



NUCLEAR RISK REDUCTION

CLOSING PATHWAYS TO USE

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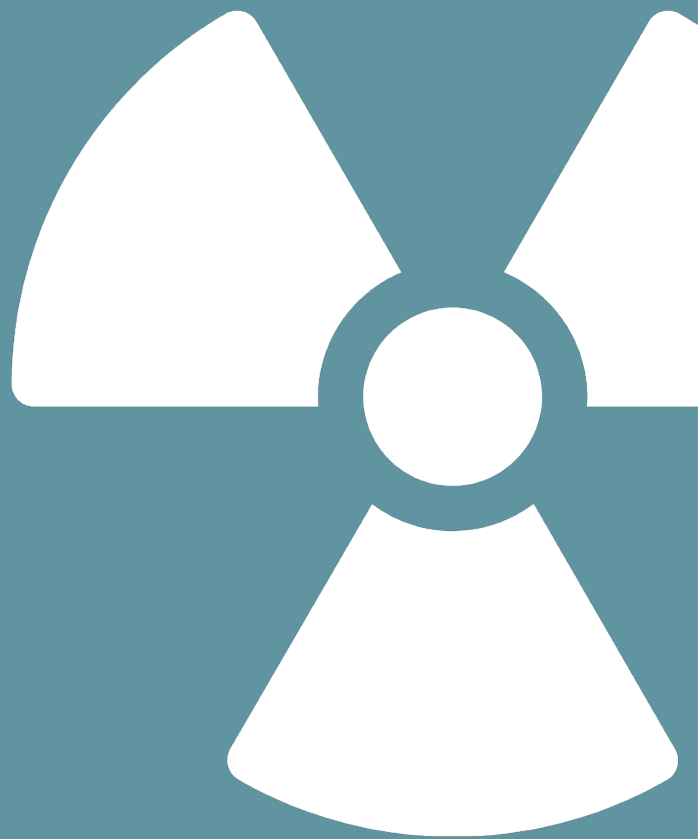


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ABBREVIATIONS AND ACRONYMS

ABM Treaty	Anti-Ballistic Missile Treaty
AI	artificial intelligence
ASAT	anti-satellite
C3	command, control, and communications
DPRK	Democratic People's Republic of Korea
HGV	hypersonic glide vehicles
INF	Intermediate-Range Nuclear Forces Treaty
MIRV	multiple independently targetable re-entry vehicle
NATO	North Atlantic Treaty Organization
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
OSCE	Organization for Security and Cooperation in Europe
P5	The five permanent members of the Security Council
ROK	Republic of Korea
START	Strategic Arms Reduction Treaty

FOREWORD



Over the past decade, international concerns about the risk of nuclear weapon use, whether intentional or inadvertent, have sharpened to a degree unmatched since the deepest chill of the Cold War. Renewed attention to the subject has simultaneously derived from and fed into multilateral discourse and a body of research on both the probability and consequences sides of the risk equation. In the process, what has become evident is the persistence and dynamism of risk, as nuclear weapons remain central to the security doctrines of a number of States and technological developments contribute to further strategic uncertainty and unpredictability.

Given the disastrous consequences of any detonation event, the current level of risk of nuclear weapon use is unacceptable. In a time of heightened tensions and global anxiety, all States—irrespective of their stances on nuclear weapons—share an interest in the urgent pursuit and implementation of measures to reduce the risk of use, as highlighted by the Secretary-General in June 2018. The development of such measures constitutes not only a critical step in itself but also in the rebuilding of trust and confidence towards nuclear arms control and disarmament efforts and the total elimination of nuclear weapons.

A risk focus is central to UNIDIR's approach to arms control and disarmament; identifying and understanding the risks linked to weapons as well as their implications for international security can contribute to new thinking on practical ways to address them.

This work is in keeping with UNIDIR's Mandate from the General Assembly to promote informed participation by all States in disarmament efforts. It will provide the international community with more diversified and complete data on problems relating to international security, the armaments race, and disarmament in the nuclear field. Without the generous support of the Governments of Australia, Finland, Sweden, and Switzerland, this work would not have been possible.

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Director
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EXECUTIVE SUMMARY



Addressing the risks that could lead to any use of nuclear weapons is in the security interest of all States. In a difficult geopolitical environment marked by tense relations among some nuclear-armed States and the increased possibility of conflict across a number of contexts, policymakers have recognized the urgency of undertaking risk reduction efforts both for its own sake and in facilitating constructive engagement on divisive nuclear issues. Yet there is no clear path forward. Common understandings on risk reduction and related concepts remain absent. The gamut of relevant ideas and proposals highlights both the wide scope of risk sources and the variation in risk priorities and perceptions among States. Compounding the challenge is the dynamism of risk across situations.

A systematic approach to nuclear risk reduction requires careful consideration of the manner in which risk of use scenarios could manifest in particular contexts. Such an analysis constitutes a critical step in developing common understandings of risk and risk reduction elements, and in the identification of joint priorities among States. The application of a risk framing in this manner can thus shed light on the necessary approach and appropriate practical and feasible measures to combat the possibility, helping to facilitate the development of those measures—towards closing the pathways to nuclear weapon use.

This study:

- outlines an approach to nuclear risk and risk reduction centred on pathways to the potential use of nuclear weapons;
- identifies risk drivers linked to cross-cutting domains in the global landscape—in particular the altered strategic environment and the implications of technological developments—and in selected geopolitical regions in which nuclear weapons prominently feature; and
- offers a series of recommendations for States to consider, aimed to mitigate different risk sources and close off pathways to use within contexts and across them.

The main findings posited by contributors are as follows:

- The transformation of geopolitics, characterized by increased **multipolarity** and contestation among the United States, the Russian Federation, and China in particular, have fostered a deep mutual mistrust of nuclear doctrines and intentions that will not be easy to reverse and will require managing through strategic engagement and consultation.
- Developments in **strategic technologies** exacerbate tense relations among some nuclear-armed States, and require an approach wherein States enhance their understanding about their implications for the strategic balance, restrict or clarify behaviours linked to relevant capabilities, or restrict capabilities altogether, in order to contribute to additional predictability in their relations.

- Real and perceived insecurities among States in the competitive and volatile **Euro-Atlantic** region can be alleviated by dialogue, information-sharing, and transparency mechanisms, which can clarify doctrinal misperceptions and overcome flawed analysis about nuclear risk scenarios that otherwise could become self-fulfilling prophecies.
- A number of factors—from leadership to opacity—makes the Korean Peninsula acutely vulnerable to risk of nuclear weapon use, and deep and extensive engagement of a ‘rogue’ nuclear-armed State may be necessary to reduce that risk and transform the troubled strategic environment in **Northeast Asia**.
- The complexities of the chain involving multiple nuclear-armed States present in **Southern Asia** warrants a smaller-scale approach to risk reduction that de-emphasizes a regional focus. High-level attention to the topic at a multilateral level may help to prime engagement and drive unilateral and bilateral action.
- Nuclear weapon politics in the **Middle East** is complicated by the unique discourse linked to Israel’s long-standing policy of opacity, but a broader approach to risk reduction that focuses on general confidence- and security-building may downplay the role of those weapons, including for external nuclear-armed actors who have footprints in the region.

To reduce the overall risk of nuclear weapon use, all States should consider the following:

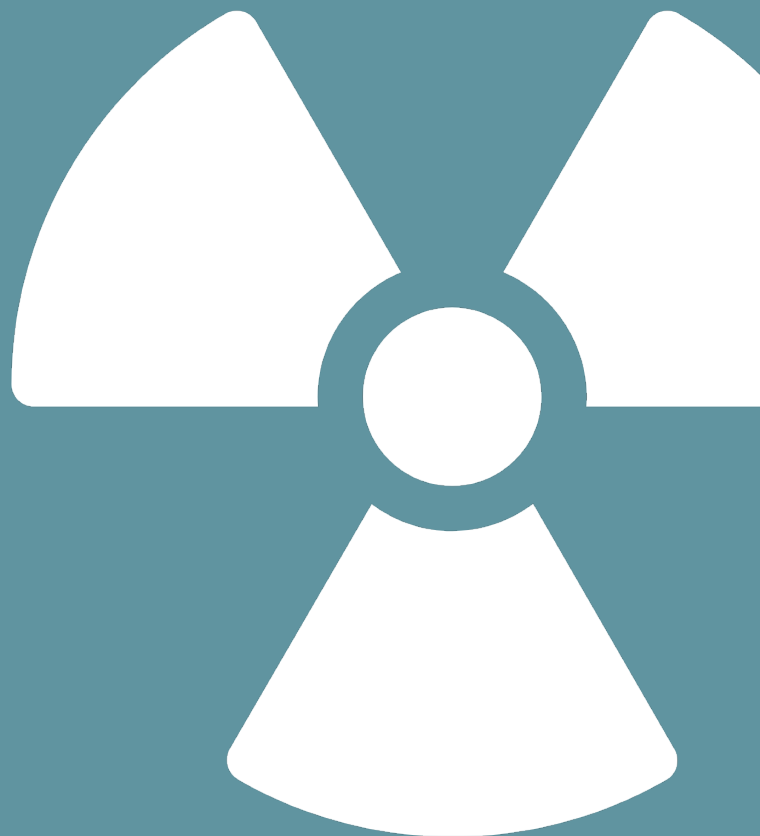
1. Increase their strategic engagement to address the mistrust that has accompanied geopolitical competition and shifting power dynamics.
2. Preserve, formalize, and develop policies of restraint that help to undercut the action–reaction dynamics that can drive technology racing, arms racing, and nuclear escalation.
3. Enhance use of notifications, signals, and crisis communication channels, and employ other methods of crisis avoidance and management, with a view to restoring greater predictability in relations.
4. Commit to reduce risk of nuclear use, including through increased awareness and strengthened analysis of risk pathways.

Agreement among policymakers on the urgent need to pursue and implement measures to reduce the risk of any use of nuclear weapons reflects the alarming state of affairs. The enormity of the challenge—and the complexity of risk profiles—across domains and regions underlines the need for common understandings, including of basic concepts, risk sources, and underlying conditions. These can serve as a basis for carefully considered policies that can have immediate resonance and lay the groundwork for reinvigorating arms control and disarmament efforts. This volume seeks to contribute to that dialogue.

CHAPTER 1

NUCLEAR RISK REDUCTION: CLOSING PATHWAYS TO USE

Wilfred Wan



INTRODUCTION

Amidst an arms control and disarmament architecture in peril, it is striking that among the international community there exists any broad point of convergence pertaining to nuclear weapons policy. Even the widely shared agreement on the need to prevent nuclear conflict is undermined in this environment by the gap between proponents of deterrence and of disarmament. It is striking then in most recent years the desire to reduce any risk of nuclear weapon use has emerged on the agenda across a series of multilateral forums and State-driven initiatives. This appears linked to underlying concerns about:

- 1) the global geopolitical and security circumstance,
- 2) the uncertain ramifications of technological developments, and
- 3) the accompanying tension and possibility of conflict among nuclear-armed and nuclear-allied States.

Partly in response, there is a widespread call to explore and execute practical risk reduction measures that would have immediate impact and can also contribute to more constructive engagement on divisive nuclear issues by all sides.

The significance of risk reduction to global nuclear order is evident in its ubiquity. The Chair of the 2019 Preparatory Committee to the 2020 Review Conference of the Nuclear Non-Proliferation Treaty (NPT) recommended “the elaboration of measures that can ... reduce the risk of the use of nuclear weapons, whether intentionally, by miscalculation or by accident, in the context of achieving nuclear disarmament”.¹ Identifying interim measures to address risk as means to facilitating disarmament progress is a linchpin of the US initiative on Creating an Environment for Nuclear Disarmament,² and constitutes a key step in the Swedish approach as elaborated in their Stockholm Initiative.³ Risk reduction has also been highlighted in the Secretary-General’s 2018 Agenda for Disarmament and in a number of intergovernmental processes, including the 2019 Group of Seven Statement on Non-Proliferation and Disarmament, the 2018 session of the Disarmament Commission, and the 2016 Report of the Open-Ended Working Group taking forward multilateral nuclear disarmament negotiations

The concept of nuclear risk reduction is hardly novel. Even during the Cold War, the United States and Soviet Union cooperated on a number of activities in this vein, and nuclear-armed neighbours India and Pakistan have signed several agreements with

¹ NPT/CONF.2020/PC.III/WP.49, p. 3.

² C. A. Ford, “Inaugurating a New and More Realistic Global Disarmament Dialogue”, 2 July 2019, <https://www.state.gov/inaugurating-a-new-and-more-realistic-global-disarmament-dialogue/>.

³ The Stockholm Ministerial Meeting on Nuclear Disarmament and the Non-Proliferation Treaty, ministerial declaration, Stockholm, 11 June 2019, <https://www.government.se/statements/2019/06/the-stockholm-ministerial-meeting-on-nuclear-disarmament-and-the-non-proliferation-treaty/>.

the intent of preventing conflict that could escalate to nuclear use. Many ideas discussed in the aforementioned venues have been around in some shape or form for decades. Discussion of risk of use concerns have fallen under a number of different umbrellas: long-standing debates on no first use policies and negative security assurances including under the auspices of the nuclear-weapon-free zones, post-11 September 2001 concerns about non-State acquisition of nuclear weapons and related materials, calls for the need to reduce the operational readiness of nuclear weapon systems, and broader consideration of the responsibilities of the five permanent members of the Security Council (the P5)—also the five NPT-recognized nuclear-weapon States.⁴ The 64-point Action Plan agreed upon at the 2010 NPT Review Conference also includes a number of measures that tackle risk of use.⁵ What is distinct in the contemporary exploration of the topic of risk reduction is both its tone—featuring a greater sense of urgency than since the Cold War’s end—and its scope, which is broader and more multilateral in nature, and not tethered to individual proposals.

⁴ See W. Wan, *Nuclear Risk Reduction: The State of Ideas*, UNIDIR, 2019, <http://unidir.org/files/publications/pdfs/nuclear-risk-reduction-the-state-of-ideas-en-767.pdf>.

⁵ For instance, in Action 5, the nuclear-weapon States are “called upon to promptly engage with a view to ... further diminish the role and significance of nuclear weapons in all military and security concepts, doctrines, and policies ... discuss policies that could prevent the use of nuclear weapons and eventually lead to their elimination, lessen the danger of nuclear war and contribute to the non-proliferation and disarmament of nuclear weapons ... consider the legitimate interest of non-nuclear weapon States in further reducing the operational status of nuclear weapons systems in ways that promote international stability and security ... reduce the risk of accidental use of nuclear umbrellas; and ... further enhance transparency and increase mutual confidence”; *2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Final Document*, UN document NPT/CONF.2010/50 (Vol. I), part I, p. 21, [https://undocs.org/NPT/CONF.2010/50%20\(VOL.I\)](https://undocs.org/NPT/CONF.2010/50%20(VOL.I)).

CHALLENGES TO MOVING FORWARD

Even with growing widespread support for reducing risk in principle, complexities in the contemporary nuclear landscape and security environment render no clear and singular path forward. Transitioning to concrete policy action encounters a number of challenges.

As mentioned, there exist underlying concerns about the global and geopolitical circumstance, which is characterized by strategic tension between several of the nuclear-armed States then, and a general decline in cooperation and trust between them. Where best then to start on nuclear risk reduction that stands a shot of practical success? For instance, the P5 process has to date preferred strategic considerations in discussing risk reduction measures. Their source of concern has been the possibility of nuclear use “that may be caused by misunderstandings and misjudgments”.⁶ In many ways this is echoed in the notion of “strategic risk reduction” advanced in the 2019 Group of Seven Statement.⁷ The focus is on risk of use linked to misperceptions, rather than the possibility of deliberate use in tactical contexts, or accidental use linked to technical error, for instance. The US Creating an Environment for Nuclear Disarmament initiative may represent a more expansive approach to the concept of risk reduction—not least by including in its proceedings India, Pakistan, and Israel, three non-NPT nuclear-armed States—but that remains to be seen.

In theory, plurilateral or multilateral initiatives can bring about a greater understanding of each State’s priorities, a prerequisite to the identification of feasible risk reduction activities. At the same time, the multiplicity of actors in this space can further complicate the proceedings. The specific inclusion of non-NPT nuclear-armed States in the risk reduction conversation could be seen by others as legitimizing their nuclear status. Broadened membership can also shift focus away from the ground realities of individual States; States can also become more reticent engaging with whom they perceive to be external actors. Perceptions of risk are informed by national perspectives, and driven by varied constituencies, priorities, and strategic cultures. A related challenge then is what States see as appropriate risk reduction measures can differ tremendously; further exploration of risk reduction may only reveal unbridgeable gaps. There exists the danger that multilateral forums will turn into either echo chambers for like-minded States or contentious locales for States to air a litany of

⁶ Ministry of Foreign Affairs of the People’s Republic of China, “Five Nuclear-Weapon States Hold a Formal Conference in Beijing”, MFA News, 30 January 2019, https://www.fmprc.gov.cn/mfa_eng/wjbxw/t1634793.shtml.

⁷ Focusing on transparency and dialogue with a view to “help avoid misunderstanding and miscalculation”; 2019 G7 Statement on Non-Proliferation and Disarmament, Biarritz, France, 6 April 2019, <https://www.elysee.fr/admin/upload/default/0001/05/2ffa826926cd72354b90a05f7de765bfcc9908b6.pdf>.

grievances, rather than facilitating dialogue or consensus-building. Indeed, ideas for multilateral commitments to no first use and de-alerting have stalled—precisely because there exists deep-seated disagreement among groups on whether such measures would actually reduce risk, or increase it by other means, for instance by undermining strategic stability.

Complicating identification of common risk concerns is the fact that risk itself is dynamic. For example, the impact of developments across technologies and domains on nuclear risks are yet to be fully realized (“nuclear risk” throughout this volume referring to the risk of nuclear weapon use). Artificial intelligence and machine learning seem likely to play greater roles in early warning and command and control systems. The growth of infrastructure in space—civil and military—complicates the environment in which nuclear assets (such as reconnaissance and communication satellites) operate. Dual-capable long-range delivery systems that are likely to be deployed in the next decade “could change the deterrence calculus”.⁸ Such developments and others in terms of capabilities reverberate in other manners as well, for instance by fundamentally increasing the complexity of systems and in shortening human decision-making timelines. Indeed there is a body of research on the possibility of false alarms and accidents linked to those conditions.⁹ Limits to our knowledge with nuclear weapon systems and other advanced technologies persist and could expand.¹⁰ Risk assessment then constitutes a moving target fraught with uncertainty.

Perhaps in the longer term some of these challenges can have some positive impact, for instance by restoring recognition of mutual nuclear vulnerability and removing the incentives for nuclear first strike. But in the current environment, such uncertainties underwrite worst-case scenarios for nuclear war planning; they feed into the possibility for escalation in crisis, increasing the risk of use. Complications to the task of risk reduction must not prevent efforts in the arena. Progress is essential both in itself and in revitalizing efforts towards nuclear arms control and disarmament.

⁸ UNIDIR–UNODA, *Hypersonic Weapons: A Challenge and Opportunity for Strategic Arms Control*, 2019, p. 1.

⁹ Including S.D. Sagan, *The Limits of Safety: Organizations, Accidents, and Nuclear Weapons*, 1993; C. Perrow, *Normal Accidents: Living with High-Risk Technologies*, 1999; E. Schlosser, *Command and Control: Nuclear Weapons, the Damascus Incident, and the Illusion of Safety*, 2013; P. Lewis et al., *Too Close for Comfort: Cases of Near Nuclear Use and Options for Policy*, Chatham House, 2014.

¹⁰ See the pieces cited in note 10, as well as B. Pelopidas, “The Unbearable Lightness of Luck: Three Sources of Overconfidence in the Manageability of Nuclear Crises”, *European Journal of International Security*, vol. 2, no. 2, July 2017, <https://doi.org/10.1017/eis.2017.6>.

A FRAMEWORK FOR ANALYSIS

Effective risk reduction requires first an understanding of the pathways to potential nuclear use. By reframing the topic accordingly, policymakers and scholars can consider the sources and underlying conditions driving risk pathways, facilitating the development of practical, feasible, and contextually appropriate measures. A previous UNIDIR publication—reprinted in this volume as chapter 2—identified four general risk-of-use pathways. These pathways establish the initial parameters for contextual analysis.¹¹ They are as follows:

- **doctrinal use** refers to use as outlined in declared policies, primarily based on retaliatory possibilities, with allowance for ambiguities in those policies;
- **escalatory use** refers to use linked to an ongoing tension or conflict, or to the introduction of nuclear weapons in times of crisis;
- **unauthorized use** refers to non-sanctioned use, including by rogue State actors, as well as use linked to non-State actors, including of lost, stolen, diverted, or crude nuclear devices; and
- **accidental use** refers to use linked to error, including technical malfunction and related human fallibility.

Accordingly, risk reduction approaches that target the sources and underlying conditions driving each of these pathways can minimize risk of use overall.

To reduce doctrinal risk, States can narrow the situations in which they would consider deliberate nuclear use, especially in retaliatory circumstances. Activities in this vein include generally stigmatizing the use of nuclear weapons and circumscribing the conditions in which these weapons would be used. Addressing the blurring boundary between nuclear and non-nuclear weapons is key here. In addition, States can lessen the ambiguity surrounding use conditions where possible. Clarifying doctrines for instance could help prevent the inadvertent crossing of thresholds that could instigate a pre-emptive nuclear strike.

To reduce escalatory risk, States can reduce the viability of nuclear weapons. Alongside strategic and operational measures, lessening ambiguity through transparency and information exchange (including with hotlines) can play a role. These can reduce the possibility that nuclear weapons are introduced due to miscalculation or misperception. States can also seek to avoid escalatory dynamics by managing crises where they occur or by preventing them in the first place, addressing underlying security and geopolitical tensions.

¹¹ W. Wan, *Nuclear Risk Reduction: A Framework for Analysis*, UNIDIR, 2019, <http://unidir.org/files/publications/pdfs/nuclear-risk-reduction-a-framework-for-analysis-en-809.pdf>.

To reduce unauthorized risk, States can bolster their defences in order to deny any illicit access to nuclear weapons and related materials. This includes tightening procedures around their storage, maintenance, transfer, and control—including in the digital realm. Additionally, the veil of secrecy surrounding nuclear weapons programmes—even within domestic structures—suggests a need for more objective and enhanced risk assessment and management.

To reduce accidental risk, States can move to minimize errors. This can be done by strengthening safety features in the systems that govern the operation and maintenance of nuclear weapons and related systems, and again may include activities in the digital realm. States can also enhance operator control over potential nuclear use or insert technical means of protection against human fallibility—though movement in either direction each entails its own set of risks. Beyond this, States can move to contain the consequences of errors when they occur.

These principles and objectives provide a blueprint with which States can address the outlined risk-of-use pathways, and certainly actions in one category can reverberate across other pathways to use (changes to postures that extend decision-making time, for instance, can also lessen the chance of human error). Still they constitute only a starting point. Even assuming common risk assessments, as well as the corresponding political will to drive action, the nature of risk of nuclear weapon use varies considerably across contexts. Thus, further understanding of how these pathways manifest in individual contexts is critical to identifying the measures best suited to reduce risk or even close off those risk pathways to use, and may contribute to uncovering lessons applicable to other contexts as well.

RISK REDUCTION IN CONTEXT

Building from UNIDIR's framework paper, this study represents a foray into exploring the current context of nuclear risk and identifying practical ways that might reduce risk, taking into account their specificities alongside broader principles and measures of relevance like those identified in our earlier analysis.

This volume first examines nuclear risk in the context of change in the global landscape, in particular the altered strategic environment and the implications of technological developments. Certainly there exist other cross-cutting risk factors, including broader threats to multilateralism and the deteriorating arms control and disarmament endeavour. Yet multipolarity and strategic technology are explored in-depth in this volume as they constitute causal factors for those variables, directly impacting the risk of nuclear use. Discussion of cross-cutting domains also sets the scene for regional-centric analysis. The remaining contributions examine four geopolitical regions in which nuclear weapons feature prominently: the Euro-Atlantic, Northeast Asia, Southern Asia, and the Middle East. Notably, the nature of the strategic environment prevents clear delineation of boundaries or even of those involved. Such fluidities further complicate risk-of-use pathways, as will be evident.

Broadly, the authors consider the sources and underlying conditions driving risk of nuclear use in their respective domains or regions. To this end they examine the doctrines and capabilities of relevant nuclear-armed States, the relations among and between them and with nuclear-allied States, and the general security environment in which they operate. John Borrie notes in his chapter that the military competition among nuclear-armed States is "fuelled by greater uncertainty about each other's intentions and capabilities"; indeed, how States interpret these is central to risk dynamics. Incorporating these and other complexities into the analysis allows each author to flesh out a 'risk profile' of nuclear weapon use.

From there, the authors examine the means through which such risks could be addressed. Taking into account the challenges of the environment, they identify opportunities for joint action by nuclear- and non-nuclear-armed States alike to lower the risk of use, as well as possibilities for unilateral initiatives to reduce nuclear risk. In some instances, they consider existing institutional frameworks and look to cooperative security experiences (positive and negative), which can have significant implications for the feasibility and effectiveness of current and future risk reduction measures. In this manner authors derive practical, concrete policy options to address risk-of-use pathways.

Authors of the contributions that follow were invited as experts in their particular domains and regions. They were requested to directly engage the ideas and language of previous UNIDIR publications on the topic of nuclear risk reduction, and were

presented with a series of thematic questions to consider in their particular areas of study. An authors' workshop during this process helped to cohere the themes of the volume. Additional subject matter experts were solicited to provide feedback on individual chapters in a double-blind peer review process, prior to finalization. This volume will serve as a basis for the Institute's ongoing research on reducing the risk of nuclear weapon use. These overview chapters provide a starting point from which further nuanced analysis and focused engagement can be conducted.

In chapter 3, Ankit Panda writes on the altered global strategic environment, marked by "an era of contestation and increased multipolarity". He points to the heightened great power competition between the United States, the Russian Federation, and China, and identifies the different manifestations of that competition: including nuclear risk along doctrinal and escalatory pathways. Reducing risk will require addressing these fundamental issues of mistrust.

In chapter 4, John Borrie considers a host of technological developments that are contributing to contemporary strategic unpredictability—potentially driving crisis and even nuclear conflict among States. He explores the potential destabilizing effects of missile defence, hypersonics, anti-satellite weapons, cyber, and artificial intelligence capabilities, among others, and suggests a three-step approach that could contribute to additional predictability in the relations and assessments of States.

