have renewed a sense of urgency in many allied capitals and created strong incentives to refocus on deterrence. While the United States has traditionally taken the burden of nuclear deterrence, allies have a lot to offer in other areas. They have important capabilities in the new military domains, and they are at the front lines of technology competition. Adjusting these regional deterrence structures by asking allies to take a bigger role in sharing the burden would provide a significant contribution to regional security.

There are many ways to strengthen extended deterrence with a greater reliance on allies:

- increased role in the nuclear mission
- elevated consultations
- fielding a denser network of IAMD sensors and shooters
- deploying deep-precision strike capabilities
- improved cyber and space resilience
- limited roles in cyber offense and counterspace missions
- coordinated deterrence campaigning and messaging.[313]

Working with allies can also help to advance analytical thinking about the new nuclear risks. Tabletop exercises, wargaming, and net assessment could all contribute to a better understanding of escalation dynamics in this complex environment, which could inform decisionmakers in setting the right risk reduction agenda.

Lastly, the U.S. alliance system is also helpful in contesting the Russian and Chinese public narratives around nuclear risk reduction and arms control. Intelligence and information sharing with allies enhances the monitoring of adversary commitments. This helps to rally international support to sanction adversaries when they violate their legal obligations. It also helps to stigmatize irresponsible behavior.

For all these reasons, the expansive U.S. network of alliances and

313 Maximilian Hoell, Samuel Hickey, Mason Bammer, and Eliza Friend, "Workshop Summary: Toward a New Division of Deterrence Labor Between and Among the United States and its Allies and Partners," Center for Global Security Research (June 2023). https://cgsr.llnl.gov/sites/cgsr/files/2024-08/CGSR-Workshop-Summary-2023-06.pdf. Accessed November 8, 2024.

partnerships provides a unique strategic advantage over adversaries, and the United States should continue to deepen these collaborations and seek risk reduction opportunities with its allies.

Conclusion

The past decade has witnessed the almost complete collapse of nuclear arms control, which has pushed the world to the verge of having no limitations or guardrails for nuclear competition. Legally-binding arms control mechanisms have been discarded, and international norms are eroding. In the absence of these mechanisms, less formal risk reduction measures can provide some remedy.[314] They can help to temper escalatory pressures, set guardrails, and avoid unintended outcomes.

Risk reduction was a successful mechanism in the Cold War period. In many cases, it was even resilient to deteriorating relations between the great powers. These tools have also supplemented arms control measures and often paved the way for more ambitious cooperative mechanisms. However, as risk reduction got disassociated from its roots embedded in deterrence and arms control theory, a gap started to emerge between the aspirational goals of the international community and the actual achievements of risk reduction efforts. My core argument is that risk reduction cannot be implemented in isolation from the broader security environment, and it must be continuously adapted to the realities and challenges of great power relations. Today's environment is more complex and dangerous than any time before, but risk reduction approaches have not been successfully adapted to these new realities. In this concluding chapter, I provide 10 principles that could guide such an adaptation and eventually lead to a more realistic and more feasible risk reduction framework.

314 Nina Tannenwald, "Life beyond Arms Control: Moving toward a Global Regime of Nuclear Restraint & Responsibility," *Dædalus* 149, no. 2 (Spring 2020), pp. 205–221.

1) Formulating a universally accepted view of risk reduction priorities is unlikely

Increasing multipolarity in the international system and the great powers' growing reliance on non-nuclear strategic tools have created a more complex and dangerous environment with new escalatory pathways that are poorly understood and often underappreciated. Greater awareness about these risks is hindered by ambiguities in nuclear doctrine and overconfidence about escalation management. As a result, dangerous blind spots have emerged in the great powers' thinking about escalation.

Despite these growing threats, a global view of nuclear risks that everyone accepts is very difficult to achieve because the terms risks, dangers, and threats are often used interchangeably, but they occasionally mean different things to different actors. Risk perception greatly depends on geographic location, regional power structure, one's own military strength, its alliances, and other historical, cultural, and domestic political factors. Each nation looks at these problems through the lens of their own security perspective, national objectives, and strategic culture. Thus, what is considered to be risk reduction for one side could be perceived as an increase of risks by the other. Besides, not all risk reduction measures would bring equal benefits to all states. Certain mechanisms would primarily favor one side, while the other side might only see limited or no benefit at all. Due to these subjective judgments and asymmetric benefits, each nuclear possessor has a different assessment of risk reduction priorities, which makes it extremely hard to set a global agenda for risk reduction.