In chapter 5, Ulrich Kühn points to concurrent strategic, regional, and subregional competitive dynamics in the Euro-Atlantic. He argues that asymmetric risk perceptions—fuelled by intentional manipulation by States—are driving action-reaction dynamics that affect doctrines and postures (and interpretations thereof), increasing insecurity in an already tense environment. Addressing these will require cooperative efforts of diplomacy, restraint, and transparency by main actors.

In chapter 6, Tanya Ogilvie-White examines the impact of expanding nuclear capabilities and deteriorating strategic relationships on risk-of-use pathways in Northeast Asia, focusing in particular on the Korean Peninsula—with the nuclear opacity of the Democratic People's Republic of Korea being a major risk factor. She suggests an expansive risk reduction approach that considers nuclear and non-nuclear realms, with initiatives aimed to build trust and confidence towards transforming the strategic environment.

In chapter 7, Manpreet Sethi writes on the cascading effects of nuclear capabilities, doctrines, and postures in Southern Asia, the geographic term purposefully chosen to underline the undeniable impact of China in the longstanding India-Pakistan rivalry. Past confidence-building measures have not vastly raised the low levels of trust among States. She calls for an approach that looks to exploit any and all openings, and

suggests these steps may fall along unilateral and bilateral lines rather than regional lines.

In chapter 8, Hassan Elbahtimy underlines the unique status of the Middle East, which contains only one nuclear-armed State but has military footprints from several external nuclear-armed States, which can drive escalatory pathways. Israel's extreme opacity further complicates regional nuclear politics, and challenges nuclear risk reduction efforts. Instead, he argues an approach that focuses on general confidence- and security-building may more effectively assuage risk of use across all pathways.

A concluding chapter considers common themes across the volume, identifies questions that remain, and sketches a path forward for policymakers and scholars. It presents some practical ideas and approaches to reduce the risk of nuclear weapon use of any kind, and to pursue a more propitious environment for constructive engagement on all nuclear issues, including disarmament.

CHAPTER 2

NUCLEAR RISK REDUCTION:
A FRAMEWORK FOR ANALYSIS
(REPRINTED)

Wilfred Wan



CONTEXT

In recent years there has emerged among the international community a renewed sense of urgency to address the range of risks that could lead to any use of nuclear weapons. This reflects concern with the current state of affairs, in which rising tension among nuclear-armed States has increased the possibility of conflict across a number of contexts. All of the nuclear-armed States are undertaking modernization programmes. Meanwhile, for some of these nuclear-armed States and their allies, extended nuclear deterrence remains central in strategic doctrine. The multipolar nature of today's international system, alongside changes in political leadership in some States, has further contributed to perceptions of increased uncertainty concerning the conditions under which nuclear weapons may be used. This is occurring against a backdrop in which the international arms control and disarmament architecture is under serious strain and progress in terms of nuclear reductions has faltered.

Risk reduction activity thus appears increasingly critical both in itself and in providing a foundation for engagement on divisive nuclear issues. Yet broad-based support for the idea of reducing to an absolute minimum nuclear risk has not—to date—translated into general agreement on the means by which this might be achieved.¹ What constitutes risk reduction measures for some may for others increase risk by upending the credibility of nuclear deterrence, threatening strategic stability, or creating new forms of unhelpful nuclear ambiguity. These differing interpretations of risk and risk reduction reflect varied constituencies, priorities, and strategic cultures. Still, such divergences should not be insuperable hinderances to nuclear risk reduction efforts. In fact, one priority of risk reduction should be to enhance mutual understanding of risk interpretations in order to reduce the possibility of use stemming from miscalculation or misperception. Overall, risk reduction efforts need to pinpoint areas of common interest in order to spark joint action.

¹ See W. Wan, *Nuclear Risk Reduction: The State of Ideas*, UNIDIR, 2019, <http://unidir.org/files/publications/pdfs/nuclear-risk-reduction-the-state-of-ideas-en-767.pdf>.

»» OUTLINE

A comprehensive and considered approach to nuclear weapon risk reduction must account for the dynamism of risk across situations. Nuclear risk is a global issue due to the interconnecting relations and security concerns of nuclear-armed States as well as the impacts of nuclear weapon use. But pathways to that use vary and are intertwined with the characteristics of a given context. These can include the doctrines and force postures of relevant nuclear-armed States, the nature of their alliances, and underlying sources of tension. Reducing risk of use in Europe, for instance, requires at a minimum consideration of the security perceptions of NATO States and the Russian Federation, which can then facilitate understanding of how proposed measures (for example, limiting the size and scope of military exercises in the Baltics) would address—or exacerbate—their particular concerns. This kind of contextual analysis can allow the reframing of a difficult topic, one often invoked from national perspectives. In the interim, a conceptual framework for risk reduction can help establish parameters for that analysis.

This paper proceeds as follows. The next section explores in the abstract risk scenarios involving the use of nuclear weapons. It discusses four pathways to use, identifying sources of risk and, where relevant, referring to historical ‘close calls’ that exemplify the scenario. Then, the paper considers the appropriate means of addressing the identified pathways to use. It outlines a broad approach and accompanying objectives for combating each. Drawing from scholars, analysts, and policymakers, it also previews baskets of risk reduction measures that fall into each approach (see the appendix for a summary of these ideas).² Following that, the paper considers how nuclear-armed States have hitherto engaged with nuclear risk reduction in bilateral and multilateral settings. A concluding section revisits contestation surrounding the concept of risk reduction. It offers a proposal for deploying the framework with a view to developing practical and feasible measures linked to particular contexts, which UNIDIR will explore in its research moving forward.

² As there are many such ideas and proposals, inevitably the selection is somewhat arbitrary.

»» NUCLEAR WEAPON USE SCENARIOS

Plausible scenarios in which nuclear weapons could be used vary widely due to factors such as the actors involved and their doctrines for employment of nuclear weapons, their nuclear and related capabilities (for instance, delivery systems), and the role of contingent factors (for instance, chance). Variation in use scenarios underlines the need to tailor risk reduction measures to the factors that define each context. But identifying the general pathways to nuclear use can set the initial parameters for contextual analysis. This section undertakes this exercise.

A framework that captures nuclear use scenarios in the abstract—as presented here—can build upon existing dialogue about nuclear weapons. The fundamental distinction often drawn is between intentional (or deliberate) and inadvertent use, with the latter category also encompassing accidental, mistaken, or unauthorized usage. Yet this binary distinction can be problematic, as a deliberate use of nuclear weapons based on a false assessment or in response to a false alarm blurs lines of intentionality. A catch-all third option—with use as intentional, accidental, or otherwise—does not address this issue either.³ One recent study presented an altogether different range of categories: unauthorized use, unintended use, and intended use based on incorrect assumptions.⁴ While this offers necessary nuance, the treatment conspicuously casts aside the possibility of deliberate use.

Building on existing categories, this paper presents four ‘risk of use’ scenarios. A detailed examination follows, but briefly:

doctrinal use refers to use as outlined in declared policies, primarily based on retaliatory possibilities, with allowance for ambiguities in those policies;

escalatory use refers to use linked to an ongoing tension or conflict, or to the introduction of nuclear weapons in times of crisis;

unauthorized use refers to non-sanctioned use, including by rogue State actors, as well as use linked to non-State actors, including of lost, stolen, diverted, or crude nuclear devices; and

accidental use refers to use linked to error, including technical malfunction and related human fallibility.

³ Global Zero, *Global Zero Commission on Nuclear Risk Reduction: De-Alerting and Stabilizing the World's Nuclear Force Postures*, April 2015, <https://www.globalzero.org/wp-content/uploads/2018/10/Global-Zero-Commission-on-Nuclear-Risk-Reduction-Full-Report.pdf>.

⁴ S. van der Meer, “Reducing Nuclear Weapons Risks: A Menu of 11 Policy Options”, *Policy Brief*, Clingendael: Netherlands Institute of International Relations, June 2018, https://www.clingendael.org/sites/default/files/2018-06/PB_Reducing_nuclear_weapons_risks.pdf.

The categorization above is not ‘hard and fast’, and this section later considers interactive effects across pathways (for example, crisis conditions that contribute to accidental use). Examining US–Soviet relations three decades ago, Joseph Nye observed that “efforts to reduce the risk of nuclear war must start with an understanding of the likely paths by which a nuclear war might begin”.⁵ The same principle holds true when examining possible nuclear use today. The four scenarios above capture a range of possible detonation events (see Figure 2.1), comprising an organizing framework around which risk reduction can be discussed. Each is detailed below.

Figure 2.1. Nuclear Weapon Use Scenarios

PATHWAY	DEFINITION	EXAMPLES
Doctrinal Use	In accordance with declaratory policies and ambiguities thereof	<ul style="list-style-type: none">• Following nuclear attack• Existential threat to the State
Escalatory Use	Linked to ongoing conflict or crisis, rising to nuclear use	<ul style="list-style-type: none">• Pre-emptive strike• Battlefield situations
Unauthorized Use	Non-sanctioned use or use by non-State actors	<ul style="list-style-type: none">• Rogue domestic actors• Nuclear terrorism
Accidental Use	Linked to error	<ul style="list-style-type: none">• Technical malfunction• Driven by false alarm

DOCTRINAL USE

Most of the nine States that possess nuclear weapons have to some degree outlined the circumstances in which they would be prepared to use them.⁶ Existing doctrines centre largely—but not exclusively—on notions of retaliation in response to both nuclear and non-nuclear attack. Two States—China and India—have expressly

⁵ J.S. Nye Jr., “U.S.-Soviet Relations and Nuclear-Risk Reduction”, *Political Science Quarterly*, vol. 99, no. 3, August 1984, p. 404.

⁶ Even those who speak of a normative inhibition against nuclear use admit the so-called taboo is under fire, for example with “the restraints on nuclear use by a U.S. president [are] less robust than previously thought” and uncertainty regarding its overall robustness “in the face of strategic pressures”. See N. Tannenwald, “How Strong Is the Nuclear Taboo Today?”, *The Washington Quarterly*, vol. 41, no. 3, September 2018, p. 104.

declared ‘no first use’ policies,⁷ cementing a retaliatory stance.⁸ Meanwhile, the 2018 US Nuclear Posture Review sets forth that nuclear use is “contemplated only in the most extreme circumstances to protect our vital interests and those of our allies”.⁹ It establishes that nuclear capabilities are present to “respond effectively if deterrence were to fail”, as means to re-establishing deterrence. The Russian Federation’s 2014 Military Doctrine similarly notes that its right to use nuclear weapons is reserved “in response to the use of nuclear and other types of weapons of mass destruction against it/or its allies, as well as in the event of aggression against the Russian Federation with the use of conventional weapons when the very existence of the state is in jeopardy”.¹⁰

Expansive notions of deterrence can increase the range of situations that fulfil established conditions for doctrinal use. For instance, the US Nuclear Posture Review specifies the deterrent role of nuclear weapons against “significant non-nuclear strategic attacks”.¹¹ While it does not define these attacks, the document earlier identifies non-nuclear strategic *threats* as “including chemical, biological, cyber, and large-scale conventional aggression”.¹² The Russian Federation’s Military Doctrine extends the role of nuclear weapons beyond traditional deterrent situations, specifying its applicability for preventing outbreak of regional war.¹³ Pakistan’s National Command Authority has outlined its pursuit of full-spectrum deterrence.¹⁴ Such language contains a degree of purposeful ambiguity, expanding the spectrum of circumstance for use. This is especially true as the self-restraints imposed on nuclear

⁷ In a 2003 press release, India specified it also retained the nuclear option “in the event of a major attack against India, or Indian forces anywhere, by biological or chemical weapons”. See Ministry of External Affairs, “The Cabinet Committee on Security Reviews Operationalization of India’s Nuclear Doctrine”, 4 January 2003, https://mea.gov.in/press-releases.htm?dtl/20131/The_Cabinet_Committee_on_Security_Reviews_perationalization_of_Indias_Nuclear_Doctrine.

⁸ However, scholars have expressed some degree of scepticism both about the nature of their commitments and the continued viability of those policies under changing security circumstances; see K. Sundaram, “India and the Policy of No First Use of Nuclear Weapons”, *Journal for Peace and Nuclear Disarmament*, vol. 1, no. 1, 2018; Z. Pan, “A Study of China’s No-First-Use Policy on Nuclear Weapons”, *Journal for Peace and Nuclear Disarmament*, vol. 1, no. 1, 2018.

⁹ US Department of Defense, *Nuclear Posture Review 2018*, February 2018, p. II, <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF>.

¹⁰ The Military Doctrine of the Russian Federation, no. Pr.-2976, 25 December 2014, <https://rusemb.org.uk/press/2029>.

¹¹ US Department of Defense, *Nuclear Posture Review 2018*, February 2018, p. 58, <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF>.

¹² Ibid, p. 38. This is in contrast to the 2010 US Nuclear Posture Review, which specified that the role of nuclear weapons “to deter and respond to non-nuclear attacks—conventional, biological, or chemical—has declined significantly”. US Department of Defense, *Nuclear Posture Review Report*, April 2010, p. 15, https://dod.defense.gov/Portals/1/features/defenseReviews/NPR/2010_Nuclear_Posture_Review_Report.pdf.

¹³ The Military Doctrine of the Russian Federation, no. Pr.-2976, 25 December 2014, <https://rusemb.org.uk/press/2029>.

¹⁴ Inter-Services Public Relations, “Press Release: No PR-64/206-ISPR”, 24 February 2016, <https://www.ispr.gov.pk/press-release-detail.php?id=3211>.

use remain modest.¹⁵ Individual decision makers are the arbiters of what constitutes deterrence failure, or when nuclear weapons might be necessary “for our survival” in response to the crossing of national spatial, military, economic, and political thresholds.¹⁶ These decision makers could perceive a non-nuclear attack as threatening their survival, invoking the “extreme circumstances of self-defence”—and engaging in retaliation.¹⁷ Further, the anticipation of such attacks could suffice in fulfilling those conditions as well.¹⁸ Consequently, how States perceive intentions, policies, plans, and actions can set in motion a pathway to doctrinal use. The role of subjective interpretation is concerning in a multipolar world marked by “increasingly competitive dynamics within the web of interlocking deterrence dyads”, let alone triads and beyond.¹⁹

ESCALATORY USE

Escalatory risk refers to the introduction of nuclear weapons in an ongoing tension or conflict. The category is wide-ranging, and includes use in a strategic context, on the battlefield, in crisis, and in an offensive manner. Escalatory scenarios are often invoked in South Asia today, in light of the long history and simmering conflict between nuclear-armed neighbours India and Pakistan. For instance, a February 2019 attack by a Pakistani-based militant group in Kashmir escalated to an Indian incursion of Pakistani airspace and a tense standoff over a captured Indian air force pilot. Some have argued that such confrontations will persist due to asymmetries in conventional and nuclear capabilities, which has led Pakistan to “posturing bordering on

¹⁵ The five nuclear-weapon States recognized by the Nuclear Non-Proliferation Treaty (NPT) do provide limited negative assurances against the use or threat of use against non-nuclear-weapon States, including in Security Council resolution 984 (11 April 1995) and in the context of nuclear-weapon-free zone (NWFZs) treaties. See “Mapping Negative Security Assurances: Background Paper for Subsidiary Group 4 of the Conference on Disarmament”, UNIDIR, 12 June 2018, <http://www.unidir.ch/files/medias/pdfs/background-paper-to-inform-cd-subsiary-body-4-discussion-eng-0-780.pdf>.

¹⁶ Pakistan Defense Minister Khawaja Asif, as quoted in Z. Keck, “Pakistan Says It’s Ready to Use Nuclear Weapons—Should India Worry?”, *The National Interest*, 3 November 2017, <https://nationalinterest.org/blog/the-buzz/pakistan-says-its-ready-use-nuclear-weapons%E2%80%94should-india-23034>.

¹⁷ “Self-defence” is specified by both France and the United Kingdom; see French Ministry of the Armed Forces, *Deterrence*, 1 November 2017, <https://www.defense.gouv.fr/english/dgris/defence-policy/deterrence/deterrence>; UK Government, *National Security Strategy and Strategic Defence and Security Review 2015: A Secure and Prosperous United Kingdom*, November 2015, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/555607/2015_Strategic_Defence_and_Security_Review.pdf.

¹⁸ The Democratic People’s Republic of Korea for instance claims its nuclear weapons serve the “purpose of deterring and repelling the aggression and attack of the enemy against the DPRK and dealing deadly retaliatory blows at the strongholds of aggression”; Korean Central News Agency, “Law on Consolidating Position of Nuclear Weapons States Adopted”, 1 April 2013, <http://www.kcna.co.jp/item/2013/201304/news01/20130401-25ee.html>.

¹⁹ J.M. Acton, “Technology, Doctrine, and the Risk of Nuclear War”, in N. Tannenwald, J. Acton and J. Vaynman (eds), *Meeting the Challenges of the New Nuclear Age: Emerging Risks and Declining Norms in the Age of Technological Innovation and Changing Nuclear Doctrines*, American Academy of Arts and Sciences, 2018, p. 34, <https://www.amacad.org/publication/emerging-risks-declining-norms>.

brinksmanship”.²⁰ Former Pakistani Director General of the Strategic Plans Division Khalid Kidwai once described the State’s nuclear forces as “integrated as a backup force” and an extension of its conventional capabilities.²¹

Yet evolving military strategies suggest that the possibility of nuclear weapons use in escalation-related purposes has not been definitively excluded elsewhere. In 2003, the Russian Federation’s Ministry of Defence reportedly elaborated a concept of de-escalation through limited nuclear strikes.²² Meanwhile, the 2018 US Nuclear Posture Review emphasizes the value of a flexible deterrent with low-yield options, and seeks “additional diversity in platforms, range, and survivability”—including against situations of “regional aggression” (though it was also clear to specify this will not enable “nuclear war-fighting”).²³ In that vein, some observe that the Russian Federation and China are developing nuclear-capable forces that could be used in regional conflicts with the United States involving the Baltics or Taiwan respectively.²⁴ The general notion of conventional conflict rising to the level of nuclear use has taken new dimension as the line between conventional and nuclear weapons—and their delivery systems—blurs.²⁵ Indeed, there appears a “growing reliance on nuclear weapons in limited scenarios below the strategic level”.²⁶ Modernization programmes that are enhancing the capabilities and effectiveness of nuclear weapons exacerbate the issue.

The potential for escalatory nuclear use in crisis, meanwhile, became abundantly clear during the 1962 Cuban Missile Crisis. The US Navy’s tactic of signalling Soviet submarines to surface through its detonation of depth charges and hand grenades was not well understood and at times interpreted as hostile. In one instance, the manoeuvre prompted a Soviet submarine captain to direct an officer to assemble the nuclear torpedo onboard to battle readiness.²⁷ By some accounts, the captain was unable to establish contact with the General Staff, and made the decision not to launch the torpedo only following consultation with his officers—including the brigade chief

²⁰ M. Sethi, “Pakistan’s Nuclear Posturing and India’s Nuclear Doctrine”, *Scholar Warrior*, 2016, p. 69; see also E.B. Montgomery and E.S. Edelman, “Rethinking Stability in South Asia: India, Pakistan, and the Competition for Escalation Dominance”, *Journal of Strategic Studies*, vol. 38, no. 1–2, 2015.

²¹ “A Conversation with Gen. Khalid Kidwai” (transcript from the Carnegie Nuclear Policy Conference, 23 March 2015), Carnegie Endowment for International Peace, <http://carnegieendowment.org/files/03-230315carnegieKIDWAI.pdf>.

²² Discussed further in K. Zysk, “Nonstrategic Nuclear Weapons in Russia’s Evolving Military Doctrine”, *Bulletin of the Atomic Scientists*, vol. 73, no. 5, 2017.

²³ US Department of Defense, *Nuclear Posture Review 2018*, February 2018, pp. xii and 54, <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF>.

²⁴ E. Colby, “If You Want Peace, Prepare for Nuclear War”, *Foreign Affairs*, November/December 2018, <https://www.foreignaffairs.com/articles/china/2018-10-15/if-you-want-peace-prepare-nuclear-war>.

²⁵ P. Podvig, “Blurring the Line between Nuclear and Nonnuclear Weapons: Increasing the Risk of Accidental Nuclear War?”, *Bulletin of the Atomic Scientists*, vol. 72, no. 3, 2016, pp. 145–149.

²⁶ H.M. Kristensen, “The Quest for More Useable Nuclear Weapons”, in J. Borrie, T. Caughley, and W. Wan (eds), *Understanding Nuclear Weapon Risks*, UNIDIR, 2017, p. 44, <http://www.unidir.org/files/publications/pdfs/understanding-nuclear-weapon-risks-en-676.pdf>.

²⁷ S.V. Savranskaya, “New Sources on the Role of Soviet Submarines in the Cuban Missile Crisis”, *Journal of Strategic Studies*, vol. 28, no. 2, 2005.

of staff on board serving as second captain.²⁸ There is some dispute as to whether a decision to launch required an order from Moscow (if so, this use would have fallen into the ‘unauthorized use’ category). Still, as one study subsequently noted, the situation came “too close for comfort”.²⁹ The potential for escalatory use here would have been a product of misunderstanding as well as miscalculation, as the Americans were unaware of nuclear torpedoes onboard those Soviet submarines.

Another pathway to escalatory use stems from attacks that undermine the deterrent capability of nuclear-armed States. For instance, space-based assets long critical to the functioning of nuclear operations (including reconnaissance and communication satellites and early-warning sensors) exist in an environment that is growing ever more busy and complex.³⁰ The development of anti-satellite capabilities and even the presence of space debris can render second-strike capabilities vulnerable; an incidental strike on these assets can drive escalation to nuclear use.³¹ Meanwhile, reliance on space assets that serve dual-use purposes—nuclear and non-nuclear—can contribute to the possibility of escalation through entanglement, with attacks targeting non-nuclear capabilities potentially misinterpreted.³² Advances in non-nuclear capabilities such as hypersonic weapons can have similarly destabilizing effects. In the case of a hypersonic glide vehicle “it may not be known until the very last moment whether it is targeting conventional forces and facilities or nuclear forces”, or whether it may be carrying a conventional or nuclear warhead.³³ These systems and other nuclear-related capabilities present new escalatory chains to use.

UNAUTHORIZED USE

The risk of nuclear use not sanctioned by a State appears as a distinct possibility in times of crisis, when lines of authority “could blur and an aggressive junior commander could act precipitously”—a scenario raised above with the example cited of the Soviet submarine captain during the Cuban Missile Crisis.³⁴ The unauthorized use scenario

²⁸ Ibid. See also B. Tertrais, “On the Brink—Really? Revisiting Nuclear Close Calls Since 1945”, *The Washington Quarterly*, vol. 40, no. 2, 2017, pp. 51–66; W. Burr and T.S. Blanton, “The Submarines of October—U.S. and Soviet Naval Encounters During the Cuban Missile Crisis”, National Security Archive Electronic Briefing Book, no. 75, 31 October 2002, <https://nsarchive2.gwu.edu/NSAEBB/NSAEBB75/>.

²⁹ P. Lewis, H. Williams, B. Pelopidas, and S. Aghlani, *Too Close for Comfort: Cases of Near Nuclear Use and Options for Policy*, Chatham House, 2014.

³⁰ A. Atorino-Courtois, *Space and U.S. Deterrence: A Virtual ThinkTank (ViTTa) Report*, NSI Team, December 2017, http://nsiteam.com/social/wp-content/uploads/2018/01/NSI_Space_ViTTa_Q14_Space-and-US-Deterrence_FINAL.pdf

³¹ J. Rodgers, *Space Security and Strategic Stability*, UNIDIR, 2018, <http://unidir.ch/files/publications/pdfs/space-security-and-strategic-stability-en-697.pdf>

³² J.M. Acton, “Escalation through Entanglement: How the Vulnerability of Command-and-Control Systems Raises the Risks of an Inadvertent Nuclear War”, *International Security*, vol. 43, no. 1, 2018.

³³ J. Borrie, A. Dowler, and P. Podvig, *Hypersonic Weapons: A Challenge and Opportunity for Strategic Arms Control*, UNODA/UNIDIR, 2019, p. 20, <http://www.unidir.ch/files/publications/pdfs/hypersonic-weapons-a-challenge-and-opportunity-for-strategic-arms-control-en-744.pdf>.

³⁴ P.D. Feaver, “Command and Control in Emerging Nuclear Nations”, *International Security*, vol. 17, no. 3, 1992–1993, p. 167.

emerged expressly in the Soviet Union during the August 1991 coup, in which eight members of the Soviet government declared a state of emergency and briefly seized control from Mikhail Gorbachev. This 72-hour period also included the loss of civilian control over the Soviet nuclear arsenal, as communication links were broken between the Soviet President (then also General Secretary) and the outside world—including members of his nuclear watch detail (the nuclear briefcase itself was allegedly disabled by loyal military officials).³⁵ Notably there were two other briefcases—in the hands of the Minister of Defence and the Chief of General Staff—which were reportedly deactivated upon the disappearance of the first. While human judgment and technical safeguards helped to prevent seizure of the command and control of the Soviet Union's strategic nuclear weapons in this instance, it illustrates that even in the most carefully controlled decision-making environments, there are chains of events that could lead to access and control over nuclear weapons by non-State actors and groups. A retired colonel in the Soviet Strategic Rocket Forces later claimed that Soviet tactical or battlefield nuclear weapons had even fewer safeguards against misuse than strategic nuclear weapons.³⁶ And even outside the context of a coup, issues of personnel reliability—especially in the context of pre-delegated launch authority—raise the spectre of unauthorized use today.³⁷

Discussions of unauthorized nuclear use in the twenty-first century to date have coalesced around non-State armed groups, primarily those with political or religious motivations.³⁸ The risk of non-State use, either of an existing warhead or a crude device constructed from weapons-usable materials, emerged in the public consciousness first following the events of 11 September 2001, when it was revealed that Al-Qaida had sought to acquire or develop nuclear weapons for nearly a decade; US officials voiced concerns internally as early as 1998.³⁹ Today, groups continue to harbour ambitions in the area of chemical, biological, radiological, and nuclear weapons. The Islamic State in Iraq and the Levant, for instance, in 2015 referred to the possibility of buying a nuclear weapon; that same year it also acquired approximately 40 kg of low-enriched uranium from scientific institutions in Iraq.⁴⁰ This is far from

³⁵ M. Tsypkin, "Adventures of the 'Nuclear Briefcase': A Russian Document Analysis", *Strategic Insights*, vol. 3, no. 9, 2004.

³⁶ R. Jeffrey Smith, "'Nuclear Suitcase' Disabled During Coup, Hill Told", *Washington Post*, 25 September 1991, <https://www.washingtonpost.com/archive/politics/1991/09/25/nuclear-suitcase-disabled-during-coup-hill-told/a5d5b155-ddec-41eb-bb2e-0f6d74821a74>.