2) An incremental approach is more likely to succeed than a comprehensive risk reduction agenda

The idea of a step-by-step incremental approach to risk reduction and arms control goes all the way back to Schelling. Instead of a rush to abolition, he advocated for a gradual approach that incorporated elements of restraint and elements of competition. Given the challenges of the current environment, this approach remains the most realistic way forward. Since a one-size-fits-all solution does not exist, the great powers should focus on identifying the most useful risk reduction measures on a case-by-case basis. Pursuing such an incremental approach could bring real results and pave the way for additional measures. The examination of the Cold War period showed that even limited bilateral agreements can have a much broader effect on the global system. First, there is the learning benefit for

other regions. While most adversarial relationships have their own specific characteristics, normally there are some general lessons that can provide useful guidance in other scenarios. Second, successful bilateral mechanisms can also trigger much broader measures (as happened in the case of the INCSEA agreement).

3) Successful implementation of cooperative risk reduction requires agreement about the *why, what,* and *how* questions

Cooperative risk reduction rests on the assumption that in a crisis between nuclear possessors, there are still a few outcomes all actors want to avoid. The key challenge in this new two-peer environment is identifying which outcomes each state wants to avoid and examining whether there are any overlaps between them. Once this is done, states can move on to discuss strategies to address the main threats and implement appropriate measures. Thus, success in cooperative risk reduction requires an agreement about undesired outcomes (why), a general awareness of and an agreement about the risks that can cause dangerous outcomes (what), and an agreement about the right tools to reduce the risks that generate undesired outcomes (how). Although these three components are logically tied together and follow each other in a sequence, there is no hierarchy between them in terms of importance. Lack of agreement over any of these factors would undermine a cooperative risk reduction agenda.

Currently, great powers only converge on the first question: they all want to avoid a major nuclear war and reduce the dangers of inadvertent escalation. Reaching consensus over the remaining issues will require a sustained dialogue.

4) There is enough convergence between the great powers to start a dialogue

Right now, there is not enough agreement between the great powers to implement concrete risk reduction measures, but there is enough convergence to start a dialogue. Mutual agreement over undesired outcomes provides a good foundation to come to the table. In the current context, the P5 format is the most realistic and promising framework to discuss nuclear risks among the great powers.

Regular discussions about doctrine and forces could help to build a better understanding of the different national approaches to risk reduction. It could dispel misunderstandings about intentions and could also help to

explain nuclear use thresholds. Achieving clarity about these issues would significantly limit the risks of inadvertent escalation. These discussions could also help to address the lack of awareness about certain dangers (for example, the dangers of entanglement) and trigger greater attention to these problems. Lastly, such sustained, long-term dialogue could also play an important role in rebuilding trust between the great powers which is the most important precondition of advancing cooperative security.

5) Risk reduction approaches must continuously adapt to the changing security environment

The sources of nuclear risks are as diverse as the strategies to deal with them. Nuclear risks can emerge from deliberate actions due to the risk-benefit calculus of national leaders, and they can also result from accidents or inadvertent escalation due to a misunderstanding of enemy intentions, capabilities, and expected responses. Nuclear risks are not static, they dynamically change in response to the changes of the security environment. Over the course of the nuclear age, priorities have regularly shifted, and different pathways were considered the most likely.

In the Cold War period, the gravest threat was a major nuclear war between the two superpowers. After the dissolution of the Soviet Union, new types of threats have emerged such as loose nuclear weapons and materials and WMD terrorism. Therefore, the focus of risk reduction shifted to threat reduction programs and safety and security measures. Today, there is a realistic threat again for great power war, including a nuclear one.
Since all these threats require a specific approach and toolkit, tailored and flexible solutions are needed that respond to the needs of the security environment and can rapidly adjust to emerging new requirements.