³⁷ The United Kingdom and the Russian Federation have known pre-delegation procedures, though under strict conditions; see J.G. Lewis and B. Tertrais, *The Finger on the Button: The Authority to Use Nuclear Weapons in Nuclear-Armed States*, CNS Occasional Paper no. 45, February 2019, <https://www.nonproliferation.org/wp-content/uploads/2019/02/Finger-on-the-Nuclear-Button.pdf>.

³⁸ C.D. Ferguson and W.C. Potter, *The Four Faces of Nuclear Terrorism*, 2005.

³⁹ National Commission on Terrorist Attacks Upon the United States, "The 9/11 Commission Report: Final Report of the National Commission on Terrorist Attacks upon the United States", 2004, p. 180, <http://govinfo.library.unt.edu/911/report/911Report.pdf>.

⁴⁰ H. Saul, "Isis Claims it Could Buy its First Nuclear Weapon from Pakistan within a Year", *The Independent*, 23 May 2015, <https://www.independent.co.uk/news/world/middle-east/isis-claims-it-could-buy-its-first-nuclear-weapon-from-pakistan-within-12-months-10270525.html>; W. Rudischhauser,

acquisition of warheads or highly enriched uranium or plutonium, and indeed experts identify a dirty bomb based on radiological materials as the more plausible scenario.⁴¹ Still, the group's experience in the chemical field—with the development and use of sulfur mustard in Iraq and the Syrian Arab Republic—offers an ominous case study underlining its intent and likely willingness to use nuclear weapons if it acquired them.⁴² And despite territorial setbacks, its financial capabilities mean that nuclear acquisition cannot be ruled out.⁴³

Overall, while the non-State scenario likely entails a complex process of acquisition or development of weapons or weapons-usable materials, it cannot be discounted. Demand exists, and supply may too. Events in the early 2000s drew attention to the existence, reach, and complexity of the international nuclear black market.⁴⁴ While the consequences of this nuclear black market have so far been limited to incidents involving State clients, the illicit procurement of knowledge and technologies can provide an avenue of access for non-State actors as well.⁴⁵ Long after the 2004 arrest of Pakistani nuclear scientist Abdul Qadeer Khan, who admitted selling technology and equipment over decades to Libya, The Democratic People's Republic of Korea, and the Islamic Republic of Iran, "policymakers and intelligence agencies simply do not know the full extent of his ring" or how much nuclear weapons knowledge remains unaccounted for.⁴⁶ And despite multilateral initiatives to improve the control and security of nuclear arsenals and stocks, risk remains on that front. The Nuclear Threat Initiative continues to sound the alarm about the opacity of materials safety and security in the Islamic Republic of Iran, Israel, Pakistan, and especially the Democratic People's Republic of Korea. This is compounded by their security environments, with "political instability, ineffective governance, pervasiveness of corruption, and the presence and capabilities of terrorist groups" adding to the risk of theft or sabotage.⁴⁷ Such conditions even suggest the possibility of poorly guarded, or loose nuclear

"Could ISIL Go Nuclear?", *NATO Review Magazine*, 2015, <https://www.nato.int/docu/review/2015/ISIL/ISIL-Nuclear-Chemical-Threat-Iraq-Syria/EN/index.htm>.

⁴¹ M. Bunn, M. Malin, N. Roth and W. Tobey, *Preventing Nuclear Terrorism: Continuous Improvement or Dangerous Decline?*, Project on Managing the Atom, Harvard Kennedy School and Belfer Center for Science and International Affairs, 2016, <https://www.belfercenter.org/sites/default/files/legacy/files/PreventingNuclearTerrorism-Web.pdf>.

⁴² See for example Third Report of the Organization for the Prohibition of Chemical Weapons–United Nations Joint Investigative Mechanism, UN document S/2016/738.

⁴³ S. Hummel, "The Islamic State and WMD: Assessing the Future Threat", *CTC Sentinel*, vol. 9, no. 1, 2016.

⁴⁴ Including the US interception of a 2002 Scud missile shipment from the Democratic People's Republic of Korea to Yemen.

⁴⁵ C. Braun and C.F. Chyba, "Proliferation Rings: New Challenges to the Nuclear Nonproliferation Regime", *International Security*, vol. 29, no. 2, 2004.

⁴⁶ C. Collins and D. Frantz, "The Long Shadow of A.Q. Khan: How One Scientist Helped the World Go Nuclear", *Foreign Affairs*, 31 January 2018, <https://www.foreignaffairs.com/articles/north-korea/2018-01-31/long-shadow-aq-khan>.

⁴⁷ E.D. Dumbacher and P. Southland, "NTI Nuclear Security Index: Building a Framework for Assurance, Accountability, and Action: Fourth Edition", *Nuclear Threat Initiative*, September 2018, https://ntiindex.org/wp-content/uploads/2018/08/NTI_2018-Index_FINAL.pdf.

weapons—once discussed in the context of former Soviet satellites, now a “serious and growing risk ... in India and Pakistan”.⁴⁸

ACCIDENTAL USE

The known history of nuclear weapons programmes contains incidents of false alarms, accidents, and near misses attributed to technical malfunctions, human fallibility, and even natural events. None have yet resulted in a detonation event, although in a few documented instances the possibility of such was prevented only by individual judgment under high pressure and uncertainty. The need for such ‘human safeguards’—while comforting on some level—illustrates use scenarios linked to error. Perhaps the most prominent close call is the infamous 1983 incident in which the Soviet Union early-warning system generated ‘high reliability’ signals to its command system that a US intercontinental ballistic missile had been launched—and within seconds, identified four more as part of the attack.⁴⁹ Without the time to conduct a systems check, Lieutenant-Colonel Stanislav Petrov acted on gut instinct and reported the alert as a false alarm. It was discovered later that the false alarm had been caused by the sun’s reflection off high-altitude clouds, which confused a Soviet early warning satellite’s sensors. Petrov’s decision prevented a situation in which Soviet leadership would have to decide in minutes on what they might have mistakenly perceived to be a second-strike response.

Erroneous warnings on the US side have also led to alert actions that, fortunately, fell shy of nuclear use.⁵⁰ In 1979, a simulation of a Soviet missile attack was transferred into the regular warning system at the North American Air Defense Command (NORAD). The ‘launch’ was reported to National Security Adviser Zbigniew Brezezinski but was revealed to be a false alarm before he called the President.⁵¹ Beyond false alarms, declassified ‘broken arrow’ incidents involving nuclear weapons have included missile explosions, aircraft collisions, and even the release of nuclear weapons—without nuclear detonation. The fact that these types of occurrences—captured in works like Eric Schlosser’s *Command and Control*—have taken place in the United States, whose nuclear weapons are “among the safest, most advanced, most secure against unauthorized use that have ever been built”, strongly indicates they happen in other nuclear-armed States.⁵² Fundamentally, this risk is a product of the complex interactions and tightly coupled systems that govern nuclear weapons systems and other advanced technologies. Response systems are of particular concern, as “missiles

⁴⁸ G. Allison, “Nuclear Terrorism: Did We Beat the Odds or Change Them?”, *Prism*, vol. 7, no. 3, 2018, p. 19.

⁴⁹ D.E. Hoffman, *The Dead Hand: The Untold Story of the Cold War Arms Race and Its Dangerous Legacy*, Doubleday, 2009.

⁵⁰ S.D. Sagan, *The Limits of Safety: Organizations, Accidents, and Nuclear Weapons*, 1993.

⁵¹ “The 3 A.M. Phone Call”, The National Security Archive Electronic Briefing Book, no. 371, George Washington University, 1 March 2012, <https://nsarchive2.gwu.edu/nukevault/ebb371/>.

⁵² E. Schlosser, *Command and Control*, 2013, p. 481.

cannot be recalled; submarine commanders may be out of touch but able to act on their own; missiles may go off accidentally”.⁵³

The potential for accidental use of nuclear weapons has taken on new dimension in the contemporary landscape. Indeed, physical access to nuclear weapons or materials may no longer be necessary to cause a detonation event. The lack of knowledge regarding the vulnerability to cyberattack of existing nuclear weapons systems adds further cause for concern. It is possible, for instance, that cyberattack methods including “data manipulation, digital jamming and cyber spoofing could jeopardize the integrity of communication”.⁵⁴ Manipulation of the data provided by early-warning systems and command, control, and communications (C3), including space assets, can drive doctrinal and escalatory use scenarios based on false premises.⁵⁵ There also exists the possibility that rogue actors could manipulate the flow of information with an eye towards a nuclear attack by proxy; in fact a fake news story in 2016 contributed to online nuclear threats between Pakistan and Israel.⁵⁶ While there are no outward signs that this impacted on the decision-making of either State, the scenario puts a contemporary spin on the Cold War concept of ‘catalytic nuclear war’, in which third party actions induce a nuclear war between the two superpowers.

INTERACTIVE EFFECTS

The categories identified above do not constitute mutually exclusive risk scenarios. Rather, the underlying conditions that can facilitate these scenarios could permit them to feed into one another. Ambiguities associated with doctrines can contribute to confusion that pushes decision makers to rationalize the escalatory use of nuclear weapons. For instance, the aforementioned Russian mention of limited nuclear strikes led many in the West to ascribe it a doctrine of “escalate to de-escalate”.⁵⁷ Even as Moscow has steadily denied any interest in such a first-strike posture, perceptions of its lower nuclear threshold can have a psychological effect; for instance, its large-scale military exercises and strike simulations may appear more immediately threatening to others.⁵⁸ Meanwhile, just as the opacity surrounding nuclear safety and security raises

⁵³ C. Perrow, *Normal Accidents: Living with High-Risk Technologies*, 1999, p. 292.

⁵⁴ B. Unal and P. Lewis, *Cybersecurity of Nuclear Weapons Systems: Threats, Vulnerabilities and Consequences*, Chatham House, January 2018, p. 19, <https://www.chathamhouse.org/sites/default/files/publications/research/2018-01-11-cybersecurity-nuclear-weapons-unal-lewis-final.pdf>.

⁵⁵ P. Hayes, “Non-State Terrorism and Inadvertent Nuclear War”, Nautilus Institute for Security and Sustainability Special Reports, 18 January 2018, <https://nautilus.org/napsnet/napsnet-special-reports/non-state-terrorism-and-inadvertent-nuclear-war/>.

⁵⁶ R. Goldman, “Reading Fake News, Pakistani Minister Directs Nuclear Threat at Israel”, *New York Times*, 24 December 2016, <https://www.nytimes.com/2016/12/24/world/asia/pakistan-israel-khawaja-asif-fake-news-nuclear.html>.

⁵⁷ For instance, see M.B. Schneider, “Escalate to De-escalate”, *Proceedings*, US Naval Institute, vol. 143/2/1368, February 2017; M. Kroenig, “The Case for Tactical U.S. Nukes”, *Wall Street Journal*, 24 January 2018.

⁵⁸ B. Tertrais, “Russia’s Nuclear Policy: Worrying for the Wrong Reasons”, *Survival*, vol. 60, no. 2, 2018.

concerns about non-State acquisition and unauthorized use, it could factor in accidental detonations as well. After all, the limited number of persons and institutions linked to domestic stockpile management can present a barrier to creating independent oversight; the known history of the US stockpile reflects the “difficulty of maintaining an adequate level of safety through exclusive reliance on internal command and control”.⁵⁹

Crisis conditions arguably may have the most consequential cross-cutting impact. Much can happen in a situation of heightened tension with a measure of unpredictability, and in which the decision-making process is considerably shortened.⁶⁰ The 13 days of the Cuban Missile Crisis that followed the US discovery of deployed Soviet ballistic missiles in Cuba illustrates the long shadow cast by such circumstances. Decision makers can feel pressure to act forcefully, as US President John F. Kennedy did in pledging a “full retaliatory response” against the Soviet Union should Cuba launch a nuclear missile against any country in the Western hemisphere—expanding the possibility for doctrinal use.⁶¹ The heightened alert status can increase the interactive complexity and tight coupling of relevant warning and response systems; indeed “numerous failure modes were not anticipated and never fixed” during this period—reflecting increased risk of accidental use.⁶² The effects of technical and human errors can be compounded as well, as in the cited submarine encounter in which both sides acted under a cloud of uncertainty—nearly leading to escalatory use. Lingering questions as to whether a nuclear response by the submarine commander would have constituted unauthorized use further reflects the complexity of crisis, as “rules of engagement and delegations of authority can change in ways that may be inadequately understood by central authorities”.⁶³

Ultimately, it is not uncommon for the underlying risk conditions to have wide-ranging effects. At times, the line between the different use scenarios discussed can be quite blurry. Some doctrines refer—implicitly or explicitly—to escalatory scenarios, attaching a deliberative element to the latter (of course, intentional escalation unrelated to declaratory policy remains a distinct possibility). Meanwhile, accidental use can be thought of as inherently unauthorized. Again, this categorization is not hard and fast.

⁵⁹ R. Lahidji, “The Safety of Nuclear Weapons and Materials: Lessons from the Assessment of Nuclear Power Plant Risks”, in J. Borrie, T. Caughley, and W. Wan (eds), *Understanding Nuclear Weapon Risks*, UNIDIR, 2017, <http://www.unidir.org/files/publications/pdfs/understanding-nuclear-weapon-risks-en-676.pdf>.

⁶⁰ “A crisis is a situation that threatens high-priority goals of the decision-making unit, restricts the amount of time available for response before the decision is transformed and surprises the members of the decision-making unit by its occurrence”, C. F. Hermann (ed.), *International Crises: Insights from Behavioral Research*, 1972, p. 13.

⁶¹ J.F. Kennedy, “Address during the Cuban Missile Crisis”, 22 October 1962, <https://www.jfklibrary.org/learn/about-jfk/historic-speeches/address-during-the-cuban-missile-crisis>.

⁶² S.D. Sagan, *The Limits of Safety: Organizations, Accidents, and Nuclear Weapons*, 1993, p. 153.

⁶³ S.D. Sagan, “Nuclear Alerts and Crisis Management”, *International Security*, vol. 9, no. 4, 1985, p. 133.

In the abstract however, it provides a means to filter the risk reduction measures that can tangibly address each.

ADDRESSING USE SCENARIOS

Debating the means by which to achieve nuclear disarmament lies beyond the scope of this paper, as does consideration of steps to try to address the consequences of nuclear weapon use.⁶⁴ Rather it considers pathways to nuclear use and measures that could narrow or obstruct these. This *does* include select proposals considered in arms control and disarmament contexts, as those targeting specific classes of weapons could impact those pathways. There also exist encompassing approaches to risk reduction that focus on awareness, dialogue, and general political commitments, including the 64-point Action Plan agreed upon at the 2010 Review Conference of the Nuclear Non-Proliferation Treaty (NPT) and more recently the dialogue on doctrine among the five NPT-recognized nuclear-weapon States (China, France, the Russian Federation, the United Kingdom, and the United States).⁶⁵ These too warrant further discussion.

This section primarily considers risk reduction in the context of the four pathways introduced earlier. It outlines for each an approach to address the conditions under which nuclear weapons may be used, identifying principles and objectives that should inform policy. It then catalogues for each a spectrum of ideas that reflect these principles and objectives, which include ideas and proposals drawn from disparate sources across the academic, research, and policymaking communities. Some have attracted more controversy than others, though all provide legitimate areas of discussion. Beyond briefly sketching them, this paper does not analyse the individual pros and cons of these ideas, nor does it discuss the complexities and unintended consequences linked to their implementation. Doing so requires systematic consideration of the contexts and regions in which such measures—and others—may be deployed.

⁶⁴ For discussion of consequences, see J. Borrie and T. Caughley, *An Illusion of Safety: Challenges of Nuclear Weapon Detonations for United Nations Humanitarian Coordination and Response*, UNIDIR, 2014, <http://www.unidir.org/files/publications/pdfs/an-illusion-of-safety-en-6111.pdf>.

⁶⁵ L.A. Dunn, "The Strategic Elimination of Nuclear Weapons: An Alternative Global Agenda for Nuclear Disarmament", *The Nonproliferation Review*, vol. 24, no. 5–6, 2017; R. Einhorn and W.P.S. Sidhu, "The Strategic Chain: Linking Pakistan, India, China, and the United States", *Arms Control and Non-Proliferation Series Paper 14*, Brookings, March 2017, https://www.brookings.edu/wp-content/uploads/2017/03/acnpi_201703_strategic_chain.pdf; Group of Eminent Persons for Substantive Advancement of Nuclear Disarmament, *Recommendations for the 2020 Review Process for the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)*, March 2019, <https://www.mofa.go.jp/files/000403715.pdf>.

REDUCING DOCTRINAL RISK

As discussed, the risk of doctrinal nuclear use is linked to the declaratory policies of States as well as the purposeful ambiguity inherent in those policies. There are several means of approaching this pathway to use, beginning with a) stigmatizing overall use. Deterrence theory continues to underpin national security policies of many nuclear-armed and nuclear-allied States, with the implication that there exist “circumstances so extreme that they would remove all inhibitions on nuclear use”.⁶⁶ Strengthening the non-use taboo helps contain the spectrum of extreme circumstances. Relatedly, a second component of the approach entails b) circumscribing the conditions under which States contemplate nuclear retaliation. This effectively shrinks that universe of cases. A third centres on c) clarifying doctrine, or reducing ambiguity surrounding those conditions. Domestically, this diminishes the flexibility that individual decision makers have in deciding when using nuclear weapons might be ‘appropriate’. Internationally, clearly defined thresholds for nuclear retaliation can create ‘red lines’ that reduce the possibility of brinksmanship (especially inadvertent brinksmanship) and in so doing help to prevent the crossing of those thresholds.

Figure 2.2. Reducing Doctrinal Risk: Objectives and Sample Ideas

Stigmatize Use	Circumscribe Use Conditions	Clarify Doctrine
<ul style="list-style-type: none">• Political statements to renounce use• Prohibition on use or threat of use• 'No first use' policies	<ul style="list-style-type: none">• 'Sole purpose' or 'last resort' policies• Narrow 'extreme circumstances'• Limit deterrence scope (e.g. not against cyberattack)	<ul style="list-style-type: none">• Exchange on nuclear policies• Establish parameters on threshold for use• Defence and military engagement

STIGMATIZE USE

A number of proposed measures seek to dissuade use even in the face of extreme circumstances. In 1985, US President Ronald Reagan and his Soviet counterpart Mikhail Gorbachev issued a joint statement that a “nuclear war cannot be won and must never be fought”.⁶⁷ Some, including United Nations Secretary-General António Guterres, have suggested the value of the United States and the Russian Federation as well as

⁶⁶ L. Freedman, “Disarmament and Other Nuclear Norms”, *The Washington Quarterly*, vol. 36, no. 2, 2013, p. 97.

⁶⁷ Joint Soviet–United States Statement on the Summit Meeting in Geneva, 21 November 1985, <https://www.reaganlibrary.gov/research/speeches/112185a>.

other nuclear-armed States reaffirming the statement.⁶⁸ This—and other activities that strengthen the normative barriers against use—essentially seeks to remove doctrinal use as a legitimate option. Others espouse the need to tone down rhetoric on nuclear use in general. Other measures to disincentivize States from use could include an agreement or convention to prohibit use or threat of use. Among the provisions of the 2017 Treaty on the Prohibition of Nuclear Weapons is an explicit ban on States to “use or threaten to use” nuclear weapons or other nuclear explosive devices.⁶⁹ Proposals centring on first use seek to lessen the specific possibility that retaliation comes into play: these can take the form of universal policies (as declared by China and India), bilateral or multilateral agreements, and extended negative security assurances (for example, in the context of nuclear-weapon free zones, or by removing caveats regarding non-compliant NPT members).

CIRCUMSCRIBE USE CONDITIONS

As mentioned, the 2018 Nuclear Posture Review specified the continuing deterrent role of nuclear weapons in responding to non-nuclear strategic attacks in US policy.⁷⁰ While that document lists example targets of such attacks, the lack of clear definition of ‘strategic attacks’ itself has led some to conclude that cyberattacks on those elements may suffice for a nuclear response—thus widening the scope for doctrinal use.⁷¹ Limiting that scope would have the converse effect. For instance, NATO shrunk the role of nuclear weapons in its posture in 1990 when it identified its nuclear forces as “weapons of last resort” in the post-Cold War era.⁷² In their national postures, States could exclude consideration of nuclear response to cyberattacks, specify as instigating events only WMD or nuclear attacks (for example, by affirming that the ‘sole purpose’ of nuclear forces is to deter nuclear attack), or more narrowly define what constitutes

⁶⁸ *Securing our Common Future: An Agenda for Disarmament*, Office for Disarmament Affairs, 2018, <https://s3.amazonaws.com/unoda-web/wp-content/uploads/2018/06/sg-disarmament-agenda-pubs-page.pdf>; R. Berls Jr. and L. Ratz, “Rising Nuclear Dangers: Steps to Reduce Risks in the Euro-Atlantic Region”, *NTI Paper*, Nuclear Threat Initiative, December 2016, https://media.nti.org/documents/NTI_Rising_Nuclear_Dangers_Paper_FINAL_12-5-16.pdf; J. Borrie, *Resuming Dialogue on Moving Nuclear Disarmament Forward: An Immediate Challenge*, UNIDIR, 2018, <http://www.unidir.ch/files/publications/pdfs/resuming-dialogue-on-moving-nuclear-disarmament-forward-an-immediate-challenge-en-704.pdf>.

⁶⁹ Treaty on the Prohibition of Nuclear Weapons, 2017, article I.

⁷⁰ “Significant non-nuclear strategic attacks include, but are not limited to, attacks on the U.S., allied, or partner civilian population or infrastructure, and attacks on U.S. or allied nuclear forces, their command and control, or warning and attack assessment capabilities”; see US Department of Defense, *Nuclear Posture Review 2018*, February 2018, p. 21, <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF>.

⁷¹ *Ibid.*; D.E. Sanger and W.J. Broad, “Pentagon Suggests Countering Devastating Cyberattacks with Nuclear Arms”, *New York Times*, 16 January 2018, <https://www.nytimes.com/2018/01/16/us/politics/pentagon-nuclear-review-cyberattack-trump.html>.

⁷² Declaration on a Transformed North Atlantic Alliance, issued by the Heads of State and Government participating in the meeting of the North Atlantic Council, 5–6 July 1990, https://www.nato.int/cps/en/natohq/official_texts_23693.htm.

their extreme circumstances and vital interests. Such measures effectively take use off the table outside specified situations.

CLARIFY DOCTRINE

Clear declaratory policies such as the ones outlined above have the additional effect of reducing ambiguity. There may be general aversion to such actions. In some contexts, military planners in nuclear-armed and some nuclear-allied States see ambiguity as helpful if it contributes to the desired deterrent effect of nuclear weapons. For them, risk for an adversary stems from the outcome being determined by events and processes beyond the control and even comprehension of both sides.⁷³ Indeed, “deterrence often depends on relinquishing the initiative to the other side”, leaving the adversary to decide whether to act in a manner that pushes both sides to the brink.⁷⁴ This dependence on mutual restraint however can be problematic with a larger “number and diversity of players, for whom, in addition, deterrence could have different meanings”.⁷⁵ Restraint is also not necessarily assured in crisis situations. Certainly, States will determine the level of transparency of doctrine and posture they are willing to accept. But even small movements in this manner—for example, defence and military engagement—can serve to reduce risk by enhancing mutual understanding of doctrines.⁷⁶ Greater clarity can also help prevent misperceptions regarding capabilities and posturing behaviours.⁷⁷ In the process, it contributes to a clearer distinction between situations involving conventional conflict and those involving nuclear conflict. This final aspect is especially pertinent in the context of escalation, which is explored next.

REDUCING ESCALATORY RISK

There are several means to reducing the risk of escalation to nuclear weapon use, including a) increasing predictability around use conditions. This builds upon the notion of clarifying doctrine discussed above, while extending to other transparency- and engagement-driven measures that can reduce the likelihood of escalation through miscalculation or misperception. States can also move to b) strengthen nuclear restraint, raising the threshold for use (or at least not lowering it in response to crisis-related pressure). This restraint can have a secondary signalling effect that lowers risk

⁷³ T. Schelling, *The Strategy of Conflict*, 1960.

⁷⁴ T. Schelling, *Arms and Influence*, 1966, p. 45.

⁷⁵ T. Delpach, *Nuclear Deterrence in the 21st Century: Lessons from the Cold War for a New Era of Strategic Piracy*, RAND Corporation, 2012, p. 16.

⁷⁶ L.A. Dunn, *Reversing the Slide: Intensified Great Power Competition and the Breakdown of the Arms Control Endeavor*, UNIDIR, 2019, <http://www.unidir.ch/files/publications/pdfs/reversing-the-slide-en-755.pdf>.

⁷⁷ M. Downman and M. Messmer, *Re-emerging Nuclear Risks in Europe: Mistrust, Ambiguity, Escalation and Arms-racing between NATO and Russia*, BASIC, 2019.

of overall use.⁷⁸ Fundamentally, there is also a need for c) preventing crisis, thus minimizing situations in which use may be considered.

Figure 2.3. Reducing Escalatory Risk: Objectives and Sample Ideas

Increase Predictability	Strengthen Nuclear Restraint	Prevent Crisis
<ul style="list-style-type: none"> • Establishment of clearer declaratory policies • Nuclear code of conduct, with common lexicon • Information exchange on weapons systems 	<ul style="list-style-type: none"> • Reinforce gap between conventional and nuclear • Lower operational readiness of systems • Crisis communication channels and hotlines 	<ul style="list-style-type: none"> • Pre-notification and joint early warning centers • Limit provocative behaviours • Broader measures to assuage security concerns

INCREASE PREDICTABILITY

In the post-Cold War era, the nature of relations among nuclear-armed States has been characterized by some as lacking general clarity. With the United States and the Russian Federation, “common understanding of the rules of mutual nuclear deterrence, the limited utility of nuclear weapons, and strategic stability has evaporated”.⁷⁹ Others cite similar problems in US–Chinese relations.⁸⁰ This is even more so with the non-NPT nuclear-armed States, whose relations feature “deep distrust [and] lack of proper communication”.⁸¹ Accordingly, a host of risk reduction proposals target the lack of knowledge surrounding nuclear doctrines, postures, and intentions. Most direct is the establishment or further elaboration of declaratory policies. Some have proposed regularized bilateral or multilateral dialogue on the subject, pointing to the institutionalized discussion between the five NPT nuclear-weapon States over the past decade. Military-to-military engagement at multiple levels (from leadership to operations) could further contribute in providing “windows into military plans and

⁷⁸ J.E. Doyle, “On Integrated Conventional and Nuclear Planning”, *Arms Control Today*, vol. 47, no. 2, 2017.

⁷⁹ A. Arbatov, “Challenges of the New Nuclear Era: The Russian Perspective”, in L. Brooks, F. Gavin and Alexi Arbatov (eds), *Meeting the Challenges of the New Nuclear Age: U.S. and Russian Nuclear Concepts, Past and Present*, American Academy of Arts and Sciences, 2018, p. 45.

⁸⁰ L. Bin, “Differences Between Chinese and U.S. Nuclear Thinking and Their Origins”, in L. Bin and T. Zhao (eds), *Understanding Chinese Nuclear Thinking*, Carnegie Endowment for International Peace, 2016, https://carnegieendowment.org/files/ChineseNuclearThinking_Final.pdf.

⁸¹ T. Delpech, *Nuclear Deterrence in the 21st Century*, 2012, p. 16.

programmes”, lessening the possibility for misinterpretation.⁸² Others propose the establishment of a nuclear code of conduct, with emphasis on a common lexicon on forces and deterrence concepts.⁸³ Clarifying concepts in bilateral or multilateral settings—for example, an unelaborated mention by the Russian Federation of the potential use of precision-strike weapons “within the framework of strategic deterrence measures of a forceful nature”, as highlighted by analysts—may restore some of that common understanding.⁸⁴

A related set of ideas involves enhancing information exchange in and around nuclear weapons systems, for instance with select traits of systems and forces, numbers and types of warheads and delivery vehicles, and deployment or alert status. This would allow other parties to consider such disseminated data in light of stated doctrine, for instance to ensure that an arsenal serves a deterrent-only purpose. And even in the absence of clearer doctrines, a transparency regime on forces could set forth a de facto doctrine that clarifies use parameters. This in turn strengthens strategic analysis, increasing predictability and lessening the likelihood of misperception, including in the face of crisis—thus narrowing pathways to escalatory use.

STRENGTHEN NUCLEAR RESTRAINT

Other ideas to reduce escalatory risk involve voluntarily restricting capabilities. Reductions in, storage of, and the disassembly of particular types of nuclear weapons and delivery systems—those associated with battlefield use or those contributing to ambiguity—can limit their destabilizing effects.⁸⁵ Some have suggested arms control and disarmament measures for nuclear-capable cruise missiles and hypersonic missiles, as well as for short- and medium-range tactical missiles.⁸⁶ In their estimate, these delivery systems can contribute to confusion as to their nuclear or non-nuclear nature:

⁸² L.A. Dunn, *Reversing the Slide: Intensified Great Power Competition and the Breakdown of the Arms Control Endeavor*, UNIDIR, 2019, p. 5, <http://www.unidir.ch/files/publications/pdfs/reversing-the-slide-en-755.pdf>.

⁸³ L.A. Dunn, “The Strategic Elimination of Nuclear Weapons: An Alternative Global Agenda for Nuclear Disarmament”, *The Nonproliferation Review*, vol. 24, no. 5–6, 2017; J. Anderson, “Negotiating a Nuclear ‘Code of Conduct’”, *Next Generation Nuclear Network*, 17 January 2018, <https://nuclearnetwork.csis.org/negotiating-nuclear-code-conduct>.

⁸⁴ The Military Doctrine of the Russian Federation, no. Pr.-2976, 25 December 2014, <https://rusemb.org.uk/press/2029>. For analysis on this particular issue, see A.L. Fink, “The Evolving Russian Concept of Strategic Deterrence: Risks and Response”, *Arms Control Today*, July/August 2017, <https://www.armscontrol.org/act/2017-07/features/evolving-russian-concept-strategic-deterrence-risks-responses>.

⁸⁵ For instance, P. Podvig and J. Serrat, *Lock Them Up: Zero Deployed Non-Strategic Nuclear Weapons in Europe*, UNIDIR, 2017, <http://unidir.org/files/publications/pdfs/lockthem-up-zero-deployed-non-strategic-nuclear-weapons-in-europe-en-675.pdf>.

⁸⁶ A. Weber, “Nuclear-Armed Cruise Missiles Should be Banned”, *Policy Brief No. 12*, Toda Peace Institute, May 2018, http://toda.org/files/policy_briefs/T-PB-12_Weber_Cruise-missiles.pdf; J. Borrie, A. Dowler, and P. Podvig, *Hypersonic Weapons: A Challenge and Opportunity for Strategic Arms Control*, UNODA/UNIDIR, 2019, <http://www.unidir.ch/files/publications/pdfs/hypersonic-weapons-a-challenge-and-opportunity-for-strategic-arms-control-en-744.pdf>; W.P.S. Sidhu, “To Reduce Missile Threats, Think Outside the Silo”, *Bulletin of the Atomic Scientists*, 10 August 2016, https://thebulletin.org/roundtable_entry/to-reduce-missile-threats-think-outside-the-silo/.

eliminating or restricting them would lessen the possibility of escalation based on miscalculation or misinterpretation. This notion of reinforcing the barrier separating nuclear force-related systems from other systems underlies a series of proposals. They also include designating nuclear C3 as off-limits from cyber interference, excluding nuclear or nuclear-capable forces from military exercises, and prohibiting the targeting of nuclear installations or facilities (for example, expanding the 1988 India–Pakistan Non-Attack Agreement).⁸⁷

Among the most prominent ideas under the risk reduction umbrella is the lowering the operational readiness of nuclear weapons systems. Whether these activities hinder the ability of nuclear-armed States to deter effectively, as some have argued, is the subject of analysis elsewhere and is not the subject of this paper. But one argument for the de-alerting approach, and related de-mating and de-targeting measures, is that these can help to extend the decision-making process in crisis. Proposals for such measures target everything from submarine-launched ballistic missiles to bombers to land-based armed missiles. They range in form from physical separation of warheads from delivery systems to removal of missile guidance systems to the use of silo barriers and safing switches.⁸⁸ Other proposals to extend the decision-making process involve enhancing communication in crisis. For instance, the establishment of dedicated channels and emergency hotlines—not only on a bilateral basis—draws from the precedent of the secure Moscow–Washington hotline created in response to the Cuban Missile Crisis.⁸⁹

PREVENT CRISIS

A final group of proposed measures relates to crisis prevention. The reality is that nuclear-armed States are likely to rely first and foremost on their own national technical means for intelligence, surveillance, and early warning. Still, these can be supplemented by joint early warning centres (often discussed in the context of false alarms), which can provide pre-notification of changed alert statuses or missile tests, enhancing situational understanding. Relatedly, more exchange on mutual signalling

⁸⁷ R. Einhorn and W.P.S. Sidhu, “The Strategic Chain: Linking Pakistan, India, China, and the United States”, *Arms Control and Non-Proliferation Series Paper 14*, Brookings, March 2017, https://www.brookings.edu/wp-content/uploads/2017/03/acnpi_201703_strategic_chain.pdf; R. Berls Jr. and L. Ratz, “Rising Nuclear Dangers: Steps to Reduce Risks in the Euro-Atlantic Region”, *NTI Paper*, Nuclear Threat Initiative, December 2016, https://media.nti.org/documents/NTI_Rising_Nuclear_Dangers_Paper_FINAL_12-5-16.pdf; S. van der Meer, “Reducing Nuclear Weapons Risks: A Menu of 11 Policy Options”, *Policy Brief*, Clingendael: Netherlands Institute of International Relations, June 2018, https://www.clingendael.org/sites/default/files/2018-06/PB_Reducing_nuclear_weapons_risks.pdf; P.O. Stoutland and S. Pitts-Kiefer, “Nuclear Weapons in the New Cyber Age: Report of the Cyber-Nuclear Weapons Study Group”, Nuclear Threat Initiative, September 2018, https://media.nti.org/documents/Cyber_report_finalsmall.pdf.

⁸⁸ H.M. Kristensen and M. McKenzie, *Reducing Alert Rates of Nuclear Weapons*, UNIDIR, 2012, <http://www.unidir.ch/files/publications/pdfs/reducing-alert-rates-of-nuclear-weapons-en-307.pdf>.

⁸⁹ Global Zero, *Nuclear Crisis Group: Urgent Steps to De-Escalate Nuclear Flashpoints*, 2017, https://www.globalzero.org/wp-content/uploads/2018/10/NCG_Urgent-Steps_June-2017.pdf.

in times of increased tension—concerning actions such as military mobilization, troop exercises, or weapon dispersion—can help prevent further escalation.⁹⁰ The Cuban Missile Crisis is again an instructive case, as US policymakers took into careful consideration how Soviet leadership might interpret their actions prior to deciding upon the naval blockade.⁹¹ Other proposals relate to limiting or ending what might be construed as provocative behaviours, such as medium-altitude reconnaissance flights (including by uncrewed aerial vehicles), missile flight tests, and military exercises.⁹² In recognition of entanglement scenarios, an interrelated set of ideas includes a code of conduct for space-based assets, or to establish guidelines on—or even prohibit—the testing and deployment of anti-satellite weapons.⁹³ Many of these measures play a dual role, seeking to prevent crises between nuclear-armed States from developing in the first place and managing them successfully without nuclear use if they do occur. Accordingly, broader measures to assuage security and geopolitical tensions fall in this category as well.

REDUCING UNAUTHORIZED RISK

Although fortunately it has never occurred, a number of more-or-less plausible routes to unauthorized use of nuclear weapons are of global concern. For instance, experts have relayed fears that regime collapse or near-collapse would throw the control of nuclear arsenals in the Democratic People's Republic of Korea and Pakistan into question.⁹⁴ There are also broader concerns about the vulnerability of weapons-usable materials across all nuclear-armed States.⁹⁵ This reflects evidence of long-standing and continuing interest on the part of certain violent non-State armed groups in nuclear weapons and materials acquisition. Narrowing the unauthorized use pathway requires a supply-side approach that centres on denying access—direct and indirect—to

⁹⁰ See V. Narang, *Nuclear Strategy in the Modern Era: Regional Powers and International Conflict*, 2014; K. Ven Bruusgaard, "Russian Strategic Deterrence", *Survival*, vol. 58, no. 4, 2016.

⁹¹ G.T. Allison and P. Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis*, 1999.

⁹² G. Woodhams and J. Borrie, *Armed UAVs in Conflict Escalation and Inter-State Crisis*, UNIDIR, 2018, <http://www.unidir.org/files/publications/pdfs/armed-uavs-in-conflict-escalation-and-inter-state-crises-en-727.pdf>

⁹³ R. Einhorn and W.P.S. Sidhu, "The Strategic Chain: Linking Pakistan, India, China, and the United States", *Arms Control and Non-Proliferation Series Paper 14*, Brookings, March 2017, https://www.brookings.edu/wp-content/uploads/2017/03/acnpi_201703_strategic_chain.pdf; J.M. Acton, "Escalation through Entanglement: How the Vulnerability of Command-and-Control Systems Raises the Risks of an Inadvertent Nuclear War", *International Security*, vol. 43, no. 1, 2018; D. Porras, *Toward ASAT Test Guidelines*, UNIDIR, 2018, <http://www.unidir.ch/files/publications/pdfs/-en-703.pdf>

⁹⁴ For instance, M.J. Mazarr, "The Korean Peninsula: Three Dangerous Scenarios", RAND Corporation, 2018, <https://www.rand.org/pubs/perspectives/PE262.html>; P.K. Kerr and M.B. Nikitin, *Pakistan's Nuclear Weapons*, Congressional Research Service, 1 August 2016, <https://crsreports.congress.gov/product/pdf/RL/RL34248>.

⁹⁵ E.D. Dumbacher and P. Southland, "NTI Nuclear Security Index: Building a Framework for Assurance, Accountability, and Action: Fourth Edition", *Nuclear Threat Initiative*, September 2018, https://ntiindex.org/wp-content/uploads/2018/08/NTI_2018-Index_FINAL.pdf. See also the discussion of insider threats, as in M. Bunn and S.D. Sagan, *A Worst Practices Guide to Insider Threats: Lessons from Past Mistakes*, American Academy of Arts and Sciences, 2014.

nuclear weapons and materials.⁹⁶ This entails a) enhancing safeguarding procedures around nuclear weapons and materials, including their storage, maintenance, transfer, and control. In addition, the opacity concerning weapons and materials safety and security suggests a specific need for b) stronger assessment of the nature of unauthorized risk with a view to enhancing oversight.

Figure 2.4. Reducing Unauthorized Risk: Objectives and Sample Ideas

Enhance Safeguarding Procedures	Improve Risk Assessment
<ul style="list-style-type: none"> • Improve safety and security of weapons, materials, and facilities • Create global materials security system • Information exchange (e.g. accident notification or incident database) 	<ul style="list-style-type: none"> • Increase independent oversight of nuclear weapons programmes at the domestic level • Intelligence exchange on unauthorized incidents • In-depth vulnerability assessments

ENHANCE SAFEGUARDING PROCEDURES

Ensuring the physical and cyber safety and security of nuclear weapons, materials, and facilities is ultimately a matter of national responsibility. For instance, in light of cyber vulnerabilities, further risk analysis could drive the strengthening of C3 defence and resilience.⁹⁷ Indeed, some proposals simply advise more efficient resource mobilization by States to this and other ends.⁹⁸ ‘Gift basket’ diplomacy has also been used as a means to add a level of diplomatic accountability to individual State measures, as in the Nuclear Security Summit series. The International Atomic Energy Agency (IAEA) could play a more formalized role—akin to its mandate in the area of

⁹⁶ A demand-side strategy (e.g. reinforcing nuclear stigmatization) should not be discounted in the longer term but is less pertinent to the risk of use scenarios described.

⁹⁷ B. Unal and P. Lewis, *Cybersecurity of Nuclear Weapons Systems: Threats, Vulnerabilities and Consequences*, Chatham House, January 2018, <https://www.chathamhouse.org/sites/default/files/publications/research/2018-01-11-cybersecurity-nuclear-weapons-unal-lewis-final.pdf>.

⁹⁸ R. Mowatt-Larssen, “The Armageddon Test: Preventing Nuclear Terrorism”, *Bulletin of the Atomic Scientists*, 1 September 2009, <https://thebulletin.org/2009/09/the-armageddon-test-preventing-nuclear-terrorism/>.

safety—creating a stronger nuclear security culture in the process.⁹⁹ Still others call for multilateral collaboration, including through the development of a global materials security system to track, account for, manage and secure all weapons-usable materials, or through the expansion of the Cooperative Threat Reduction Program, which provided financial assistance and technical expertise in the area of warheads, delivery vehicles, and materials in the States of the former Soviet Union.¹⁰⁰ In that vein, the United States has reportedly assisted Pakistan in securing its stockpiles for over a decade, sharing best practices and technical measures and providing equipment.¹⁰¹ A different bilateral approach others have identified involves using civil nuclear cooperation agreements as conduits for strengthened strategic trade and export control measures that can prevent the flow of sensitive materials.¹⁰²

IMPROVE ASSESSMENT AND MANAGEMENT

Much remains unknown in the public domain about the respective national safety and security procedures governing the global stockpile of nearly 14,000 nuclear weapons in nine States, or those governing the roughly 83 per cent of all highly enriched uranium and plutonium stocks that is in non-civilian custody. Existing information is piecemeal, focused on particular States and time periods such as those documented in *Command and Control*, or stem from the work of non-governmental organizations.¹⁰³ And even within domestic structures, knowledge regarding the “precise conditions of weapons stockpiles and safety procedures” as well as security aspects is generally limited to a select group of individuals and institutions.¹⁰⁴ While proper assessment is a prerequisite to addressing any risk, this appears to be a fundamental challenge in the context of the unauthorized use scenario—at both domestic and international levels.

⁹⁹ M. Bunn, M. Malin, N. Roth and W. Tobey, *Preventing Nuclear Terrorism: Continuous Improvement or Dangerous Decline?*, Project on Managing the Atom, Harvard Kennedy School and Belfer Center for Science and International Affairs, 2016, <https://www.belfercenter.org/sites/default/files/legacy/files/PreventingNuclearTerrorism-Web.pdf>.

¹⁰⁰ G.P. Schultz, W. Perry, H.A. Kissinger and S. Nunn, “Next Steps in Reducing Nuclear Risks”, *Wall Street Journal*, 5 March 2013, <https://www.wsj.com/articles/SB10001424127887324338604578325912939001772>; E. Regehr, “A Nuclear Risk Reduction Strategy for NATO”, *The Ploughshares Monitor*, vol. 20, no. 1, March 1999.

¹⁰¹ P.K. Kerr and M.B. Nikitin, *Pakistan’s Nuclear Weapons*, Congressional Research Service, 1 August 2016, <https://crsreports.congress.gov/product/pdf/RL/RL34248>.

¹⁰² T. Ogilvie-White, “Strengthening Australia’s Security: Proposals for Reducing Nuclear Dangers”, Australian Institute of International Affairs, 21 November 2014, <https://www.internationalaffairs.org.au/australianoutlook/strengthening-australias-security-proposals-for-reducing-nuclear-dangers/>.

¹⁰³ E. Schlosser, *Command and Control: Nuclear Weapons, the Damascus Incident, and the Illusion of Safety*, 2013; R. Edwards, *Nukes of Hazard: The Nuclear Bomb Convoys on Our Roads*, ICAN UK, 2016, <http://www.acronym.org.uk/new-website/wp-content/uploads/2017/03/Nukes-of-Hazard-report-FINAL-7.pdf>.

¹⁰⁴ R. Lahidji, “The Safety of Nuclear Weapons and Materials: Lessons from the Assessment of Nuclear Power Plant Risks”, in J. Borrie, T. Caughley, and W. Wan (eds), *Understanding Nuclear Weapon Risks*, UNIDIR, 2017, p. 79, <http://www.unidir.org/files/publications/pdfs/understanding-nuclear-weapon-risks-en-676.pdf>.

Focused exchange, including intelligence sharing, among several or all nuclear-armed States can help improve efforts against the possibility of improper acquisition and unauthorized use, including by non-State armed groups. There exist model measures for such information exchange, from bilateral agreements on accident notification and radiation release, to the IAEA's Incident and Trafficking Database to which States voluntarily report unauthorized activities and events involving nuclear and other radioactive incidents. Certainly, there are legitimate security concerns that prevent nuclear-armed States from sharing information on their specific breaches and vulnerabilities; transparency is not a panacea.¹⁰⁵ Yet regularized exchange on such topics can refocus States on an objective that has enjoyed less political attention in the aftermath of the 2016 Nuclear Security Summit. Revitalizing the agenda at the international level can also inspire domestic action, for instance the strengthening of independent oversight and wider nuclear security culture, or the expansion of practices such as vulnerability assessments and stress testing by regulators and operators.¹⁰⁶

REDUCING ACCIDENTAL RISK

The nature of complex interactions and tightly coupled systems may make accidents inevitable.¹⁰⁷ Yet there are means to lessen the possibility of accidental nuclear detonation. Some of the measures discussed in relation to the previous scenarios potentially have an impact here as well. For instance, clearer understandings of postures can help prevent overreaction to incongruous events involving nuclear force-related systems that may be the result of faults or accidents rather than being intentional. Measures to extend the decision-making process can allow clarification of radar readings that turn out to be erroneous—a scenario that calls to mind the mistaken interpretation by the Russian military of Norway's Black Brant scientific rocket as a potential incoming missile in 1995. But an approach that seeks specifically to address the accidental use scenario should focus on minimizing errors, both human and technical, by a) strengthening safety features (including in the cyber realm) in nuclear weapons and related systems, and b) enhancing operator control of those systems; while also c) containing the consequences of errors when they occur.

¹⁰⁵ E. Sokova, "Non-state Actors and Nuclear Weapons", in J. Borrie, T. Caughley, and W. Wan (eds), *Understanding Nuclear Weapon Risks*, UNIDIR, 2017, <http://www.unidir.org/files/publications/pdfs/understanding-nuclear-weapon-risks-en-676.pdf>.

¹⁰⁶ M. Bunn, N. Roth, W.H. Tobey, *Revitalizing Nuclear Security in an Era of Uncertainty*, Project on Managing the Atom, 2019.

¹⁰⁷ J. Borrie, *A Limit to Safety: Risk, 'Normal Accidents', and Nuclear Weapons*, ILPI-UNIDIR, December 2014, <https://www.files.ethz.ch/isn/186094/a-limit-to-safety-en-618.pdf>; P. Podvig, "Risks of Nuclear Command and Control Accidents", in J. Borrie, T. Caughley, and W. Wan (eds), *Understanding Nuclear Weapon Risks*, UNIDIR, 2017, <http://www.unidir.org/files/publications/pdfs/understanding-nuclear-weapon-risks-en-676.pdf>.

Figure 2.5. Reducing Accidental Risk: Objectives and Sample Ideas

Strengthen Safety Features	Enhance Operator Control	Contain Consequences of Errors
<ul style="list-style-type: none">• Incorporate safeguards into weapons and delivery systems• Permissive action links• Enhance cyber systems	<ul style="list-style-type: none">• Clearly defined procedures for action related to use• Incorporate backups in operations and data collection	<ul style="list-style-type: none">• Bilateral / multilateral data exchange on accidents• Joint monitoring of select events• Human training

STRENGTHEN SAFETY FEATURES

Safety features incorporated into nuclear weapons and their systems have long served as a defence against accidental nuclear use. The US stockpile, for instance, contains warheads and bombs with insensitive high explosives and fire-resistant pits.¹⁰⁸ In addition, it has developed permissive action links (PAL) devices to prevent arming or launching of nuclear weapons without prescribed codes. Evidence suggests that the United States in the 1970s also provided assistance on the development of PAL technologies to the Soviet Union, France, and the United Kingdom.¹⁰⁹ Yet cost concerns, design modifications, and even bureaucratic resistance have hindered the timely installation of these and other safety components in the past.¹¹⁰ While limited information is available on the safeguard technologies deployed by all nuclear-armed States, developing and incorporating such measures—including as part of national nuclear modernization programmes, or in cooperative fashion—presents an avenue to reducing risk of accidental use. This is true of cyber safety as well. Indeed, the cyber challenge as it pertains to nuclear risk is not entirely external, as a number of “accidents, mistakes, and near misses ... occurred because of computer errors or problems”.¹¹¹

ENHANCE OPERATOR CONTROL

Safeguard measures such as PALs can have the added effect of enhancing operator control over nuclear use. A more direct means to this end involves tightening the procedures around nuclear weapons management, such as the two-person rule

¹⁰⁸ A.P. Donnell Jr., “A Robust Approach to Nuclear Weapon Safety”, document SAND2011-4123C, Sandia National Laboratories, 2011, <https://www.osti.gov/servlets/purl/1120301>.
¹⁰⁹ D. Caldwell, “Permissive Action Links: A Description and Proposal”, *Survival*, vol. 20, no. 3, 1987, pp. 224–238.
¹¹⁰ E. Schlosser, *Command and Control*, 2013.
¹¹¹ A. Futter, *Hacking the Bomb: Cyber Threats and Nuclear Weapons*, 2018, p. 10.

adhered to by some nuclear-armed States requiring the presence of two authorized individuals in all critical operations. The inclusion of redundant or dependent systems is in fact a recurring theme in accident prevention. For instance, the presence of analogue and digital components in command and control or the establishment of multiple survivable communications links can help maintain operations in either system even if individual components fail.¹¹² Multiplicity in data collection meanwhile can help to reduce the possibility of decision-making fallibility; the United States for instance employs a ‘dual phenomenology’, with information on events that could drive a nuclear response confirmed by two independent sensors of different types (for example, infrared satellite detection and land-based radars).¹¹³ Others suggest that the further incorporation of machine learning and autonomous systems can lessen the data searching, processing, and analysis burden, offering human command better situational awareness.¹¹⁴ Notably however, the inclusion of technical elements can create a new source of errors, as they contribute to system complexity and can contain vulnerabilities hidden from operators.¹¹⁵

CONTAIN CONSEQUENCES OF ERRORS

Stronger operational control (or human safeguards) can limit the severity of technical error. Similarly, bilateral or multilateral data exchange about accidents can build a repository of knowledge that could help to prevent future accidents from increasing in magnitude to the level of nuclear use. Through early warning centres, States could engage in joint monitoring of security events that could be mistakenly interpreted, including missile launches and military exercises.¹¹⁶ The Vienna Document of the Organization for Security and Cooperation in Europe presents a model for such data exchange and notification; this would address escalatory use scenarios as well.¹¹⁷ In 1998, the United States and the Russian Federation reached agreement on a Joint Data Exchange Center to monitor global ballistic missile launches and space launch vehicles; they have reaffirmed support for the idea several times since, with a 2000

¹¹² B. Unal and P. Lewis, *Cybersecurity of Nuclear Weapons Systems: Threats, Vulnerabilities and Consequences*, Chatham House, January 2018, <https://www.chathamhouse.org/sites/default/files/publications/research/2018-01-11-cybersecurity-nuclear-weapons-unal-lewis-final.pdf>.

¹¹³ R. Halloran, “Nuclear Missiles: Warning System and the Question of When to Fire”, *New York Times*, 29 May 1983, <https://www.nytimes.com/1983/05/29/us/nuclear-missiles-warning-system-and-the-question-of-when-to-fire.html>.

¹¹⁴ For more on automation and nuclear weapons systems, see J. Borrie, “Cold War Lessons for Automation in Nuclear Weapon Systems” and V. Boulanin, “The Future of Machine Learning and Autonomy in Nuclear Weapon Systems”, in V. Boulanin (ed.), *The Impact of Artificial Intelligence on Strategic Stability and Nuclear Risk – Volume I: Euro-Atlantic Perspectives*, SIPRI, 2019.

¹¹⁵ C. Perrow, *Normal Accidents: Living with High-Risk Technologies*, 1999.

¹¹⁶ P. Maurer, *Nuclear Weapons: Averting a Global Catastrophe*, ICRC Statement, 23 April 2018, <https://www.icrc.org/en/document/nuclear-weapons-averting-global-catastrophe>.

¹¹⁷ H. Miall, “Exploring New Approaches to Arms Control in the 21st Century: Building Lessons from the INF Treaty and Presidential Nuclear Initiatives (PNIs)”, *Policy Brief No. 30*, Toda Peace Institute, November 2018, http://www.toda.org/files/policy_briefs/T-PB%2030_Hugh%20Miall_INF%20Workshop%20Report.pdf.

memorandum detailing the nature of its operations, but without further steps towards implementation.¹¹⁸

Other proposals aim both to reduce the occurrence of error and contain its consequences. Expanded training of relevant staff in simulated crisis situations could enhance their readiness in abnormal situations. Should cyberattacks occur, the ability of States to efficiently pinpoint their source can lessen the possibility of mistaken retaliation. While there are inherent challenges to attribution, some have identified best practices to mitigate human fallibility.¹¹⁹ Proposals mentioned previously to lengthen the decision-making process, to enhance communication in crisis, or to designate nuclear C3 as off-limits from cyber interference can have utility here too. Some, noting the increasing role of artificial intelligence and autonomy in nuclear forces, call for commitments to retain the human element in decision-making linked to early warning and C3.¹²⁰ And even following an accidental launch, fail-safes built into delivery systems may be able to destroy missiles prior to catastrophe.¹²¹ Still, no range or combination of measures can altogether eliminate the possibility of operator error. And again, given the nature of complex interactions, technical solutions can bring about their own issues and uncertainties.¹²²

¹¹⁸ Memorandum of Agreement Between the United States of America and The Russian Federation on the Establishment of a Joint Center for the Exchange of Data from Early Warning Systems and Notifications of Missile Launches, 4 June 2000, <https://www.state.gov/t/isn/4799.htm>.