6) Nuclear risk reduction is inherently tied to non-nuclear constraints

There are many reasons why nuclear risks cannot be understood in isolation from the broader security context. First, nuclear risks can emerge from other domains. Today, it is difficult to imagine a nuclear use scenario that would not originate in an escalating conventional conflict. This is especially true as great powers have diversified their non-nuclear strategic toolkit and increased the prominence of these weapons in their security policy and military planning. As a result, some of the traditional firebreaks between the conventional and nuclear domains have diminished, and new escalatory pathways have emerged.

Second, many risks are linked to the great powers' threat perceptions, which are influenced by the status of their overall relations. Deep-seated mistrust and worst-case assumptions about the intentions of adversary leaders have important implications for inadvertent escalation due misunderstandings and miscalculation.

Third, nuclear use decisions would most likely consider the overall military strength of adversaries. From the beginning of the nuclear age, conventional balances have been an important factor in nuclear employment strategies.

Thus, nuclear risk reduction efforts cannot only focus on nuclear weapons. In the Cold War period, risk reduction approaches were inclusive of mechanisms that addressed the conventional-nuclear interaction. In fact, non-nuclear constraints sometimes had a much greater impact on nuclear risk reduction than the mechanisms that had a specific nuclear focus. Implementing such a holistic approach to risk reduction would bring many benefits in the current context as well.

7) A better analytic approach is needed to build consensus among great powers

Overcoming the problems associated with subjective threat perceptions and diverse priorities is challenging because nuclear risks are difficult to quantify. There is no objective mechanism to judge what is the risk on any given day, and what degree of risk reduction would be achieved with a specific mechanism. The analytic toolkit is lacking here because of the blinders and biases in the communities looking at these problems. The United States, Russia, and China have all conducted their own analysis of nuclear risks. But in most cases, they have arrived at different conclusions and refused to share their perspective with each other.

Lack of dialogue about risk assessment is problematic because this new security environment is dynamically changing, and the complexities are only increasing. As a result, great powers do not have the ability to accurately judge in every situation whether an action will be perceived as escalatory or not by their adversaries. This suggests that further analytical work is needed to explore escalatory risks in the current context, and great powers must engage in deeper discussions about these issues. This could help to raise awareness and build consensus about the most stressing dangers, which is necessary to identify what kind of innovations are needed in risk reduction approaches.

8) Not all nuclear risks can be handled in a cooperative way

Although I contend that even in this complex and highly competitive environment there are a few common goals that could serve as the basis of collaboration, not all nuclear risks can be handled in a cooperative way. Risk has an ambiguous character in strategy, which means that states have very different levels of risk tolerance, and they also have different approaches to risk manipulation. While states can grow worried about certain risks and decide to take action to reduce them, states can also deliberately create and exploit risks to advance their national security. Throughout the nuclear age, many nuclear weapon states have effectively used the mechanism of risk manipulation to coerce their adversaries, and it is likely to remain part of their deterrence strategy to varying degrees. Great powers that are intentionally using nuclear threats for coercive purposes have a vested interest in keeping certain risks credible. Therefore, there are a few areas where great power interests do not align, and cooperative mechanisms are unlikely to succeed.

Thus, the only way to deal with these threats is to deter them. In the Cold War period, the risk reduction concept was intertwined with deterrence and arms control theory, and these mechanisms were seen as different tools to achieve the same national security objectives. Effective deterrence requires the presence of certain risks and states can use these risks to their benefit. The key to achieving stability and managing risks is finding the right mix of cooperation and competition. Great powers have spent decades learning how to utilize the tools of arms control, risk reduction, and deterrence in tandem with each other to stabilize their relations and reduce the likelihood of nuclear war. In the post-Cold War period, risk reduction got disassociated from deterrence and arms control, and it broadened both in terms of participants and issues. In many cases, this led to an agenda that is not realistic in the current security environment, and generally unacceptable from the perspective of nuclear possessors. Bridging this gap requires that we consider deterrence an essential part of any comprehensive risk reduction strategy.