¹¹⁹ Office of the Director of National Intelligence, *A Guide to Cyber Attribution*, 14 September 2018, https://www.dni.gov/files/CTIIC/documents/ODNI_A_Guide_to_Cyber_Attribution.pdf.

¹²⁰ S. van der Meer, "Reducing Nuclear Weapons Risks: A Menu of 11 Policy Options", *Policy Brief*, Clingendael: Netherlands Institute of International Relations, June 2018, https://www.clingendael.org/sites/default/files/2018-06/PB_Reducing_nuclear_weapons_risks.pdf; H. Miall, "Exploring New Approaches to Arms Control in the 21st Century: Building Lessons from the INF Treaty and Presidential Nuclear Initiatives (PNIs)", *Policy Brief No. 30*, Toda Peace Institute, November 2018, http://www.toda.org/files/policy_briefs/T-PB%2030_Hugh%20Miall_INF%20Workshop%20Report.pdf.

¹²¹ See Range Commanders Council Range Safety Group Flight, *Termination Systems Commonality Standard*, document 319-14, September 2014, <https://apps.dtic.mil/docs/citations/ADA620923>.

¹²² P. Podvig, "Risks of Nuclear Command and Control Accidents", in J. Borrie, T. Caughley, and W. Wan (eds), *Understanding Nuclear Weapon Risks*, UNIDIR, 2017, <http://www.unidir.org/files/publications/pdfs/understanding-nuclear-weapon-risks-en-676.pdf>.

RISK REDUCTION IN PRACTICE

As indicated in the discussion above, there exists a foundation for risk reduction activities beyond the national level. In fact, nuclear risk reduction was a “central preoccupation” of Cold War-era leaders in the United States and the Soviet Union.¹²³ The resolution of the Cuban Missile Crisis included a private agreement for the removal of ballistic missiles from Cuba and Turkey. Alongside the Moscow–Washington hotline, this suggested an active desire to avoid the brinksmanship that precipitated the crisis and near escalatory use.¹²⁴ These concerns contributed also to the 1971 Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War—which included pledges to notify one another of possible detonation incidents, planned missile launches, and detection of unidentified objects by missile warning systems. A year later, the sides concluded the first round of the Strategic Arms Limitation Talks—the basis for an arms control structure that later came to include the Strategic Arms Reduction Treaty and its successors, with accompanying Nuclear Risk Reduction Centers.

The two superpowers sought to address potential drivers of nuclear crisis in other ways as well. A 1972 agreement on the Prevention of Incidents On and Over the High Seas (the IncSea accord), detailed naval restraint, use of informative signals, and notification exchange between the sides. A 1989 Prevention of Dangerous Military Activities Agreement echoed similar principles across other areas. While neither agreement referred specifically to nuclear use, they aimed to “reduce the possibility of conflict by accident, miscalculation, or the failure of communication; and to increase stability in times of both calm and crisis” between two nuclear-armed States.¹²⁵ Unauthorized use, meanwhile, has become a post-Cold War point of emphasis, with the United States and the Russian Federation addressing stockpile and material safety through the Trilateral Initiative, the Cooperative Threat Reduction programme, and the Plutonium Management and Disposition Agreement—though these activities have halted in recent years.

The nature of tension and conflict has similarly driven bilateral measures between India and Pakistan. Some of these predate the development of nuclear weapons in South Asia but have become pertinent to that context, including the installation of hotlines between Prime Ministers and Directors General of Military Operations. The 1988 Agreement on the Prohibition of Attack against Nuclear Installations and Facilities is

¹²³ M. Krepon, “Nuclear Risk Reduction: Is Cold War Experience Applicable to Southern Asia?”, in M. Krepon (ed.), *Nuclear Risk Reduction in South Asia*, 2004, p. 8.

¹²⁴ J.M. Lindsay, “TWE Remembers: Secret Soviet Tactical Nuclear Weapons in Cuba (Cuban Missile Crisis, a Coda)”, Council on Foreign Relations blog, 29 October 2012, <https://www.cfr.org/blog/twe-remembers-secret-soviet-tactical-nuclear-weapons-cuba-cuban-missile-crisis-coda>.

¹²⁵ US Department of State Bureau of International Security and Nonproliferation, “Narrative” on the *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*, 25 May 1972.

an early example of restraint in the civilian nuclear sphere.¹²⁶ Following their weapons tests, the 1999 Lahore Declaration pushed both sides to “take immediate steps for reducing the risk of accidental or unauthorized use of nuclear weapons and discuss concepts and doctrines with a view to elaborating measures for confidence building in the nuclear and conventional fields, aimed at prevention of conflict”.¹²⁷ This has led to ministerial and expert level dialogue that resulted in the 2005 Agreement on Pre-Notification of Flight Testing of Ballistic Missiles, and in 2006, consultations specifically on nuclear doctrines.¹²⁸ In 2007 the States signed an agreement specifically on nuclear risk reduction, which included national measures to guard against accidents as well as for bilateral accident notification.

Outside the US–Soviet (now Russian) and the India–Pakistan nuclear dyads (in which China also features), nuclear risk reduction activity remains elusive, with multilateral engagement uneven. The 64-point action plan outlined in the final document of the 2010 NPT Review Conference did call for the five nuclear-weapon States to pursue “a diminishing role for nuclear weapons in security policies to minimize the risk that these weapons ever be used”, to “discuss policies that could prevent the use of nuclear weapons” with a view to reducing risk of accidental use.¹²⁹ Since 2009 the five NPT nuclear-weapon States have held sporadic conferences among themselves on issues of strategy and security. In January 2019, following a two-year break, they affirmed the need to “strengthen exchanges on nuclear policies and strategies, enhance strategic mutual trust and maintain common security, in a bid to spare no effort to prevent nuclear risks that may be caused by misunderstandings and misjudgments”.¹³⁰ Risk reduction has emerged as a key issue in the 2020 NPT review cycle, with the chair of the 2019 Preparatory Committee recommending the “elaboration of measures that can contribute to building confidence and reduce the risk of the use of nuclear weapons”.¹³¹

¹²⁶ It defines those installations and facilities based on the presence of “fresh or irradiated nuclear fuel and materials”. See Agreement on the Prohibition of Attack Against Nuclear Installations and Facilities, 31 December 1988, <https://fas.org/nuke/guide/india/doctrine/nucl.htm>.

¹²⁷ The Lahore Declaration and Memorandum of Understanding, 21 February 1999, <https://peacemaker.un.org/indiapakistan-lahoredeclaration99>.

¹²⁸ Joint Statement, 4th Round of Pakistan–India Expert Level Dialogue on Nuclear CBMs held in Islamabad on 25–26 April, <https://mea.gov.in/bilateral-documents.htm?dtl/6110/Joint+Statement+4th+Round+of+PakistanIndia+Expert+Level+Dialogue+on+Nuclear+CBMs+held+in+Islamabad+on+2526+April>.

¹²⁹ *2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons: Final Document*, volume I, parts I and II, document NPT/CONF.2010/50, 28 May 2010, pp. 15 and 21, [http://undocs.org/NPT/CONF.2010/50%20\(VOL.I\)](http://undocs.org/NPT/CONF.2010/50%20(VOL.I)).

¹³⁰ “Five Nuclear-weapon States Hold a Formal Conference in Beijing”, 30 January 2019, Ministry of Foreign Affairs of the People’s Republic of China, https://www.fmprc.gov.cn/mfa_eng/wjbxw/t1634793.shtml.

¹³¹ Chair’s factual summary (working paper), Preparatory Committee for the 2020 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, 10 May 2019, document NPT/CONF.2020/PC.III/WP.49, p. 3, <http://undocs.org/NPT/CONF.2020/PC.III/WP.49>.

The continued P5 dialogue constitutes a significant step in enhancing mutual understanding, increasing the predictability of potential nuclear engagement, and reducing risk of use across all scenarios—at least those involving the five NPT nuclear-weapon States. Along similar lines, the Group of Seven in April 2019 cited specifically the need for “efforts towards strategic risk reduction” to “help avoid misunderstanding and miscalculation”.¹³² The value of these exchanges on fundamental concepts—and of expressed recognition of and commitment to risk reduction activities—cannot be overstated. Yet against the backdrop of these high-level multilateral campaigns there remains a need for a practical approach that allows for bespoke actions to address contextual specificities. Past bilateral experiences can serve as invaluable points of reference, but the complexities of the current geopolitical environment suggest the value of a wider perspective. For instance, for those for whom nuclear weapons remain essential, maximizing regional security and stability is “nuclear risk reduction in the highest sense”.¹³³ As unfolding regional nuclear dynamics may define the security landscape for decades to come, engagement with the topic of risk reduction at that level indeed could prove invaluable.¹³⁴

¹³² Efforts would include “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”, *2019 G7 Statement on Non-Proliferation and Disarmament*, 6 April 2019, para. 22, https://www.diplomatie.gouv.fr/IMG/pdf/2019_g7_statement_on_non-proliferation_and_disarmament_cle881416.pdf.

¹³³ C.A. Ford, *Stability Engagement with Nuclear “Third Parties”: Regional Risk Reduction Diplomacy*, 8 March 2019, <https://www.state.gov/stability-engagement-with-nuclear-third-parties-regional-risk-reduction-diplomacy/>.

¹³⁴ The Arms Control and Regional Security (ACRS) process in the Middle East serves as a historical example of an overarching regional framework. It was not nuclear-focused but negotiated confidence-building measures that included a communications network, military information exchange, and other transparency measures. Formal activities ceased in 1995. See M.D. Yaffe, “Promoting Arms Control and Regional Security in the Middle East”, *Disarmament Forum*, no. 2, 2001, pp. 9–25.

MOVING FORWARD

Widespread concern about nuclear risk has not forged consensus among States on how to move forward. Risk reduction has become a contested space. Some may argue that risk reduction is a status quo endeavour that impedes progress towards the larger goal of nuclear disarmament. Indeed nuclear-armed States often cite improvements to the safety, security, and reliability of their nuclear weapons in describing their extensive modernization programmes. Others criticize the sensationalism around the subject and the “myth of an inherently and permanently high risk of nuclear use”: after all, nuclear weapons have not been used since 1945.¹³⁵ Still others may cite the futility of developing risk reduction measures against a difficult security and geopolitical environment: the deterioration of arms control and disarmament structures appears indicative of the fundamental lack of political will on such issues.

Yet risk of nuclear use takes many forms. Modernization programmes may lessen the possibility of accidents but they also improve nuclear weapon capabilities and effectiveness, in the eyes of some rendering them more usable in conflict situations.¹³⁶ Responsible management rather than luck may be the reason for the lack of detonation events over seven decades but changes to that management will be necessary to respond to technological developments across nuclear weapons systems and other systems impinging on the nuclear balance. Underlying tension and security concerns may provide rationalization for States aggressive nuclear doctrines but adversaries can still clarify those postures and find common ground on measures to prevent accidents or unauthorized use, as they did during the Cold War. Ultimately, nuclear risk reduction stands on its own. It should not be seen as an impediment to disarmament progress but as a distinct means to create a more propitious environment for constructive engagement on all nuclear issues, including disarmament. Indeed, risk reduction takes on added meaning in current circumstances.

In order to advance the conversation, nuclear risk reduction must be recast in a more systematic manner. This paper has advanced a framework identifying four risk of use scenarios: doctrinal, escalatory, unauthorized, and accidental. It sets out approaches to reduce the risk of each, establishing general objectives and offering illustrative measures. What is required next is an understanding of how these scenarios may manifest in particular contexts, including regional ones. There is no shortage of analysis of NATO and Russian doctrines, postures, and activities, but considering these

¹³⁵ B. Tertrais, “On the Brink—Really? Revisiting Nuclear Close Calls Since 1945”, *The Washington Quarterly*, vol. 40, no. 2, 2017, p. 51. Others see this as an inductive fallacy; see J. Borrie, *A Limit to Safety: Risk, ‘Normal Accidents’, and Nuclear Weapons*, ILPI-UNIDIR, December 2014, <https://www.files.ethz.ch/isn/186094/a-limit-to-safety-en-618.pdf>.

¹³⁶ H.M. Kristensen, “The Quest for More Useable Nuclear Weapons”, in J. Borrie, T. Caughley, and W. Wan (eds), *Understanding Nuclear Weapon Risks*, UNIDIR, 2017, <http://www.unidir.org/files/publications/pdfs/understanding-nuclear-weapon-risks-en-676.pdf>.

in the context of specific escalatory use scenarios—for instance, in the Baltic sub-region—will shed light on the necessary approach and appropriate measures to combat the possibility. Similarly, examining the Korean Peninsula for potential trigger events across different use pathways is a prerequisite to identifying relevant measures to assuage risk there. In this manner, the international community can move to identify practical and feasible risk reduction baskets pertinent to the situation, tackling pathways that may be present, lessening their number and thus reducing risk of use overall.

APPENDIX

Expanded Summary of Compiled Ideas, Proposals, and Recommendations to Reduce the Risk of Nuclear Weapon Use

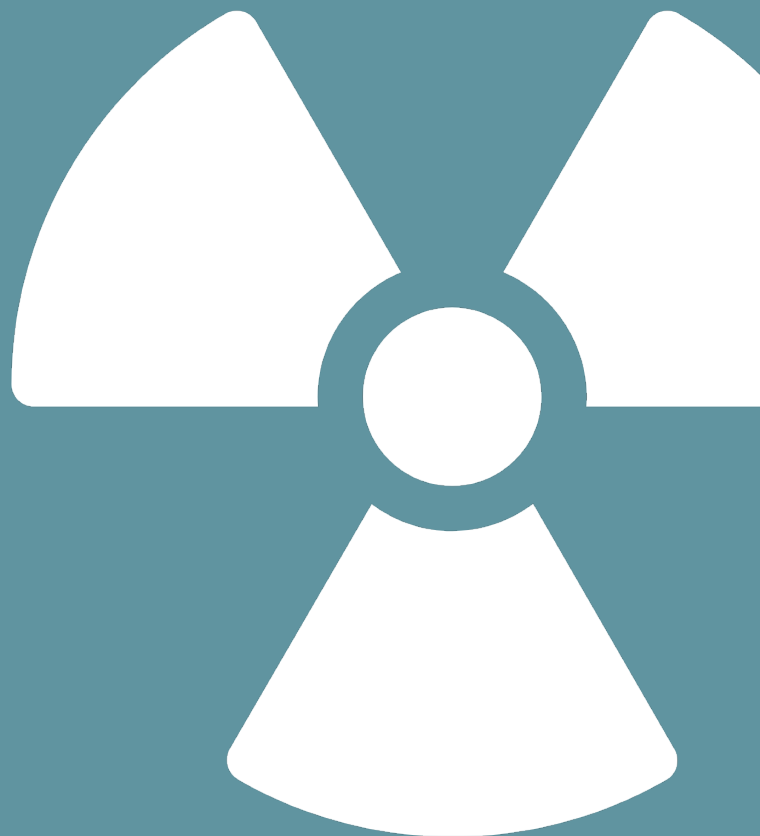
CATEGORY	RISK REDUCTION ACTIVITIES	SAMPLE MEASURES AND PROPOSALS
Political–Doctrinal Commitments	Commitment to non-use or no threat of use	<ul style="list-style-type: none"> Reaffirm Reagan–Gorbachev statement: “A nuclear war cannot be won and must never be fought.” Agreement on prohibition of use or threat of use (e.g. Article 1(d) in TPNW) Address use rhetoric from political and military leaders
	Lessened role of nuclear weapons in security policies	<ul style="list-style-type: none"> Scaling back of modernization programmes Dialogue and research on deterrence alternatives ‘Denuclearization’ of war plans and military exercises
	Declaratory policies on avoiding nuclear use	<ul style="list-style-type: none"> ‘No first use’ pledges, or bilateral or multilateral agreements Declarations of ‘sole purpose (is to deter/defend)’ or ‘(weapon of) last resort’ Pledges to limit scope of nuclear use even in ‘extreme circumstances’
	Ban on classes of nuclear weapons or delivery systems	<ul style="list-style-type: none"> Targeting lower-yield warheads, dual-capable systems Dialogues on intermediate-range ballistic missiles, nuclear-armed cruise missiles and drones, hypersonic weapons, and other relevant systems
	Extension of negative security assurances	<ul style="list-style-type: none"> Binding legal treaty or resolution Eliminate caveats, e.g. against non-compliant NPT States or other WMD use Sign and ratify nuclear-weapon free zone treaties and remove exemptions
	Develop understandings or statements of principles	<ul style="list-style-type: none"> Develop common lexicon on deterrence and capabilities Establish code of conduct or code on nuclear responsibility Expand Global Initiative to Combat Nuclear Terrorism principles
Strategic Considerations	Protection of nuclear-related technological systems	<ul style="list-style-type: none"> Agreement on cyber non-interference with C3 or critical infrastructure Protection of space-based assets linked to early warning or communications Guidelines on testing or deployment of anti-satellite weapons
	Agreement not to attack nuclear-related facilities	<ul style="list-style-type: none"> Expansion of 1988 India–Pakistan Non-Attack Agreement to cover military and civilian facilities, or adoption to other geographic areas Includes regular list exchange of relevant facilities
	Reductions in numbers of deployed weapons	<ul style="list-style-type: none"> Withdrawal, to be put into central/national storage or be disassembled Targeting non-strategic nuclear weapons and other weapons or delivery systems perceived as destabilizing (see examples presented in ‘ban on classes’ above)
	Restrictions on the nature of deployment	<ul style="list-style-type: none"> Limit number of storage locations, especially in volatile areas Establish geographic boundaries, e.g. proximity of submarines to coasts Limits on particular systems, e.g. New START and deployed mobile launchers
	Changes to deployment patterns and alert status (increasing decision time)	<ul style="list-style-type: none"> Removal from prompt-launch status, or de-alert Adjustments to timeframe of readiness plans from minutes to days or weeks ‘Partial’ de-alerting, including reducing warhead loading
	Crisis avoidance and management cooperation	<ul style="list-style-type: none"> Agreements (e.g. 1973 US–Soviet Agreement on the Prevention of Nuclear War) Restraint in deployments and mobilization in times of crisis Military/defence personnel engagement

CATEGORY	RISK REDUCTION ACTIVITIES	SAMPLE MEASURES AND PROPOSALS
Operational Procedures	Strengthen data assessment and decision-making	<ul style="list-style-type: none"> ▪ 'Dual phenomenology' to verify or refute early warning data ▪ Two-person rule requiring multiple authorized individuals for critical operations ▪ Inclusion of redundancies in C3
	Physical separation of nuclear weapons	<ul style="list-style-type: none"> ▪ De-mating nuclear weapons from delivery vehicles ▪ Isolate fissile core or trigger from warhead package ▪ Maintain separate sites for storage of nuclear and conventional weapons
	Mechanisms to delay, disrupt, or deactivate launch	<ul style="list-style-type: none"> ▪ De-targeting (e.g. default on open ocean areas rather than territories) ▪ Use of ready-safe switches; or removal or altering of firing switches ▪ Place visible barriers on missile silo lids
	Enhance safety and security of weapons and materials	<ul style="list-style-type: none"> ▪ Strengthen nuclear security systems, including human training ▪ Expand Cooperative Threat Reduction-type assistance activities ▪ Deploy resources for interdiction of illicit ship-to-ship transfers
	Address provocative military practices	<ul style="list-style-type: none"> ▪ Airspace incidents: e.g. reconnaissance flights, missile flight tests, buzzing practices ▪ Large-scale military exercises, including with nuclear forces ▪ Increased mutual signalling, especially in times of crisis
	Pre-notification of actions susceptible to misinterpretation	<ul style="list-style-type: none"> ▪ Changes in deployment, alert status, etc., as well as practices listed above
Bolstering Engagement and Transparency	High-level dialogues on pertinent issues	<ul style="list-style-type: none"> ▪ Topics include strategic stability, deterrence, nuclear risk/threats ▪ Regularized discussion in context of NPT or other multilateral forums ▪ e.g. P5 on national nuclear doctrines and postures; Nuclear Security Summit series
	Information exchange on pertinent issues	<ul style="list-style-type: none"> ▪ Includes doctrines, capabilities, hosted weapons, military exercises ▪ e.g. 2011 Vienna Document of OSCE: with exchange of information, follow-up reporting, site visits, consultative mechanisms
	Communication in crisis situations	<ul style="list-style-type: none"> ▪ Implement or expand hotlines or direct communication links for national and military leadership, e.g. Washington–Moscow or New Delhi–Islamabad ▪ Early warning centres and systems, joint notifications
	Notification of nuclear-related incidents	<ul style="list-style-type: none"> ▪ Expand 1986 Convention on Early Notification of a Nuclear Accident ▪ Intelligence sharing, building on IAEA Incident and Trafficking Database ▪ Enhance detection and attribution of cyberattacks linked to nuclear weapons systems
	Systematized risk assessment and analysis	<ul style="list-style-type: none"> ▪ Database of past nuclear weapons-related incidents; share best practices ▪ Strengthen resilience and diversity of C3 in context of risk linked to emerging technologies ▪ Conduct simulated crisis scenarios and stress testing

CHAPTER 3

MULTIPOLARITY, GREAT
POWER COMPETITION, AND
NUCLEAR RISK REDUCTION

Ankit Panda



SUMMARY

- Competitive geopolitical dynamics between the United States and the Russian Federation, the two States that possess the overwhelming portion of world nuclear forces between them, are resulting in increased nuclear risks.
- As a result of increased competition between these great powers, mutual mistrust of one another's nuclear postures and strategies has caused a sharp rise in doctrinal nuclear risk.
- Evolving strategic nuclear dynamics between the United States, the Russian Federation, and China pose a challenge to existing arms control regimes as well as the development of new ones, broadening multiple risk pathways in the US–China and US–Russia nuclear dyads
- Growing concerns about strategic stability in the US–China and US–Russia nuclear dyads are resulting in technology races, where each concerned power is seeking to cinch first-mover advantages in critical emerging technologies, including hypersonic boost-glide weapons, artificial intelligence, and unmanned systems.

» INTRODUCTION

Post-Cold War assumptions about nuclear risks are undergoing a period of flux as the third decade of the twenty-first century begins. The 'unipolar moment' of uncontested American geopolitical dominance has given way to an era of contestation and increased multipolarity. Beginning in 2014, the United States' relationship with the Russian Federation declined precipitously, spurred primarily by Moscow's annexation of Crimea from Ukraine. Around this time, with the consolidation of a new generation of leadership in China under Xi Jinping, who was appointed president in 2013, Washington began voicing greater concerns about what it saw as revisionist Chinese behaviour in its periphery, such as in the South China Sea.¹ The Trump administration, in the meantime, has embraced the notion that unipolarity has given way to greater multipolarity in the form of a competition that pits the United States on the one hand against China, and the Russian Federation on the other. "After being dismissed as a phenomenon of an earlier century, great power competition returned", the administration's 2017 National Security Strategy, a major strategic document, observed.²

Though the Russian Federation and China have not reciprocated the use of the phrase 'great power competition' in their respective national strategies, both have treated the United States as a strategic competitor. American concerns have been met with greater coordination between Moscow and Beijing in the international sphere too; Moscow and Beijing may not be formal allies, but some observers have pointed to an entente between them.³ The transformation of geopolitics among these three powers has had and will have serious consequences for nuclear risk. 'Great power competition' is the highest tier of nuclear multipolarity; it interacts with lower-level issues, including the emergence of an increasingly mature nuclear capability on the part of the Democratic People's Republic of Korea in Northeast Asia, evolving deterrence dynamics in South Asia, and growing conventional capabilities among non-nuclear States that are beneficiaries of extended nuclear deterrence.

¹ M.D. Shear, "Obama Calls on Beijing to Stop Construction in South China Sea", *New York Times*, 18 November 2015, <https://www.nytimes.com/2015/11/19/world/asia/obama-apec-summit-south-china-sea-philippines.html>.

² *National Security Strategy of the United States of America*, The White House, December 2017, <https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905-2.pdf>.

³ G.T. Allison and D.K. Simes, "A Sino-Russian Entente Again Threatens America", *Wall Street Journal*, 30 January 2019, <https://www.wsj.com/articles/a-sino-russian-entente-again-threatens-america-11548806978>.

»» THE EVAPORATION OF ARMS CONTROL

Owing to the profusion of strategic mistrust and competition in recent years, the United States regards Chinese and Russian intentions with regard to their nuclear forces with deep suspicion and Beijing and Moscow reciprocate. As this era of 'great power competition' intensifies, nuclear doctrinal risk, escalatory risk, and, to a lesser degree, accidental and unauthorized risk increase. Arms control, meanwhile, falls by the wayside. Historically, States have regarded arms control measures as trade-offs between transparency and security; at times of heightened suspicion and competitive dynamics, the perceived security costs of arms control can be high.⁴ Even where parties might favour arms control to limit the costs of competition or even engender some predictability in adversary behaviour and decision-making, they may be dissuaded from follow-through amid concerns about their counterparty's competitive ambitions. In the US–Russia–China context today, this appears to be the case insofar as any novel arms control regimes are concerned.

The viability of successful arms control requires prospective participants to sense that the transparency requirements that allows regime verifiability and utility would not also diminish national security. In the present context of 'great power competition', it does not appear that the three powers—the United States, the Russian Federation, and China—have a shared assessment of the trade-offs between security and transparency. Mutual suspicions have heightened perceptions of the costs of transparency, potentially explaining, for instance, the demise of the 1987 Intermediate-Range Nuclear Forces Treaty (INF) in 2017—a result of alleged Russian violations of the treaty's terms in a furtive manner, according to the United States.⁵ While neither the Russian Federation nor the United States have alleged that the other is in violation of the 2011 New Strategic Arms Reduction Treaty (New START), it is not certain that the treaty—the last remaining arrangement of its kind between the two powers accounting for the overwhelming majority of nuclear weapons—will be extended. The Russian side has offered unconditionally to extend the agreement with no apparent response from the US side.⁶

⁴ A.J. Coe and J. Vaynman, "Why Arms Control Is So Rare", *American Political Science Review*, December 2019, 1-14, doi:10.1017/S000305541900073X.