9) Deterrence obligations can come into conflict with risk reduction and arms control

Risk reduction measures can sometimes trigger unintended negative outcomes. While certain operational practices are known to carry serious nuclear risks, the measures devised to address them could trigger dangerous new forms of risk. Thus, implementing such mechanisms would resolve one problem but it would only trade the old threat to a new type of risk. Due to

these unintended consequences, states have come to prioritize certain risk reduction solutions over other mechanisms, which sometimes involves the acceptance of difficult trade-offs.

These trade-offs can also materialize in the form of broader policy objectives. While the theoretical foundations of deterrence, arms control, and risk reduction are intertwined, these mechanisms can create opposing obligations. In situations like this, a pragmatic assessment of the security environment can help to identify which tools are better suited to advance national security objectives and which obligations deserve priority. Periods of intense competition usually put a high premium on deterrence solutions, while a more benign security environment would probably justify prioritizing arms control and risk reduction. As the security environment changes, priorities may also shift, and previously shelved initiatives could become feasible.

10) There is a path forward even if adversaries refuse to cooperate

Historically, there has been a long list of measures that the great powers have taken individually to reduce nuclear dangers. When relations are strained due to intense competition, cooperation might not be possible. This, however, does not mean that risk reduction cannot be advanced unilaterally. There are three distinct approaches that can help even if adversaries refuse to cooperate.

First, deterrence strategies can be adapted to reduce nuclear risks. Improving the credibility of deterrence can help to reduce adversary incentives to use nuclear weapons, and it can also convince allies not to develop their own nuclear capabilities. The second approach is unilateral restraint. Historical record suggests that states should not pursue these measures with the anticipation that their adversaries will follow suit. At the same time, there are a number of areas where unilateral restraint is beneficial even without adversary buy-in. Lastly, closer collaboration with allies can also play an important role in risk reduction because it can help to advance normative arms control initiatives, strengthen deterrence and put more pressure on adversaries to negotiate, and improve analytical thinking about escalatory pathways and nuclear risks.

♦

Altogether, these principles reflect the enduring lessons of the past, the specificities of the security environment today, and the status of great power relations. They are meant to support the development of a systemic approach to risk reduction that builds realistic expectations of what role these mechanisms can play in a two-peer environment. Following these guidelines can help reduce the gap between the aspirational goals of risk reduction, and the practical achievements.

In today's world, the balance has shifted back from arms control and risk reduction to deterrence. But despite the many challenges, agreement between the great powers on the desire to both avoid major nuclear war and reduce the chances of inadvertent escalation suggests that the international community should keep striving for renewed dialogue. That dialogue—over time—could help to create greater agreement on the most dangerous behaviors and practices and the best mechanisms to deal with them. In the interim, there are several unilateral steps that the United States could take to avoid augmentation of nuclear risks, and U.S. leaders should encourage others to do so as well.

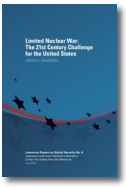
CGSR Publications

Livermore Papers on Global Security

#1 Lewis A. Dunn
Redefining the U.S. Agenda for Nuclear Disarmament
(2016)

#2 Yukio Satoh
U.S. Extended Deterrence and Japan's Security
(2017)

#3 Dave Johnson
Russia's Conventional Precision Strike Capabilities, Regional Crises, and Nuclear Thresholds
(2018)



#4 John K. Warden
Limited Nuclear War: The 21st Century Challenge for the United States
(2018)

#5 Michael Nacht, Sarah Laderman, and Julie Beeston
Strategic Competition in China-U.S. Relations
(2018)

#6 Newell L. Highsmith
On the Legality of Nuclear Deterrence
(2019)

#7 Brad Roberts
On Theories of Victory, Red and Blue
(2020)

(Continued on next page)

Publications available for download at *cgsr.llnl.gov*

#8 Toby Dalton & George Perkovich
Thinking the Other Unthinkable: Disarmament in North Korea and Beyond
(2020)

#9 Michael Albertson
Negotiating with Putin's Russia: Lessons Learned from a Lost Decade of Bilateral Arms Control
(2021)

#10 Michael Albertson
Closing the Gap: Aligning Arms Control Concepts with Emerging Challenges
(2022)

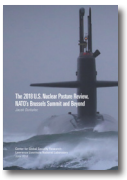
#11 Christopher A. Ford
Competitive Strategy in Information Confrontation
(2022)