⁵ The Treaty banned the United States and the Soviet Union from possessing, testing, and deploying ground-launched cruise and ballistic missiles with ranges between 500 and 5,500 km anywhere on Earth indefinitely. After the dissolution of the Soviet Union, Soviet successor States that once hosted INF facilities participated in the arrangement; see also L. Seligman and R. Gramer, "What Does the Demise of the INF Treaty Mean for Nuclear Arms Control?", *Foreign Policy*, 2 August 2019, <https://foreignpolicy.com/2019/08/02/what-does-the-demise-of-the-i-n-f-treaty-mean-for-nuclear-arms-control-intermediate-nuclear-forces-new-start-strategic-arms-limitation-nonproliferation-trump-russia-arms-control-explained/>.

⁶ A. Ostroukh, "Putin Says Russia Ready to Extend New START Nuclear Arms Treaty", *Reuters*, 5 December 2019, <https://www.reuters.com/article/us-russia-usa-missiles/putin-says-russia-ready-to-extend-new-start-nuclear-arms-treaty-idUSKBN1Y923K>.

Strategic nuclear dynamics between these three powers are evolving. For instance, US withdrawal from the INF appeared to be equally predicated on concerns about a Russian missile system that allegedly violated the treaty's proscribed range limits for ground-launched weapons and about long-term strategic competition with China in the Asia-Pacific theatre. Contemporary debates about the extension of New START in the United States have been permeated by concerns about China. Even though Beijing's nuclear arsenal is an order of magnitude smaller than those of the United States and the Russian Federation, advocacy for trilateral strategic arms control has become linked to opposition to an unconditional New START extension—even at the risk of allowing the collapse of existing bilateral arms control regimes.

A long-running risk of growing nuclear threats pertains to the American pursuit of damage limitation capabilities borne of concerns about regional nuclear threats. For instance, beginning with the Democratic People's Republic of Korea's launch of the Taepodong-1 satellite launch vehicle/technology demonstrator in 1998, US homeland missile defence capabilities have gradually developed. Though US declaratory policy on the purpose of homeland missile defence continues to identify this technology as solely for protection from regional threats—like that of the intercontinental ballistic missiles of the Democratic People's Republic of Korea (DPRK)—the Russian Federation and China have long perceived these capabilities as threatening to their own strategic deterrents. Statements by high-level US officials that concerns about the Russian Federation and China have driven US investments in homeland missile defence technologies have not gone unnoticed in Moscow and Beijing.⁷ Moreover, US deployments of theatre-range missile defence systems to Northeast Asia and Europe have compounded these fears (as discussed elsewhere in this volume), particularly as powerful early warning sensors in the region might be networked with homeland defence systems.

⁷ A. Panda, "Bolton: China Is One Reason US 'Looking at Strengthening National Missile Defense'", *The Diplomat*, 19 March 2019, <https://thediplomat.com/2019/03/bolton-china-is-one-reason-us-looking-at-strengthening-national-missile-defense/>.

»» PERCEPTION, MISPERCEPTION, AND GREAT POWER DOCTRINAL RISK

As during the heyday of the Cold War, nuclear doctrines and nuclear intentions are held under deep mistrust among the powers. China and the Russian Federation accuse the United States, under the Trump administration, of expanding the scope for nuclear weapons in national defence while the United States continues to view China's basic nuclear posture and the Russian Federation's nuclear use thresholds with scepticism. As a result, on both sides of this competition, decision makers calculate that the adversary is behaving as they might in a worst-case scenario world. For the United States, this has meant a deep-seated conviction that the Russian Federation has operationalized an 'escalate to deescalate' nuclear strategy, whereby Moscow would undertake a limited employment of nuclear weapons to demonstrate resolve and prompt de-escalation by Washington and its North Atlantic Treaty Organization (NATO) allies.⁸ Russian doctrine, meanwhile, does not preclude the first use of nuclear weapons, but leaves the possibility open only in retaliation for the initial use of weapons of mass destruction (including non-nuclear) by an adversary, or in cases when the "very existence of the State is in jeopardy".⁹ The doctrine further adds, however, that "Nuclear weapons will remain an important factor for preventing an outbreak of nuclear military conflicts involving the use of conventional arms (large-scale war or regional war)".¹⁰ The inclusion of a reference to a regional war introduces some ambiguity about the conditions under which nuclear weapons—including non-strategic nuclear weapons—might be used to deter conventional escalation short of the existential threat consideration.

Mutual scepticism among great powers has also meant the intensification of concern in the United States about China's continued commitment—now more than five decades long—to an absolute 'no first use' posture amid Beijing's pursuit of technologies like multiple independently targetable re-entry vehicles (MIRVs). At least one US intelligence agency has offered an assessment that China's nuclear force size is expected to double in the coming years. "China is likely to at least double the size of its nuclear stockpile in the course of implementing the most rapid expansion and diversification of its nuclear arsenal in China's history", Lt. Gen. Robert Ashley, director

⁸ K.B. Payne, "Nuclear Deterrence in a New Era: Applying 'Tailored Deterrence'", *National Institute for Public Policy*, no. 431, 21 May 2018, <https://www.nipp.org/2018/05/21/payne-keith-b-nuclear-deterrence-in-a-new-era-applying-tailored-deterrence/>.

⁹ Translation of Russian doctrine appearing in O. Olikier and A. Baklitskiy, "The Nuclear Posture Review and Russian 'De-Escalation': A Dangerous Solution to a Nonexistent Problem", *War on the Rocks*, 20 February 2018, <https://warontherocks.com/2018/02/nuclear-posture-review-russian-de-escalation-dangerous-solution-nonexistent-problem/>.

¹⁰ The Military Doctrine of the Russian Federation, no. Pr.-2976, 25 December 2014, <https://rusemb.org.uk/press/2029>.

of the US Defense Intelligence Agency, said in May 2019.¹¹ However, some question the likelihood of this projection.¹²

In Washington, Moscow, and Beijing alike, nuclear posture planning and thinking on deterrence are largely being built upon perceptions of the adversary's intentions that may not be accurate. Without any trilateral consultation on strategic stability that might allow for the open airing of concerns on these doctrinal issues, misperceptions are likely to heighten. As three of the five NPT nuclear-weapon States, the United States, the Russian Federation, and China have committed to undertake largely descriptive exercises on nuclear doctrine matters as part of the 2020 NPT Review Conference, but this appears to merely scratch the surface on the sources of mistrust. Frank exchange among the great powers on doctrinal risk issues appears to suffer from the same challenges confronting arms control today, namely that none of the three appear to believe that greater transparency can usefully augment security. As a result, misperceptions persist and nuclear risks remain higher than they could otherwise be.

Fundamentally, modern complexities, such as cooperation between the Russian Federation and China on ballistic missile early-warning technology, suggests that the notion of distinct deterrence dyads may no longer be a useful framework.¹³ Moscow and Beijing are not formal allies, but they do find themselves in something of a twenty-first century entente, finding common cause in opposing US strategic objectives in their immediate peripheries. The United States also finds itself in a third nuclear dyadic deterrence relationship with the DPRK; US conventional and nuclear posturing in East Asia today, for instance, cannot isolate these distinct dyads. US efforts to develop and deploy new post-INF conventional missile capabilities to augment deterrence of China in a Taiwan Strait contingency, for instance, will heighten nuclear risks with the DPRK by increasing incentives for Pyongyang to revise its peacetime nuclear posture.¹⁴

¹¹ R.P. Ashley Jr., "Russian and Chinese Nuclear Modernization Trends", *Defense Intelligence Agency*, 29 May 2019, <https://www.dia.mil/News/Speeches-and-Testimonies/Article-View/Article/1859890/russian-and-chinese-nuclear-modernization-trends/>.

¹² H.M. Kristensen, "DIA Estimates for Chinese Nuclear Warheads", *Federation of American Scientists*, 31 May 2019, <https://fas.org/blogs/security/2019/05/chinese-nuclear-stockpile/>.

¹³ S. Kravchenko, "Putin Says Russia Is Helping China Build Missile Warning System", *Bloomberg.com*, 3 October 2019, <https://www.bloomberg.com/news/articles/2019-10-03/putin-says-russia-is-helping-china-build-missile-warning-system>.

¹⁴ A. Panda, "New U.S. Missiles in Asia Could Increase the North Korean Nuclear Threat", *Foreign Policy*, 13 November 2019, <https://foreignpolicy.com/2019/11/14/us-missiles-asia-inf-north-korea-nuclear-threat-grow/>.

»» GREAT POWER COMPETITION AND EMERGING CAPABILITIES

Since US withdrawal from the 1972 Anti-Ballistic Missile Treaty (ABM Treaty) and subsequent US investment in homeland missile defence systems, Beijing and Moscow have perceived a threat to their strategic nuclear deterrents, prompting investments in a range of technological solutions to better assure the survivability of their nuclear forces. US policy as of the 2019 Missile Defense Review remains that its homeland missile defences are exclusively aimed at limited threats from States like the DPRK and not at the strategic deterrents of China and the Russian Federation, but comments from sources such as President Donald J. Trump that the goal of American missile defences are to “ensure we can detect and destroy any missile launched against the United States—anywhere, anytime, anyplace”—have undermined the credibility of those assurances.¹⁵ As discussed earlier, the strategic mistrust arising from great power competition has led to worst-case-scenario planning in both the Russian Federation and China in response to perceived risk from US missile defences.

China and the Russian Federation have dealt with these challenges in different ways. Beijing has reacted to date by MIRVing and pursuing more robust solid-fuel, road-mobile missiles, like the DF-41. Additionally, China is leading the pack in terms of theatre-range hypersonic boost-glide weapons like the DF-17, which for the moment remains conventional only.¹⁶ The Russian Federation has reacted by pursuing the development of a suite of increasingly exotic weapons to bolster its ability to assuredly retaliate and penetrate American missile defences. Though not strictly an arms race, the United States, the Russian Federation, and China appear to be experiencing ‘technology racing’ dynamics, whereby each is seeking to become the first-mover in certain critical technologies. Hypersonic boost-glide weapons are a case in point.¹⁷ The Russian Federation’s late-2019 deployment of the Avangard payload for the SS-19 (Mod 4) and China’s imminent 2020 deployment of the DF-17 hypersonic glide vehicle (HGV) equipped missile have led to concerns in the United States that Washington, by trailing in its deployment of HGV systems, is being put in a strategically disadvantageous position.¹⁸ Similar pressures also exist with regard to other so-called

¹⁵ P. Stewart, “Trump Missile Defense Review Calls North Korea ‘Extraordinary Threat’”, *Reuters*, 18 January 2019, <https://fr.reuters.com/article/idUSKCN1PB04V>.

¹⁶ J. Acton, “China’s Ballyhooed New Hypersonic Missile Isn’t Exactly a Game-Changer”, *Washington Post*, 4 October 2019, <https://www.washingtonpost.com/opinions/2019/10/04/chinas-ballyhooed-new-hypersonic-missile-isnt-exactly-game-changer/>.

¹⁷ On HGVs and their strategic stability consequences, see I. Oelrich, “Cool Your Jets: Some Perspective on the Hying of Hypersonic Weapons”, *Bulletin of the Atomic Scientists*, vol. 76, no. 1, 2020, <https://doi.org/10.1080/00963402.2019.1701283>; J. Borrie, A. Dowler, and P. Podvig, *Hypersonic Weapons: A Challenge and Opportunity for Strategic Arms Control*, UNODA/UNIDIR, 2019, <http://www.unidir.ch/files/publications/pdfs/hypersonic-weapons-a-challenge-andopportunity-for-strategic-arms-control-en-744.pdf>.

¹⁸ Such concerns appear explicitly in US debates on funds appropriation for hypersonic glide vehicle development: “Adversaries have made alarming progress in developing and demonstrating such

‘emerging’ technologies, including artificial intelligence, quantum technologies, and directed energy weapons.

Beyond the more frequently discussed contested technologies, certain nuclear delivery concepts have found renewed currency in recent years. A prominent example is the Russian Federation’s Burevestnik cruise missile, which remains under development and is said to use an unspecific nuclear reactor power source. The Burevestnik was announced alongside systems like the Avangard and the Poseidon during Russian President Vladimir Putin’s March 2018 address to the Federal Assembly and, as such, is also designed to posit a solution to Russian concerns about US theatre and homeland missile defences. With a purported unlimited flight range, the Burevestnik is designed to assure a second strike.¹⁹ In theory, given its position as a second-strike weapon, the Burevestnik may prove stabilizing on US first-strike incentives and thereby decrease Russian perceptions of insecurity. However, it has become apparent that the core technology underlying the Burevestnik’s nuclear propulsion unit presents a major source of risk. In August 2019, a Burevestnik missile undergoing recovery operations near the Russian town of Nenoksa exploded, killing multiple scientists working on the system and causing an unspecified level of radiological contamination in the nearby area. In the 1950s, the United States abandoned a similar nuclear-propulsion-based cruise missile under the Project Pluto scheme after encountering insurmountable technical challenges that presented several sources of risk. Burevestnik, in particular, represents a system with a dangerous scope for nuclear and radiological accidents. Underscoring the ‘technology race’ dynamic underscoring certain new Russian systems, Putin emphasized in his public presentation of the Burevestnik that “no other country has developed anything like this”.²⁰ He went on to underscore the unique primacy of Russian technological advancement, adding that “there will be something similar one day but by that time our guys will have come up with something even better”.²¹

While the latter half of the 2010s largely saw the profusion of interest in many of these ‘emerging’ technologies and their relationship to nuclear risk and crisis stability, the broader process of their emergence dates back to the early 2000s and the demise of the ABM Treaty. ‘Technology racing’ has manifested a cat-and-mouse game between the offence (the Russian Federation, China) and the defence (the United States). Instead of new technologies (for instance, hypersonic boost-glide weapons) urging a

weapons, far outstripping the pace of United States advancements”; *Department of Defense Appropriations Act, 2020*, Explanation of Effects, p. 73, <https://appropriations.house.gov/sites/democrats.appropriations.house.gov/files/HR%201158%20-%20Division%20A%20-%20Defense%20SOM%20FY20.pdf>.

¹⁹ D. Stefanovich, “New Russian Second Strike Systems”, presentation at Institute for Peace Research and Security Policy at the University of Hamburg, 20 August 2019, https://ifsh.de/file/person/Stefanovich_New_Russian_2nd_Strike_IFSH.pdf.

²⁰ V. Putin, “Presidential Address to the Federal Assembly”, 1 March 2018, <http://en.kremlin.ru/events/president/news/56957>.

²¹ Ibid.

swing toward greater mutual vulnerability and thereby ultimately promoting strategic stability, threat perceptions remain high.²² Russian and Chinese investments in boost-glide weapons have, for instance, heightened US interest in expanding the scope of missile defence research and development to counter these weapons by expanding both the sensor and interceptor layers for missile defence technologies. Medium-range, dual-capable hypersonic boost-glide systems like China's DF-17 can also contribute to crisis instability. Breaking this cycle will require a fundamental change at the first-order level in the competitive relationships between these States, allowing Washington to introduce missile defences to arms control in exchange for limits on exotic and advanced Russian and Chinese delivery systems.

²² For more on technological developments and their impact on risk, see J. Borrie's contribution to this volume.

ESCALATION RISKS

Much contemporary escalation risk stems from high-level competition between the great powers; in many circumstances, competition and mistrust among the three great powers have worsened regional dilemmas. Furthermore, as a result of doctrinal misperceptions in both the US–Russia and US–China nuclear deterrence dyads, escalatory risks are non-negligible. Many of the fundamental trends of the post-Cold War strategic environment insofar as it relates to nuclear risks—for instance, the notion of continued warhead stockpile reductions in the Russian Federation and the United States—no longer appear to be ironclad as arms control agreements crumble. Similarly, there are questions as to whether the three pre-eminent great powers—the Russian Federation, the United States, and China—could realistically offer a twenty-first century affirmation of the famous assurance from US President Ronald Reagan and Soviet President Mikhail Gorbachev that “a nuclear war cannot be won and must never be fought”.²³

For the United States, the possibility of limited nuclear use on the Korean Peninsula remains, providing, to some at least, the potential for a ‘winnable’ nuclear war against the DPRK. The 2018 Nuclear Posture Review, for instance, observed that because the DPRK relies on “hardened and deeply buried facilities to secure the Kim regime”, the United States would “field a range of conventional and nuclear capabilities able to hold such targets at risk”.²⁴ The same document does not acknowledge any form of vulnerability to the DPRK nuclear arsenal suggesting that the United States intends to leave open the possibility of nuclear use to punish the DPRK and thus to prevail. The precise escalatory threshold for nuclear use remains ambiguous, but the risk of nuclear escalation by the United States serves its deterrence objectives. Where escalation risks are most acute in a multipolar context, however, is in South Asia and Northeast Asia, where two nuclear-weapons possessors—Pakistan and the DPRK—rely on deterring conventionally superior adversaries by threatening to use nuclear weapons first.

SOUTH ASIA

India and Pakistan have now 21 years of nuclear co-existence and nuclear learning between them, having fought a limited conventional war in 1999 and faced off in a risky, conventional skirmish in 2019. Ambiguity concerning intentions, escalation thresholds, and signalling exists in South Asia today, as the February 2019 skirmish

²³ “Joint Statement by Reagan, Gorbachev”, *Washington Post*, 10 December 1987, <https://www.washingtonpost.com/archive/politics/1987/12/11/joint-statement-by-reagan-gorbachev/cd990a8d-87a1-4d74-88f8-704f93c80cd3/>.

²⁴ Office of the US Secretary of Defense, “2018 Nuclear Posture Review”, February 2018, p. 33, <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF>.

demonstrated.²⁵ Both States may have additionally learned dangerous lessons from that skirmish, sensing that there exists greater space for conventional brinkmanship than previously presumed. Meanwhile, the region remains poor in formal institutions of nuclear restraint and arms control. Nuclear risk scenarios in South Asia are broadening instead of narrowing. Perceptions of India's fraying commitment to its policy of 'no first use' has also contributed to a sense of vindication in Pakistan regarding Indian intentions.²⁶ Finally, in the realm of technology, both India and Pakistan have started to explore sea-based nuclear weapons, presenting unique challenges for command and control as well as safety and security.²⁷

India's twin deterrence challenges vis-à-vis China and Pakistan highlight another instance of multipolar nuclear risk. For instance, India faces the task of devising a force structure that can deter both what it perceives an offensively oriented Pakistan, relying on a nuclear strategy of low-threshold first-use, and China, which postures to assure retaliation buttressed by a credible peacetime policy of no first use. (Few Indian strategists take China's no first use policy at face value.²⁸) These tasks appear irreconcilable for India, where decision makers may feel that they must necessarily size their force to account for deterrence requirements vis-à-vis China, even if this exacerbates Pakistani threat perceptions.²⁹

US officials have recently suggested that processes of trilateral arms control or strategic stability consultations among the United States, the Russian Federation, and China could have salutary effects on South Asian risks. Trilateral arms control "has the potential to help reduce arms race pressures in the South Asian context, too".³⁰ The December 2019 comments from Christopher Ford, the US Assistant Secretary for International Security and Nonproliferation, suggest increased thinking about multipolar linkages in nuclear risk; the mechanism by which he identified a potential decrease in arms race pressures in South Asia hinges on new limitations on China's nuclear arsenal feeding back into Indian thinking on nuclear deterrence requirements. New Delhi has stated publicly that it relies on a credible minimum deterrence. However, the Indian posture that may be required to achieve minimum deterrence of China almost certainly exceeds that which would achieve minimum deterrence vis-à-vis

²⁵ J.G. Lewis, "'Night of Murder': On the Brink of Nuclear War in South Asia", *Nuclear Threat Initiative*, 6 November 2019, <https://www.nti.org/analysis/articles/night-murder-brink-nuclear-war-south-asia/>.

²⁶ C. Clary and V. Narang, "India's Counterforce Temptations: Strategic Dilemmas, Doctrine, and Capabilities", *International Security*, vol. 43, no. 3, 2019, https://doi.org/10.1162/isec_a_00340.

²⁷ C. Clary and A. Panda, "Safer at Sea? Pakistan's Sea-Based Deterrent and Nuclear Weapons Security", *The Washington Quarterly*, vol. 40, no. 3, 2017, <https://doi.org/10.1080/0163660X.2017.1370344>.

²⁸ A. Panda, "India's Rethink on 'No First Use' Nuclear Policy Won't Surprise China or Pakistan", *South China Morning Post*, 25 August 2019, <https://www.scmp.com/news/china/diplomacy/article/3024256/indias-rethink-no-first-use-nuclear-policy-wont-surprise-china>.

²⁹ See M. Sethi's contribution to this volume for a more thorough discussion of nuclear risks in South Asia.

³⁰ C.A. Ford, "The P5, the 'N5,' and the NPT Review Conference", United States Department of State, 16 December 2019, <https://www.state.gov/the-p5-the-n5-and-the-npt-review-conference/>.

Pakistan. Indian views on the desirability of US–China (or US–Russia–China) arms control are unknown.

NORTHEAST ASIA

The qualitative and quantitative growth of the DPRK as a regional nuclear power has reached a stage where, at least in the short- to medium-term, it will attempt to practice nuclear deterrence against the United States and its allies—seeking stability in the form of what DPRK officials have called the ‘balance of power’ or an ‘equilibrium of force’.³¹ Nuclear risk on the Korean Peninsula primarily stems from the relative immaturity of experience in the new nuclear deterrence dyad that exists between Washington and Pyongyang. While the two—with the Republic of Korea and Japan in tow as US allies—have decades of experience in conventional deterrence, the prospect of nuclear war presents a new challenge that the two sides have started to grapple with unilaterally, but not in the context of meaningful dialogue. The United States and the DPRK seemingly have had no bilateral dialogues on the consequences of their newfound nuclear deterrence relationship.

The ‘DPRK problem’ manifests nuclear weapon use risks along several pathways, both advertent and inadvertent. For instance, problems of command and control and nuclear safety and security abound in the DPRK, which has chosen to orient itself offensively with a low threshold for use.³² Escalation risks are also manifold. In a multipolar context, a primary concern will be the ways in which measures taken by the United States, the Republic of Korea, and Japan to deter war with the DPRK will threaten the perceived interests of the Russian Federation and China. A secondary set of concerns stems from the ways in which the Korean Peninsula will contribute to rising regional nuclear risks by introducing proliferation pressures on US allies. The challenge of alliance decoupling is acute today in Northeast Asia. For instance, missile defence and sensor deployments in that theatre to manage the DPRK challenge have already contributed to tensions, such as the 2017 deployment of a US Terminal High Altitude Area Defense battery in Seongju, Republic of Korea. These drive nuclear risks at the great power level by sowing mistrust and encouraging the pursuit of larger, more survivable nuclear forces. China reacted to the US deployment negatively, fearing that the powerful AN/TPY-2 X-band radar accompanying the battery might be capable of cueing US homeland missile defences and reducing the survivability of China’s

³¹ “N.K. Vows to Complete Nuke Program for ‘Equilibrium’ of Force with U.S.”, *Yonhap News Agency*, 16 September 2017, <https://en.yna.co.kr/view/AEN20170915008051315>.

³² See T. Ogilvie-White’s contribution to this volume for a more thorough discussion of nuclear risks in Northeast Asia. The Democratic People’s Republic of Korea has at least once professed publicly a policy of no first use. More recently, its leader Kim Jong Un has offered a negative security assurance. See “DPRK Report on the Third Plenary Meeting of the Seventh Central Committee,” National Committee on North Korea, 25 April, 2018, https://www.ncnk.org/resources/publications/dprk_report_third_plenary_meeting_of_seventh_central_committee_of_wpk.pdf.

strategic deterrent.³³ The pursuit of added survivability, while potentially stabilizing in some ways, will have pernicious effects on the great power security dilemma in Northeast Asia.

The deterrence relationship between the United States and the DPRK should also consider the inadvertent nuclear escalation risks and misunderstandings that can arise from geographic constraints. For instance, in a strategic nuclear exchange initiated by the DPRK against the US homeland, the United States would employ its Ground-Based Interceptors—the kinetic component of its Ground-Based Midcourse Defense system. These Ground-Based Interceptors may appear as inbound US intercontinental ballistic missiles to Russian early warning systems, heightening the risk of an inadvertent US–Russian nuclear exchange.³⁴ US–Russian strategic stability talks, when they consider Moscow’s concerns on missile defence, should address this issue and how Washington might continue to posture for limited homeland missile defence while limiting the possibility of inadvertent nuclear escalation.

OTHER REGIONAL ESCALATION RISKS

The contemporary multipolar environment is complicated by other factors that might play a role in nuclear escalation, including proxy conflicts (in the Syrian Arab Republic, Ukraine, etc.), and the proliferation of conventional, stand-off precision strike weapons to several non-nuclear States. Many US allies covered under collective security arrangements providing for extended nuclear deterrence are in possession of such weapons, which are perceived by the Russian Federation and China to play a role in conflict escalation. This is most acute in the context of the NATO–Russia relationship, but similar concerns exist in Northeast Asia, where the Republic of Korea and increasingly Japan invest in such weapons. In the context of US alliances with these States, pre-war planning and exercises are designed to ensure that escalation is coordinated, but a broader multilateral conversation should begin on the role these non-nuclear States may play and the exposure they may have to nuclear retaliation. Post-INF debates in the United States on the basing of conventional ballistic and cruise missile systems may further heighten these challenges.

³³ A. Panda, “THAAD and China’s Nuclear Second-Strike Capability”, *The Diplomat*, 8 March 2017, <https://thediplomat.com/2017/03/thaad-and-chinas-nuclear-second-strike-capability/>.

³⁴ J.H. Pollack, “Nuclear Dangers from North Korea: Managing the Risks to the US and Russia”, *Russia Matters*, 27 October 2017, <https://www.russiamatters.org/analysis/nuclear-dangers-north-korea-managing-risks-us-and-russia>.

RISK REDUCTION RECOMMENDATIONS

Preserving arms control. Nuclear risk reduction in a time of increasing competitive dynamics between Washington, Beijing, and Moscow will not be a simple task, but there are practical and feasible short-term measures that can be taken to meaningfully address the issues raised above. One of the most significant cross-cutting issues that stands to affect nuclear weapon risk more broadly in the coming years is that the total erosion of verifiable limits on the nuclear forces of the United States and the Russian Federation may give way to a Cold War-style quantitative expansion of capability. The February 2021 expiration of New START should not be allowed to pass without the treaty being extended for five years. In doing so, the United States and the Russian Federation can preserve a baseline of quantitative parity, which will allow for subsequent risk reduction measures to be most effective. With the expiration of New START, all other risks stand to grow and rapidly amplify.

Building US–Russia mutual understanding. For the United States and the Russian Federation, beyond preserving what remains of strategic arms control measures, greater consultations on strategic stability are necessary. For the United States, the Russian Federation’s large stockpile of what are commonly referred to as non-strategic nuclear weapons is a cause of concern and dialogue could better help shed anxieties about an ‘escalate to deescalate’ strategy.³⁵ For the Russian Federation, dialogue could provide a useful forum to better understand the realities and constraints around US missile defence programmes. The ‘strategic security’ dialogues that have taken place between the two sides in 2019 and early 2020 have not yet meaningfully contributed to nuclear risk reduction.³⁶ Divergent readouts on these dialogues suggest that mutual understanding on issues ranging from doctrine to arms control between the Russian Federation and the United States is lacking.

US–China competition and cooperation. In the US–China context, there is a drastic need for dialogue and transparency on nuclear issues. A serious, high-level US–China bilateral dialogue at the official level on nuclear issues has not taken place since April 2008, but in December 2019, the United States extended a formal invitation to China for a strategic security dialogue on nuclear risk reduction & arms control.³⁷ Growing mistrust in Beijing about US intentions renders dialogue less appealing, partly because China relies on a certain degree of opacity about its nuclear forces to augment its lean, retaliatory deterrent. While a nuclear dialogue may not be realistically convened in the short term, the two sides should continue to build confidence through regular high-

³⁵ Significantly, New START does not allow for increased transparency around the Russian Federation’s non-strategic nuclear arsenal.

³⁶ R. Rampton, “U.S., Russia to Discuss Nuclear Arms Limits in Geneva on Wednesday: Officials”, *Reuters*, 16 July 2019, <https://www.reuters.com/article/us-usa-trump-russia-idUSKCN1UA268>.

³⁷ State ISN Bureau, Twitter, accessed 20 December 2019, <https://twitter.com/StateISN/status/1208099893266530306>.

level military-to-military contacts and other strategic dialogues, such as the Diplomatic and Strategic Dialogue, which did not convene in 2019 amid heightened mistrust.³⁸ As long as quantitative asymmetries in their nuclear forces persist, technical dialogues will be difficult, but the two sides can work to scope any future dialogue around the issue of doctrine itself. General consultation on strategic stability issues, however, would appear to be in the mutual interest of both Beijing and Washington. As one prominent Chinese scholar noted, even trilateral consultations with the Russian Federation may be possible: “if the proposed trilateral negotiations are not about the number of weapons but strategic stability, China should get on board as soon as possible”.³⁹

NPT review process and beyond. The P5 process in the NPT review cycle will culminate at the 2020 Review Conference. Here too, great power competition and mistrust has led to difficulties in building a united front. But shared understandings on doctrines and especially the peaceful uses of nuclear technology should be low-hanging fruit for the five NPT nuclear-weapon States, including the United States, the Russian Federation, and China, to find space for productive agreement. Insofar as risk reduction measures are concerned, clarity on doctrine issues within the P5 process could provide a boon to eventual bilateral, dyadic consultations at the great power level. The three major powers should also provide clarity on their respective nuclear modernization plans. Even in a time of low trust, the process can provide a useful forum for consultation and confidence-building. The P5 can also simultaneously encourage other multilateral efforts at fostering exchange on risk reduction and disarmament matters, including those like the US-led Creating an Environment for Nuclear Disarmament initiative and the ‘Stepping Stones’ process. Finally, recognizing that present multilateral nuclear dynamics have far surpassed the original possessors legitimized as nuclear-weapon States under the NPT, the P5—the five nuclear-weapon States—should explore direct engagement on risk reduction matters with non-NPT nuclear-armed States, including India, Pakistan, and the DPRK, focusing on nuclear risk reduction directly.

³⁸ “U.S.-China Diplomatic and Security Dialogue”, US Department of State, 9 November 2018, <https://www.state.gov/u-s-china-diplomatic-and-security-dialogue-3/>.

³⁹ F. Jishe, “Trilateral Negotiations on Arms Control? Not Time Yet”, *China-US Focus*, 13 September 2019, <https://www.chinausfocus.com/peace-security/trilateral-negotiations-on-arms-control-not-time-yet>.

RECOMMENDATIONS TO REDUCE NUCLEAR RISK LINKED TO MULTIPOLARITY



Engage in strategic dialogues and consultations

- US–Russia discussion on strategic stability concepts: e.g. non-strategic nuclear weapons, ‘escalate to deescalate’ concerns, and missile defence
- US–China discussion on nuclear issues, including transparency; expand military-to--military contact (e.g. Diplomatic and Strategic Dialogue)



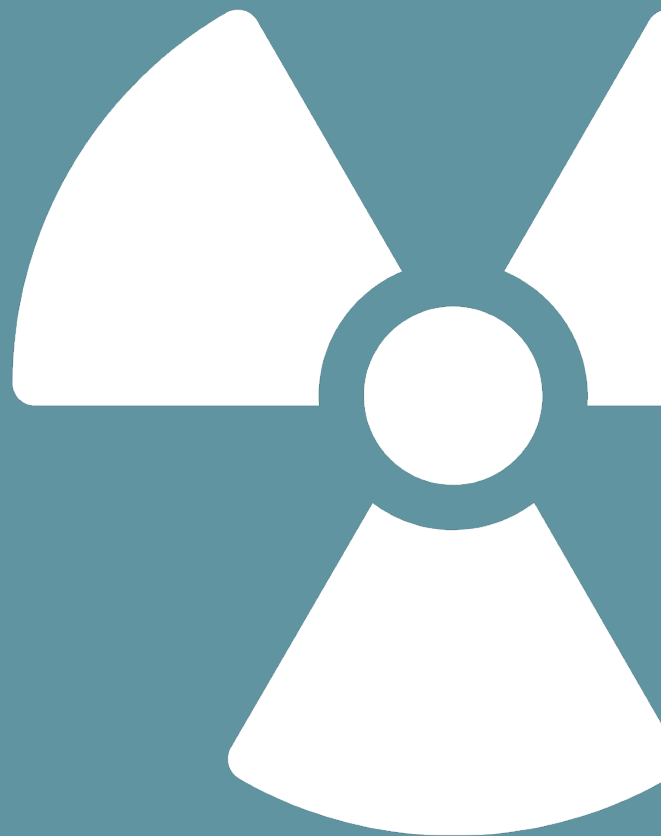
Build upon the P5 process

- Discuss understandings of doctrines and peaceful nuclear use
- Promote clarification on doctrine issues and modernization plans
- Explore engagement on risk reduction with all nuclear-armed States
- Encourage other multilateral efforts on risk reduction and disarmament

CHAPTER 4

NUCLEAR RISK AND THE
TECHNOLOGICAL DOMAIN:
A THREE-STEP APPROACH

John Borrie



SUMMARY

- Outright strategic rivalry and competition has returned among several of the nuclear-armed States and there is less predictability in their strategic relations since many decades. Lack of strategic predictability can contribute to misperceptions, more intensive military–technological competition and raise the risk of stumbling into crisis and nuclear conflict.
- This chapter focuses on the cross-cutting impacts of technological developments because—individually and in combination—these have implications for strategic balance and predictability, especially in crises. These technologies include missile defences, advanced long-range missiles (including hypersonic weapons), anti-satellite systems, cyber, artificial intelligence and machine learning (which, among other things, underpin increasingly autonomous systems) and, standing slightly apart from these technologies, lower-yield nuclear weapons.
- A three-step approach is outlined to contribute in the difficult current strategic environment to greater predictability in the relations and assessments of the nuclear-armed States as well as others involved in a position to develop some of these technologies.

INTRODUCTION

Although nuclear war was always a risk during the Cold War, today's dynamics are a far cry from the bipolarity of that situation, or the brief period of US hegemony after its end in which the United States knew no military or technological peer. In the last decade, naked strategic rivalry and competition among several of the nuclear-armed States have returned. Military competition between several of the nuclear-armed States, fuelled by greater uncertainty about each other's intentions and capabilities—strategic unpredictability—is making the world a more dangerous place. The risk is rising of nuclear-armed States stumbling into crisis and conflict, and correspondingly, of nuclear weapon use in those circumstances, whether caused deliberately or inadvertently.

Uncertainty is an endemic feature of international security politics and, in itself, does not necessarily lead to greater nuclear risk. However, four intertwined trends are contributing to contemporary strategic unpredictability that create new pathways to nuclear use and may broaden the range of other circumstances in which nuclear risk is elevated because strategic rivals find it more difficult to communicate and assess in crisis. First, there are more nuclear-armed States and greater multipolarity, with several triads, especially China–Russia–US and China–India–Pakistan, that are also managing to make their relationships more complex.¹ Second, relations between some of these States are becoming more tense. Third, the fabric of international institutions and norms that, historically, have contributed to stability are deteriorating.² Fourth, there is the as yet uncertain impact of several current or imminent technological developments. These include anti-ballistic missile defences, hypersonic and other advanced long-range weapons, anti-satellite weapons, cyber, and artificial intelligence (AI) and machine learning. Although not a new technology per se, lower-yield nuclear weapons are a related development.

Most of the other chapters in this volume consider the implications of the trends above for nuclear risk in specific geopolitical regions. This chapter focuses specifically on the cross-cutting impact of the fourth trend—technological developments—because, individually and in combination, these have implications for the strategic balance. These implications are unlikely to be all good or all bad. Rather, their effects will likely be mixed in differing proportions at different times as each are products of—and fuel

¹ See A. Panda's contribution to this volume. Other triangles include China–Democratic People's Republic of Korea–United States; see also R. Einhorn and W.P.S. Sidhu (eds), *The Strategic Chain Linking Pakistan, India, China and the United States*, The Brookings Institution, 2017.

² See J. Revill et al., *Compliance and Enforcement: Lessons from Across WMD-Related Regimes*, UNIDIR, December 2019, <https://unidir.org/publication/compliance-and-enforcement-lessons-across-wmd-related-regimes>; N. Tannenwald, "The Great Unraveling: The Future of the Nuclear Normative Order," in N. Tannenwald and J.M. Acton (eds), *Meeting the Challenges of the Nuclear Age*, American Academy of Arts and Sciences, 2018.

for—strategic modernization and arms racing among major strategic competitors like the Russian Federation, China, the United States and India in particular.

The impact of some of these technological developments might conceivably be countered by adjustments in nuclear doctrines. But those changes clear the path for capabilities and scenarios that could be destabilising in certain situations (which is a reason why lower-yield nuclear weapons are discussed here). Despite the caution that the risk of nuclear weapons use has induced in decision makers in nuclear-armed States since early in the Cold War, in crisis escalation situations technologies ostensibly intended to strengthen deterrence could inadvertently contribute to greater crisis instability and a breakdown of deterrence instead. This is acutely relevant to some nuclear-use scenarios considered in this volume.

This chapter argues that reducing unpredictability is an important reason for the nuclear-armed States to seek new cooperative arrangements, including—but not limited to—formal arms control agreements. In fact, given the more complex dynamics of the current strategic environment, it is likely that the role of legal agreements will be less central than in the past. Instead, arms control agreements of various kinds, possibly following on from specific unilateral declarations, could tangibly narrow the pathways to nuclear weapon use and have other stabilizing benefits. The question is: what is of practical use and feasible in a contemporary environment that is politically fraught and in which the impacts of several possibly destabilizing strategic technologies have yet to be fully felt? This chapter suggests a three-step approach moving forward.

INCREASING STRATEGIC CONCERNS

Today, nuclear war planners in some nuclear-armed States are confronted by the possibility of new technology leading to a way out of mutual, nuclear vulnerability that has informed their deterrent postures toward some of their nuclear rivals. They are less certain than they were about 'strategic stability'.³ The increasing unpredictability of the strategic situation has practical consequences because nuclear planning includes extreme contingencies, even if these seem initially unlikely. If certain contingencies that would have major ramifications cannot be excluded (say, amid an escalating conventional conflict, an adversary striking national nuclear command-and-control systems to try to destroy them, thereby nullifying one's nuclear deterrent) it means steps must be taken to forestall them.

Steps to forestall such possibilities can have a number of implications from a risk perspective. For instance, as mentioned above, nuclear-armed States may adjust their doctrines and operations to account for those contingencies. This could mean a more expansive scope of the circumstances in which States are willing to use nuclear weapons, as when the United States did not exclude the possibility of a nuclear response to "non-nuclear strategic attacks" in its 2018 Nuclear Review Posture.⁴ This begs the question of what such an attack is: could it include a major cyber-attack on a nation's critical infrastructure, for example? Structurally, there can also be a spiral effect as nuclear-armed States seek to ensure their nuclear deterrent capabilities against additional contingencies. In turn, some of the strategic technologies developed to enhance the credibility of one's nuclear deterrent capability can, in crisis situations, create new ambiguities that prompt escalatory responses (based on worst-case analysis) by other nuclear-armed States.

All the nuclear-armed States have their respective strategic concerns. Those of China, the Russian Federation and the United States are acute as each strives to retain nuclear retaliatory capability—something long seen as the bedrock for 'strategic stability'. Beside second-strike capability to respond to the kind of surprise scenario outlined above, an especially taxing scenario for the United States is one in which the Russian Federation attempts to negate the US nuclear deterrent through its own limited use

³ There is no settled definition of 'strategic stability', but briefly described it is "the processes, mechanisms, and agreements that facilitate the peacetime management of strategic relationships and the avoidance of nuclear conflict, combined with the deployment of military forces in ways that minimize any incentive for nuclear first use". See E.J. Moniz and S. Nunn, "The Return of Doomsday: The New Nuclear Arms Race—and How Washington and Moscow Can Stop It", *Foreign Affairs*, 6 August 2019, <https://www.foreignaffairs.com/articles/russian-federation/2019-08-06/return-doomsday>. For a recent discussion of notions of strategic stability see L. Rubin and A.N. Stulberg (eds.), *The End of Strategic Stability? Nuclear Weapons and the Challenges of Regional Rivalries*, Georgetown University Press, 2018, pp. 4-5.

⁴ US Department of Defense, *Nuclear Posture Review 2018*, February 2018, pp. 20-21: <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF>.

of nuclear weapons in a conflict to effect a military *fait accompli* (for instance, in the Baltic States or Eastern Europe), then, if conflict escalates, uses hypersonic and anti-satellite weapons and cyber offensive capabilities to attack US nuclear command, control and communication (C3) infrastructure on Earth and in space to assist a nuclear decapitating strike.

To a greater degree than in the United States, a persistent strategic concern for the Russian Federation—as well as for China due to its much smaller nuclear arsenal—appears to be a decapitating US nuclear strike with missile defences absorbing counter-strikes by those Russian or Chinese nuclear forces that survive the first attack. (This is a reason why China and the Russian Federation, among others, are possibly so concerned that the United States might place weapons in space, including as part of missile defence systems.) The point is not to argue these scenarios are likely, but nuclear planners cannot discard them, and so this exerts a pull on their perceptions about the capabilities and plans they require, especially as tensions in some of their relationships increase.

A word is also needed about the management of nuclear early-warning and C3 systems in crisis situations. By their nature, these systems are highly complex and very tightly coupled, and are environments in which failures that can lead to accidents are elevated and, some experts argue, perhaps even inevitable.⁵ Because of the ways such systems are tied together, unexpected failures can quickly multiply and interact in ways that no one can predict or respond to quickly or effectively enough to avert bad outcomes—nuclear weapon use would be a bad outcome—because of their incomprehensibility for a time of these failures to the operators.⁶ From the limited amount that is known, failures in nuclear C3 systems have brought the world close to nuclear use on several occasions and have underlined the importance of human judgement under pressure as a safeguard.⁷

It follows that nuclear risk could increase from the introduction of new technologies that create new failures and ‘hidden interactions’ which make the job of nuclear decision makers already under intense pressure more difficult. While, in principle, there is general agreement that this is best avoided, there are also many advantages to some new technologies, such as self-optimizing machine systems, which make their appeal hard to resist, especially if rivals are using them, or are suspected to be doing so. As

⁵ Tight coupling means that “there is no slack or buffer or give between two items. What happens in one directly affects what happens in the other.” Nuclear weapons on high-alert status are tightly coupled in nature. See C. Perrow, *Normal Accidents: Living with High-Risk Technologies*, Princeton University Press, 1999, pp. 89–90. See also S.D. Sagan, *The Limits of Safety: Organizations, Accidents, and Nuclear Weapons*, 1993, and B.G. Blair, *The Logic of Accidental Nuclear War*, The Brookings Institution, 1993.

⁶ See J. Borrie, *A Limit to Safety: Risk, ‘Normal Accidents’, and Nuclear Weapons*, ILPI-UNIDIR, December 2014, <https://www.files.ethz.ch/isn/186094/a-limit-to-safety-en-618.pdf>.

⁷ P. Lewis et al., *Too Close for Comfort: Cases of Near Nuclear Use and Options for Policy*, Chatham House, 2014.

the complexity of nuclear early warning and C3 systems grows with the need for timely information in response to the enhanced capabilities of other nuclear-armed States, so new strategic technologies will be key components and enablers of these systems.

»» WHICH TECHNOLOGIES?

Within this strategic context, several developments—such as anti-ballistic missile defences, hypersonic and other advanced, long-range weapons, anti-satellite weapons, cyber, AI and the un-crewed weapon systems it enables, and (sitting slightly apart from these) lower-yield nuclear weapons—can contribute to greater unpredictability overall. This is not denying some military and strategic benefits from them, although at present the utility and the technical feasibility of aspects of these technologies frequently remain unclear. For example, in some contexts, these technologies may yet prevent the escalation of conflict (for instance, US missile defences stopping a small-scale nuclear attack from the Democratic People’s Republic of Korea). Left unchecked, however, each of these developments has potential negative implications for the stability of the strategic balance as well as having potential destabilizing effects in crises between nuclear-armed States that may be difficult to predict, or both.

Broadly, these technologies do this in at least one of four ways:

1. By offering defences or means of undermining rivals’ missile and space capabilities. Beyond exploding or kinetic ‘hit-to-kill’ interceptor missiles or projectiles, developing capabilities extend to ‘left-of-launch’ capabilities such as cyber and directed-energy technologies.⁸
2. Some of these technological capabilities (such as HGV or long-range, stealthy precision missiles with conventional warheads) may be capable of performing missions once reserved for nuclear weapons such as destroying an adversary’s nuclear forces and attacking their early warning and nuclear C3 systems. To this list might be added forms of cyber and electronic intrusion that undermine operators’ confidence in the reliability of their nuclear C3 or other enabling systems.⁹
3. Technological advances that—at least in principle—permit more effective tracking of adversaries’ nuclear forces. These advances rely on a suite of technologies including better satellite remote sensing, electronic barriers, more sophisticated and autonomous sensors in drones of various kinds, machine learning and AI.
4. New nuclear weapons with higher precision and lower explosive yields may permit nuclear deterrence to be more ‘tailored’ (that is, believable) but also arguably make these more usable as plans are put in place for their use against battlefield and other military targets.

To explore these dynamics, let us now briefly turn to the individual strategic technologies of concern.

⁸ ‘Left-of-launch’ refers to attacks that aim to disable systems prior to launch.

⁹ See J. Lindsay, “Cyber Operations and Nuclear Weapons”, *NAPSNet Special Reports*, 20 June 2019, <https://nautilus.org/napsnet/napsnet-special-reports/cyber-operations-and-nuclear-weapons/>.

ANTI-BALLISTIC MISSILE DEFENCES

Since it left the ABM Treaty in 2002, the United States has developed more advanced tactical, theatre and homeland level missile defence systems to intercept missiles on ballistic flight paths. Progress on developing reliable homeland missile defences has so far remained limited. However, missile defences at the tactical and theatre levels focused on limited missions to protect military assets and troops have become capabilities of importance to more States as the technology has improved. The United States, the Russian Federation, India, France, Israel and China have all developed missile defence systems. Moreover, the United States has made systems available to its allies including in the Middle East (e.g. Saudi Arabia) and in Asia (e.g. Japan and the Republic of Korea).¹⁰

As these systems advance, their elements are becoming more integrated systems-of-systems.¹¹ Previous distinctions between tactical- or in-theatre-level systems for use against non-nuclear missiles and systems intended to intercept nuclear-armed missiles also are blurring with larger-scale homeland systems. The Russian Federation has repeatedly expressed its concerns that NATO's missile defence capabilities in Eastern Europe could undermine its second-strike nuclear retaliatory capability, although some experts question its claims.¹² In March 2018, Russian President Vladimir Putin cited a new generation of Russian strategic nuclear systems (including the Avangard hypersonic weapon) as stemming from the United States' withdrawal from the ABM Treaty.¹³ Even more so than the Russian Federation, China has raised this concern about the strategic implications of US missile defences in Asia due to China's relatively small number of deployed nuclear missiles.¹⁴ As captured by the Kuhn and Ogilvie-White contributions in this volume, this issue has already added significantly to tension in the Euro-Atlantic and in Northeast Asia.

¹⁰ See M. Korda and H. Kristensen, "U.S. Missile Defenses, 2019", *Bulletin of the Atomic Scientists*, 24 October 2019, pp. 295–306: <https://doi.org/10.1080/00963402.2019.1680055>.

¹¹ See Office of the US Secretary of Defense, *2019 Missile Defense Review: Executive Summary*, pp. viii–xiii: https://www.defense.gov/Portals/1/Interactive/2018/11-2019-Missile-Defense-Review/The%202019%20MDR_Executive%20Summary.pdf.

¹² For instance, see "Putin: Russia will Consider Tackling NATO Missile Defense Threat", *RT News*, 13 May 2016, <https://www.rt.com/news/342915-putin-nato-threat-missiles>; B. Roberts, "On the Strategic Value of Ballistic Missile Defense", *Proliferation Papers* 50, Institut Français des Relations Internationales, June 2014, <https://www.ifri.org/sites/default/files/atoms/files/pp50roberts.pdf>.

¹³ V. Putin, "Presidential Address to the Federal Assembly", 1 March 2018, <http://en.kremlin.ru/events/president/news/56957>.

¹⁴ G. Mullany and C. Buckley, "China Warns of Arms Race After U.S. Deploys Missile Defense in South Korea", *New York Times*, 7 March 2017, <https://www.nytimes.com/2017/03/07/world/asia/thaad-missile-defense-us-south-korea-china.html>.

HYPERSONIC AND OTHER ADVANCED, LONGER-RANGE WEAPONS

Several States are actively pursuing novel long-range manoeuvrable weapons. Cruise missiles have existed for decades in both conventional and nuclear form, and recently both the United States and the Russian Federation have developed new generations of higher performance, more stealthy types. Today is also the advent of, most significantly, hypersonic boost-glide systems comprising ballistic missiles equipped with HGVs. Hypersonic weapons like these, due to their speed, manoeuvrability, and trajectory, can be difficult for an adversary to track once separated from their booster, thus lending themselves to the types of decapitating strikes that are a growing concern. Today, four nuclear-armed States—China, the Russian Federation, the United States, and most recently France—have active HGV acquisition programmes.¹⁵ The United States intends to use boost-glide technology with conventional or kinetic (non-explosive) warheads, and China recently clarified that its DF-17 HGV is conventionally armed.¹⁶ It is unclear whether the Russian Federation's systems will be nuclear-armed. Despite the expense and technical challenges of building HGVs, other States are reportedly interested in the technology.¹⁷

Debate rages in strategic circles as to whether HGVs are significant enough to merit major investments in a military response.¹⁸ Some experts argue that HGVs are likely to remain a niche capability, and their hypersonic velocity is less impressive when it is considered that nuclear intercontinental ballistic missiles travel as fast in their terminal phase of flight and cannot be intercepted by today's missile defence systems either. In arms racing terms, there does appear to be some 'hypersonic hype'.¹⁹

The implications of HGVs for crisis stability are more concerning. Possible ambiguity about the nature of an HGV's warhead (nuclear or conventional) means the potential for strategic misunderstanding is considerable, especially given their combination of

¹⁵ K.M. Sayler, *Hypersonic Weapons: Background and Issues for Congress*, Congressional Research Service, 11 July 2019, <https://fas.org/spp/crs/weapons/R45811.pdf>; "Race for 'Hypersonic' Weapons Heats up as France Joins Fray", *Straits Times*, 29 January 2019, <https://www.straitstimes.com/world/europe/race-for-hypersonic-weapons-heats-up-as-france-joins-fray>.

¹⁶ A. Panda, "Hypersonic Hype: Just How Big of a Deal Is China's DF-17 Missile?", *The Diplomat*, 7 October 2019, <https://thediplomat.com/2019/10/hypersonic-hype-just-how-big-of-a-deal-is-chinas-df-17-missile>.

¹⁷ J. Borrie, A. Dowler, and P. Podvig, *Hypersonic Weapons: A Challenge and Opportunity for Strategic Arms Control*, UNODA/UNIDIR, 2019, <http://www.unidir.ch/files/publications/pdfs/hypersonic-weapons-a-challenge-andopportunity-for-strategic-arms-control-en-744.pdf>.

¹⁸ See T. Bussing, "Winning the Hypersonic Arms Race is a National Imperative", *Defense News*, 10 January 2020, <https://www.defensenews.com/opinion/commentary/2020/01/10/winning-the-hypersonic-race-is-a-national-imperative/>; for an opposing view see A.W. Reddie, "Hypersonic Missiles: Why the New 'Arms Race' is Going Nowhere Fast", *Bulletin of the Atomic Scientists*, 13 January 2020, <https://thebulletin.org/2020/01/hypersonic-missiles-new-arms-race-going-nowhere-fast/>.

¹⁹ See I. Oelrich, "Cool Your Jets: Some Perspective on the Hying of Hypersonic Weapons", *Bulletin of the Atomic Scientists*, vol. 6, no. 1, 2020, <https://doi.org/10.1080/00963402.2019.1701283>.

high speed and non-ballistic trajectory, and correspondingly short decision-making and reaction times for those concerned they are on the receiving end. Missile launches carrying HGVs could be interpreted as signalling an imminent nuclear attack. In this regard, it is noteworthy that some nuclear-armed States, like China, have comingled some aspects of their nuclear and conventional missile forces (such as C3 functions and deploying some of both on land-based mobile launchers).²⁰ Even if HGVs are subsequently shown on impact to be conventional their use could conceivably prompt ‘use it or lose it’ dilemmas for nuclear-armed States at risk of being targeted if they believe these weapons have been directed against their nuclear early-warning and C3 infrastructure—exacerbated by uncertainty about their intended targets due to their non-ballistic trajectories and manoeuvrability.