#12 Asmeret D. Asghedom
Examining the Energy Transition Through the Lens of Great Power Competition
(2023)

#13 Jacek Durkalec
Russian Net Assessment and the European Security Balance
(2024)

Publications available for download at *cgsr.llnl.gov*

Occasional Papers



Jacek Durkalec
The 2018 U.S. Nuclear Posture Review, NATO's Brussels Summit and Beyond
(2018)

Zachary S. Davis
Artificial Intelligence on the Battlefield: An Initial Survey of Potential Implications for Deterrence, Stability, and Strategic Surprise
(2019)

Mona Dreicer, editor
Getting Innovation Right
(2019)

Bruce T. Goodwin
Additive Manufacturing and Nuclear Security: Calibrating Rewards and Risks
(2019)

Benjamin Bahney, editor
Space Strategy at a Crossroads: Opportunities and Challenges for 21st Century Competition
(2020)

Brad Roberts, editor
Major Power Rivalry and Nuclear Risk Reduction: Perspectives from Russia, China, and the United States
(2020)

Anna Péczeli and Bruce Goodwin
Technical Issues in the Comprehensive Nuclear Test Ban Treaty (CTBT) Ratification Debate: A 20-Year Retrospective
(2020)

(Continued on next page)

Brad Roberts, editor
Fit for Purpose? The U.S. Strategic Posture in 2030 and Beyond
(2020)

Brad Roberts, editor
Major Power Rivalry and Nuclear Risk Reduction: Perspectives from Russia, China, and the United States
(2020)

Brad Roberts, editor
Taking Stock: U.S.–China Track 1.5 Nuclear Dialogue
(2020)

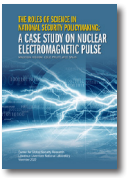
Amelia Morgan and Anna Péczeli, editors
Europe's Evolving Deterrence Discourse
(2021)

Bruce T. Goodwin
Nuclear Weapons Technology 101 for Policy Wonks
(2021)

Brad Roberts, editor
Getting the Multi-Domain Challenge Right
(2021)

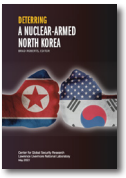
Brad Roberts, editor
Stockpile Stewardship in an Era of Renewed Strategic Competition
(2022)

Publications available for download at *cgsr.llnl.gov*



Madison Hissom, Cole Pruitt, Wes Spain
The Roles of Science in National Security Policymaking: A Case Study on Nuclear Electromagnetic Pulse
(2022)

Report of a study group convened by the Center for Global Security Research - Brad Roberts, study group chair
China's Emergence as a Second Nuclear Peer: Implications for U.S. Nuclear Deterrence Strategy
(2023)



Brad Roberts, editor
Deterring a Nuclear-armed North Korea
(2023)

Brad Roberts, editor
Morality and Nuclear Weapons
(2023)

Brad Roberts and William Tobey, co-editors
The Inflection Point and the U.S. Nuclear Security Enterprise
(2023)

Publications available for download at *cgsr.llnl.gov*

“Combining careful scholarship and smart practical thinking, Anna Péczeli’s paper stands out among recent writing on nuclear risk reduction. She puts today’s work on risk reduction into its historic context, from its origins to its past successes and failures. In so doing, Péczeli’s paper illuminates opportunities for when, where, and how risk reduction can contribute to today’s needed efforts to avoid nuclear war. It is necessary reading for practitioners and experts in the United States and overseas.”

Lewis A. Dunn
Former U.S. Ambassador to the 1985 NPT Review Conference

“With nuclear threats rising across the globe, there is an urgent need for the United States and its allies and partners to effectively manage nuclear risk. Nuclear risk reduction plays an important role, but the goals of initiatives are often ill-defined, and the mechanisms nebulous. Dr. Péczeli provides needed intellectual clarity to guide future efforts. She has conducted a comprehensive review that traces the history of the nuclear risk reduction concept and explores its continued relevance, but also need for adaptation, for a changing security environment.”

John K. Warden
Former Director for Strategic Stability and Arms Control, National Security Council

Lawrence Livermore National Laboratory

ISBN 978-1-952565-27-4