In view of these ambiguities, the advent of HGVs may prompt some nuclear-armed States to do something likely both cheaper and easier than to develop counter-systems or HGV capabilities. That is, those States amend their doctrines in response to HGV deployments to expand the conditions for retaliation with nuclear weapons, or by placing their nuclear forces on higher alert. From a risk reduction perspective this would be a backward step.

ANTI-SATELLITE WEAPONS

Today, all States rely on space for civil services. Many militaries are highly reliant on satellite access for purposes such as communications, navigation, and surveillance; space objects are also components of systems for early warning of nuclear attack.²¹ While the 1967 Outer Space Treaty prohibits the stationing of nuclear weapons in space, it is not necessary to put weapons in space to pose a danger to other space objects.²² Indeed, three States to date (the United States, China and, in April 2019, India) have tested ground-launched anti-satellite (ASAT) interceptor capabilities by deliberately hitting (their own) satellites with them.²³ Additionally there are a variety of ‘non-kinetic’ cyber and electronic counter-space capabilities that can disrupt or

²⁰ See E. Heginbotham et al., *China’s Evolving Nuclear Deterrent: Major Drivers and Issues for the United States*, RAND Corporation, 2017, p. 158, https://www.rand.org/pubs/research_reports/RR1628.html. In addition, it has been noted that China is introducing new dual-use missiles systems such as the DF-21 and DF-26 that “can accommodate both nuclear and conventional warheads and that do not seem to exhibit distinctive physical features between nuclear and conventional models”; see T. Zhao, “Conventional Challenges to Strategic Stability: Chinese Perceptions of Hypersonic Technology and the Security Dilemma” in L. Rubin and A.N. Stulberg (eds), *The End of Strategic Stability? Nuclear Weapons and the Challenges of Regional Rivalries*, Georgetown University Press, 2018, p. 195.

²¹ D. Porras, *Shared Risks: An Examination of Universal Space Security Challenges* (Briefing Paper for the United Nations Disarmament Commission), UNIDIR, 2019, <http://unidir.org/files/publications/pdfs/shared-risks-an-examination-of-universal-space-security-challenges-en-775.pdf>.

²² See D. Porras, *Eyes on the Sky: Rethinking Verification in Space*, UNIDIR, 2019, pp. 27–28, <https://unidir.org/publication/eyes-sky>.

²³ See B. Weeden and V. Samson (eds), *Global Counterspace Capabilities: An Open Source Assessment*, Secure World Foundation, 2019.

destroy satellites.²⁴ And any space object is at risk from collision. This makes the increasing ubiquity of co-orbital drone technology of significant international concern, especially as it is difficult to gauge the intent of proximity manoeuvres until collision is imminent.

Even if States have not placed objects in space that are unambiguously weapons (although it is hard to verify) and have not yet deliberately collided with or blown up each other's assets, interference from non-kinetic offensive space operations has been going on for some time.²⁵ The announcement that national 'space forces' will be formed in States such as the United States and India thus reflects growing concerns about the vulnerability of space-based infrastructure. In a major power conventional conflict, it is likely that adversaries will seek to neutralize each other's satellites in orbit using capabilities like those just described. Significantly, some military space infrastructure is critical to C3 for both conventional and nuclear forces. Entangled interaction between the nuclear and non-nuclear domains "could not only precipitate the use of nuclear weapons directly [it] could frustrate efforts to manage non-nuclear escalation, thus raising the risk of nuclear use later on".²⁶

CYBER

Modern life, including modern military systems, depends on digital data created, kept, managed and moved around on networks. The exploitation of code for hacking, spoofing, phishing, stealing, disrupting and even altering or destroying data has moved in from the margins to become a major security focus in the decade since 2009 when Israel's intelligence services inserted the Stuxnet virus into the nuclear centrifuge enrichment programme of the Islamic Republic of Iran.²⁷ China, the Islamic Republic of Iran, Israel, the Democratic People's Republic of Korea, the Russian Federation, the United Kingdom and the United States all have active cyber offensive operations capabilities.²⁸ Cyber offensive operations are increasingly ubiquitous and persistent. The lines are blurry between State-versus-State offensive operations, espionage and other activities, including theft and extortion, in which civilian infrastructure and bystanders are victims. In 2016, for instance, hackers believed to be linked to the DPRK stole USD 81 million from Bangladesh's central bank.²⁹

²⁴ See R.P. Rajagopalan, *Electronic and Cyber Warfare in Outer Space*, Space Dossier 3, UNIDIR, 2019, <http://unidir.org/files/publications/pdfs/electronic-and-cyber-warfare-in-outer-space-en-784.pdf>; B. Unal, *Cybersecurity of NATO's Space-Based Strategic Assets*, Chatham House, 2019, <https://www.chathamhouse.org/sites/default/files/2019-06-27-Space-Cybersecurity-2.pdf>.

²⁵ B. Weeden and V. Samson (eds), *Global Counterspace Capabilities: An Open Source Assessment*, Secure World Foundation, 2019.

²⁶ J.M. Acton, "Escalation through Entanglement: How the Vulnerability of Command-and-Control Systems Raises the Risks of an Inadvertent Nuclear War", *International Security*, vol. 43, no. 1, 2018, p. 60.

²⁷ See P.W. Singer and A. Friedman, *Cybersecurity and Cyberwar: What Everyone Needs to Know*, 2014.

²⁸ See D. Sanger, *The Perfect Weapon: War, Sabotage and Fear in the Cyber Age*, 2018.

²⁹ *Ibid.*, pp. 285–286.

Cyber offensive capabilities rise to the level of strategic concern and can drive nuclear risk in two kinds of scenario. The first is hacking or other cyber interference with nuclear early warning, C3 or decision support systems—or creating fear in the target that it has been compromised via cyber means.³⁰ In such instances, the “loss of trust in nuclear weapons systems due to compromised data integrity or a systems failure would create significant issues for policymakers”.³¹ This could lead to nuclear escalation; in extremis, nuclear ‘use it or lose it’ scenarios are even conceivable. The second kind of scenario concerns those in which an aggressor uses cyber offensive means to disable the critical infrastructure on which an adversary’s population relies, as in mid-2017 when DPRK hackers used ransomware called WannaCry to partially disable the hospitals in the United Kingdom’s National Health Service.³² In June 2019 it was reported that both the United States and the Russian Federation are penetrating each other’s electric utilities, planting malware potentially capable of disrupting their national power grids.³³ As mentioned, it is significant that in its 2018 Nuclear Posture Review, the United States pointedly refused to rule out a nuclear response to ‘non-nuclear strategic attacks’—something that could conceivably include a major cyber-attack.³⁴ Cyber threats already appear to be impacting the nuclear use doctrines of States, and in effect could widen them.

ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND AUTONOMY

It remains to be determined to what extent AI is used in military systems in the realm of nuclear deterrence.³⁵ Nevertheless, algorithm-based machine systems are becoming vastly better at self-optimizing their performance based on various

³⁰ J. Lindsay, “Cyber Operations and Nuclear Weapons”, *NAPSNet Special Reports*, 20 June 2019, <https://nautilus.org/napsnet/napsnet-special-reports/cyber-operations-and-nuclear-weapons/>.

³¹ B. Unal and P. Lewis, *Cybersecurity of Nuclear Weapons Systems, Threats, Vulnerabilities and Consequences*, Chatham House, 2018, p. 22, <https://www.chathamhouse.org/sites/default/files/publications/research/2018-01-11-cybersecurity-nuclear-weapons-unal-lewis-final.pdf>.

³² G. Corra, “NHS Cyber-Attack was ‘Launched from North Korea’”, *BBC World News*, 16 June 2017, <https://www.bbc.com/news/technology-40297493>.

³³ D.E. Sanger and N. Pertroth, “U.S. Escalates Online Attacks on Russia’s Power Grid”, *New York Times*, 15 June 2019, <https://www.nytimes.com/2019/06/15/us/politics/trump-cyber-russia-grid.html>.

³⁴ “The United States would only consider the employment of nuclear weapons in extreme circumstances to defend the vital interests of the United States, its allies, and partners. Extreme circumstances could include significant non-nuclear strategic attacks. Significant non-nuclear strategic attacks include, but are not limited to, attacks on the U.S., allied, or partner civilian population or infrastructure, and attacks on U.S. or allied nuclear forces, their command and control, or warning and attack assessment capabilities”; See US Department of Defense, *Nuclear Posture Review 2018*, February 2018, p. 21: <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF>.

³⁵ See J. Borrie, “Cold War Lessons for Automation in Nuclear Command and Control Systems”, in V. Boulanin (ed.), *The Impact of Artificial Intelligence on Strategic Stability and Nuclear Risk Volume I Euro-Atlantic Perspectives*, SIPRI, May 2019, pp. 41–52: <https://www.sipri.org/sites/default/files/2019-05/sipri1905-ai-strategic-stability-nuclear-risk.pdf>.

techniques, many of them related to pattern recognition and matching of data. AI is going to improve the ability of machine systems to perform or assist in various critical military functions with a greater level of autonomy ranging from communications and logistics, to network defence, fire control, intelligence analysis support and even the selection of targets and launching of attacks—including in mobile, autonomous platforms such as un-crewed aerial vehicles and submersibles that in time might also be used as nuclear delivery platforms.³⁶ It is also logical that there will be efforts to use self-optimizing systems to interpret early warning data, support decision-making in other ways, and even to search for the mobile nuclear launchers of potential adversaries. As one recent study noted, “Without being directly connected to the nuclear launchers, an AI could still provide advice to humans on matters of escalation”.³⁷

There is reason for concern about the use of AI in nuclear roles for several reasons. Most troubling is that such systems might be hacked, spoofed or otherwise subverted by an adversary. The nature of self-optimizing systems means that their operations are frequently hard to inspect, and so it might be difficult for users to be sure of the integrity of an AI-based decision-support system, at least using current techniques. This could have serious consequences in a crisis in which subversion is detected as it would undermine confidence in the integrity of one’s nuclear forces and could contribute to use it or lose it situations. (Conversely, the prospect of not being able to detect hacking, spoofing or subversion in a crisis might also have grave consequences if it distorts perceptions and decision-making in ways that are escalating.) Use of these systems could also alter perceptions of nuclear rivals’ retaliatory capabilities in unhelpful ways or create additional uncertainty between rival nuclear-armed States about the nature of each other’s launch decision-making process. In a crisis, such uncertainties might cause misperception that leads to further escalation and even nuclear weapon use.

LOWER-YIELD NUCLEAR WEAPONS

As discussed earlier, in the Russian Federation the use of lower-yield nuclear weapons is being envisaged in conflict in conjunction with conventional forces.³⁸ In recent years, the United States has responded by deploying lower-yield nuclear weapons.³⁹ A lower-yield weapon may not in fact be very small in terms of kilotons of explosive yield: rather,

³⁶ For a discussion of application to some of these functions, see M.C. Horowitz, “When Speed Kills: Lethal Autonomous Weapon Systems, Deterrence and Stability”, *Journal of Strategic Studies*, vol. 42, no. 6, 2019, pp. 764–788.

³⁷ E. Geist and A.J. Lohn, *How Might Artificial Intelligence Affect the Risk of Nuclear War?*, RAND Corporation, 2018, p. 2.

³⁸ See A. Arbatov, “Understanding the U.S.–Russia Nuclear Schism”, *Survival*, vol. 59, no. 2, 2017, p. 50, <https://doi.org/10.1080/00396338.2017.1302189>.

³⁹ See A. Woolf, *Nonstrategic Nuclear Weapons*, Congressional Research Service, 2019, 6 September 2019, <https://fas.org/sgp/crs/nuke/RL32572.pdf>.

its key characteristic is that resort to its use would be believable to an adversary. The W76-2 nuclear warhead recently deployed on US Trident ballistic missile submarines is about six kilotons. This is much smaller than the approximately 100 kilotons of the original, but still very destructive at around 500 times the explosive power of the most potent conventional explosive weapon in the US arsenal.⁴⁰ The rationale is that nuclear weapons like these offer an additional rung on the escalation ladder in a crisis; their use could be tactically useful and might even scare an adversary into backing down or de-escalating.⁴¹ In US terms, this is what is known as an escalation control option, to “support military objectives, demonstrating US capability and resolve to counter a threat’s actions. ... Options must balance the need for military action and the need to demonstrate resolve with the requirement to avoid further escalation”.⁴²

Deploying nuclear weapons in these ways would almost certainly be very destabilizing. In peacetime it requires changes in doctrines of nuclear use that in themselves send negative signals to rivals and encourage copycat behaviour that contribute to strategic unpredictability (which is arguably what the Russian Federation has set off here through its attempts to make changes to doctrine to offset its conventional military inferiority to NATO). And, nuclear use, once it started in a conflict—whatever the motive and explosive yield—could easily get out of hand and escalate much further, into a general nuclear war. In this respect, it is noteworthy that the new W76-2 five kiloton warheads are carried on Trident equipped US ballistic missile submarines, which also carry much higher-yield ‘strategic’ nuclear-tipped Trident missiles—use of the former might be confused for a general nuclear attack with the latter.⁴³

⁴⁰ See A. Facini, “The Low-Yield Nuclear Warhead: A Dangerous Weapon Based on Bad Strategic Thinking”, *Bulletin of the Atomic Scientists*, 28 January 2020, <https://thebulletin.org/2020/01/the-low-yield-nuclear-warhead-a-dangerous-weapon-based-on-bad-strategic-thinking/#>.

⁴¹ N.N. Sokov, “Why Russia Calls a Limited Nuclear Strike De-Escalation”, *Bulletin of the Atomic Scientists*, 13 March 2014, <https://thebulletin.org/2014/03/why-russia-calls-a-limited-nuclear-strike-de-escalation>.

⁴² US Joint Chiefs of Staff Joint Publication 3-72, *Nuclear Operations*, 11 June 2019, I.2, para. 5.b. This publication was removed soon from its official website soon after posting. It is available here: https://fas.org/irp/doddir/dod/jp3_72.pdf.

⁴³ See W.M. Arkin and H.M. Kristensen, “U.S. Deploys New Low-Yield Nuclear Submarine Warhead”, Federation of American Scientists, 29 January 2020, <https://fas.org/blogs/security/2020/01/w76-2deployed/>. The authors “estimate that one or two of the 20 missiles on the USS Tennessee and subsequent subs will be armed with the W76-2, either singly or carrying multiple warheads. Each W76-2 is estimated to have an explosive yield of about five kilotons. The remaining 18 missiles on each submarine like the Tennessee carry either the 90-kiloton W76-1 or the 455-kiloton W88. Each missile can carry up to eight warheads under current loading configurations”.

NARROWING TECHNOLOGICAL PATHWAYS

A focus of efforts should be to identify and seek to reduce strategic unpredictability from technologies like those outlined above in today's more tense and complex relations between multiple nuclear-armed States. Of course, the measures to be pursued depend upon the objective. Three objectives are considered below, which could also be thought of as cascading or, alternatively, overlapping phases of risk reduction activity. They are:

- (i) enhancing understanding about strategic technologies' implications for transparency, predictability and stability;
- (ii) restricting or clarifying behaviours linked to new capabilities; and
- (iii) restricting capabilities.

(i) Enhance understanding about the implications for transparency, predictability and stability

The reasons vary why some of the nuclear-armed States are developing new strategic technological capabilities. At least one of them—the United States—seeks to reduce vulnerability to certain kinds of nuclear threat (from 'rogue' States or non-state actors) through missile defences, or at least to be seen to be doing everything it can to do so. In certain cases, as in HGVs, there are indications that States may be in an emergent action–reaction cycle of arms racing. Another factor is that in the current environment, leaders of some nuclear-armed States appear to see shorter-term advantage in acting less predictably toward their rivals, and the development and fielding of new strategic technologies are a means to give effect to that. Meanwhile, in some instances, such as advanced long-range missiles of various kinds, including HGVs, missile defence and satellite interceptors and other counter-space capabilities, there is significant momentum behind their development and procurement, but in numbers and for missions that may still be somewhat fungible. The question is in which ways the States developing these capabilities will choose to exercise restraint in their own interests, for instance to reduce the risk of crisis resulting in major war because they understand strategic weapons conceived to strengthen nuclear deterrence in peacetime can be deeply destabilizing in crisis situations.

Meanwhile, advances in technologies like AI are enablers for a wide range of new applications that will be critical to the military enterprise. It seems implausible that States will not apply to the nuclear weapons domain the situational awareness, information processing and decision-support advantages AI promises to bring to the conventional military arena. Nevertheless, clearer understandings, both within national

nuclear decision-making systems and between nuclear rivals, are needed about the use of AI so as to lengthen, rather than shorten, the fuse in a crisis.⁴⁴

Responding to this question will require greater understanding among policymakers in the States involved, and a level of strategic empathy that has not been especially visible in recent years. Lewis Dunn has called for a first step in which the protagonists in current strategic rivalry—China, the Russian Federation and the United States in particular—think through the stakes. He has proposed measures such as the creation of bilateral senior arms control advisory boards, which in addition to nuclear questions would look at the likely impacts of “the full range of strategic issues dividing Washington and Moscow—strategic offences and defences, intermediate-range systems, next generation strategic systems, conventional strike systems, nuclear testing, space and cyber capabilities”.⁴⁵

Senior advisory boards of former American, Chinese and Russian officials could have value, but intensified military–military dialogue between nuclear-armed States is also needed. And beyond these three States alone, there should be initiatives that draw in wider configurations. There are ongoing P5 discussions among the five NPT nuclear-weapon States, for instance, but these do not encompass the four nuclear-armed States (the DPRK, India, Israel and Pakistan) outside the NPT (see the next section). There would be scope for an international conference, or conferences, on nuclear weapon risk reduction that could look at the impact of new strategic technologies in a format that includes all interested States. In addition to allowing structured dialogue between States, such a process could also serve to generate additional, independent research that might bring to light new findings and suggestions for ways forward. Such an initiative could be an outcome of the 2020 NPT Review Conference, or as an initiative in line with it but independent. The Stepping Stones initiative instigated by Sweden in 2019, which is intended to support the NPT, could be a vehicle for this activity.

(ii) Clarify or restrict behaviours linked to new capabilities

There are areas in which it might be possible for nuclear-armed States, especially those in the major triadic relationships described earlier, to reach understandings that would contribute to greater predictability. Already, the NPT five nuclear-weapon States have focused in their consultations on clarifying their respective strategic doctrines with one another. This greater transparency might have positive spin-offs for reducing strategic

⁴⁴ For instance, see E.B. Kania and A. Imbrie, “Great Powers Must Talk to Each Other About AI”, *Defense One*, 28 January 2020, <https://www.defenseone.com/ideas/2020/01/great-powers-must-talk-each-other-about-ai/162686>.

⁴⁵ L.A. Dunn, *Reversing the Slide: Intensified Great Power Competition and the Breakdown of the Arms Control Endeavor*, UNIDIR, 2019, p. 4, <http://www.unidir.ch/files/publications/pdfs/reversing-the-slide-en-755.pdf>.

unpredictability, including identifying areas in which nuclear rivals currently misperceive each other, and providing a way for these perceptions to be corrected in ways that might alter characteristics of their strategic competition by removing incentives to arms racing in particular areas or systems.

To do so effectively, the five nuclear-weapon States' discussions need to factor in emerging strategic technologies with implications for the strategic balance and crisis management like those described in this article. Given the closed and opaque nature of the P5 process, it is hard to say to what extent this currently occurs (and, of course, these consultations do not include non-NPT nuclear-armed States, which is an obvious constraint). Whether or not strategic technologies do feature, clarification of doctrine among the five NPT nuclear-weapon States can plausibly be expected to shed light on which of their capabilities most exacerbate tensions, and which in crisis would create significant ambiguity. "That understanding could shape national decision-making, whether providing logic for unilateral restraint or encouraging thinking about how to use formal or informal arms control means to cooperatively regulate strategic interactions".⁴⁶ This could provide a lead for other nuclear-armed States to follow.

Meanwhile, the demise of the INF has set off fears, particularly in Europe, that a build-up in non-strategic (or 'tactical') nuclear weapons in the region will resume. These systems depend on means of delivery that include nuclear-tipped cruise missiles, which generate the kind of ambiguity mentioned earlier. One meaningful way to add predictability to the situation would be for non-strategic nuclear weapons not to be deployed in certain regions. Instead, these should be moved away from their launchers and secured in central locations.⁴⁷ Ideally this would be verified through a legally binding arrangement. But, if not, such a situation would still be beneficial as some level of assurance could be provided through national technical means of reconnaissance and intelligence collection such as satellites.

Historical precedent for exercising restraint over non-strategic nuclear weapons exists: late in the Cold War, US President George H.W. Bush ordered that nuclear weapons be removed from US surface naval vessels, attack submarines and land-based naval aircraft through a Presidential Nuclear Initiative. He called upon the Soviet Union to reciprocate, which it did.⁴⁸ China and India, for their parts, could also pledge that their non-strategic delivery systems do not carry nuclear warheads and are not deployed.

⁴⁶ Ibid, p. 8.

⁴⁷ As proposed in P. Podvig and J. Serrat, *Lock Them Up: Zero Deployed Non-Strategic Nuclear Weapons in Europe*, UNIDIR, 2017, <http://unidir.org/files/publications/pdfs/lockthem-up-zero-deployed-non-strategic-nuclearweapons-in-europeen-675.pdf>.

⁴⁸ See S.J. Koch, "The Presidential Nuclear Initiatives of 1991–1992", *Policy Brief No. 23*, Toda Peace Institute, October 2018, https://toda.org/assets/files/resources/policy-briefs/t-pb-23_susan-koch_presidential-nuclear-initiatives-1991-92.pdf.

Moreover, public declarations by States that they will not be the first to use their hypersonic weapon capabilities against other's nuclear C3 infrastructure could signal restraint and have a confidence-building effect. It would not prevent the fielding of HGVs and other hypersonic systems altogether, but such declarations could be backed by announcements of deployment limits of various kinds, depending on the system. This could provide a level of reassurance in the event of the testing and use of these systems that would lessen ambiguity about their targets. Violations could be rapidly spotted and would be visible to all. Another step nuclear-armed States with hypersonic weapons could take would be to commit to declaring unequivocally whether their systems are nuclear or conventional. The verification burden could be placed upon the possessor in any arrangement, for instance by allowing managed inspections by a rival or mutually trusted third party under controlled conditions to the factory or storage sites. (This already occurs for certain missile systems under New START.)

States developing hypersonic technology (not all of them nuclear-armed States) should also exercise special restraint on transfer due to its characteristics. Indeed, hypersonic technology has recently become a more prominent issue in strategic export control regimes such as the Missile Technology Control Regime, in which India, the Russian Federation and the United States are partners, among others. China, which is not a member, apparently has no interest in joining that regime. Yet engagement with China is needed with a view to elucidating a common interest—that it is in no one's interest for hypersonic missiles to proliferate, including Beijing's. This is important, as a DPRK armed with HGVs or hypersonic cruise missiles would make the security situation in North Asia markedly more unpredictable.

As to space, three voluntary transparency and confidence-building measures could reduce strategic unpredictability stemming from ASAT capabilities.⁴⁹ The first is that States with co-orbital drones provide advance notice of their manoeuvres close to others' space objects to potentially affected actors. At present, several nuclear-armed States have classified military programmes that mean they would be reluctant to do this. However, experts have pointed out that open-source space situational awareness capabilities are now advancing toward the point that it will become impossible to keep most manoeuvres clandestine for long in any case.⁵⁰ The second measure is for States, including the nuclear-armed States possessing ASAT capabilities, to adopt test guidelines for no debris (if an actor wishes to test ASAT capabilities, they should not create debris); low debris (if they must create debris during an ASAT test, the test should be carried out at an altitude sufficiently low that the debris will not be long-

⁴⁹ D. Porras, *Shared Risks: An Examination of Universal Space Security Challenges (Briefing Paper for the United Nations Disarmament Commission)*, UNIDIR, 2019, p. 22, <http://unidir.org/files/publications/pdfs/shared-risks-an-examination-of-universal-space-security-challenges-en-775.pdf>.

⁵⁰ D. Porras, *Eyes on the Sky: Rethinking Verification in Space*, UNIDIR, 2019, p. 31, <https://unidir.org/publication/eyes-sky>.

lived), and notification (those testing ASATs should notify others of their activities even if they are not completely transparent on the motivation behind the test, in order to avoid strategic misperceptions).⁵¹ A third measure is that the nuclear-armed States, in particular, should publish their policies on their use of counter-space capabilities.

(iii) Restrict capabilities

The current environment is not especially propitious for strategic arms control, as shown by the breakdown of bilateral treaty regimes such as the INF and two decades of deadlock in the multilateral Conference on Disarmament. Nevertheless, this does not mean arms control measures are not of considerable value. An immediate priority should be on ensuring New START is extended. This agreement is the last strategic arms control arrangement standing between the two nuclear possessors with the largest arsenals. Agreed in 2010, the treaty is the culmination of several decades of US–Russian strategic arms control efforts and provides an important mechanism for clarification and engagement between the two States on their strategic nuclear systems.⁵² New START provides a means for both parties to verify the other's deployment of strategic nuclear launchers, which is an important element of predictability in a strategic relationship that in most other respects has significantly deteriorated.

An extended New START would ensure important restrictions are maintained on Russian and US strategic (nuclear) launchers. And it would buy time for Washington and Moscow to consult on how to take account of new strategic developments, including HGVs.⁵³ Moreover, it would add a measure of predictability to US–Russian strategic relations that provides wider reassurance, especially to China, which the United States would like to draw in somehow. Although it seems unlikely that China would participate directly in any follow-on from New START, the treaty's definitions might also be applied or adapted in developing understandings reached separately with China and other nuclear-armed States. Additionally, as one Chinese analyst noted: "reciprocal unilateral measures can be taken to build confidence and open the door for better understanding and communication, paving the path for the future of arms control".⁵⁴ These could include acknowledgements of mutual nuclear vulnerability,

⁵¹ D. Porras, *Towards ASAT Test Guidelines*, UNIDIR, 2018, pp. 11–12, <https://unidir.org/files/publications/pdfs/-en-703.pdf>.

⁵² See A. Woolf and P. Podvig, *Monitoring, Verification, and Compliance Resolution in US–Russian Arms Control*, UNIDIR, 2019: <https://unidir.org/publication/monitoring-verification-and-compliance-resolution-us-russian-arms-control>.

⁵³ "Foreign Ministry: Sarmat, Avangard Systems May Be Included in New START Treaty", TASS, 1 November 2019, <https://tass.com/defense/1086515>. For a US perspective see P. Vaddi, "Bringing Russia's New Nuclear Weapons into New START", Lawfare, 13 August 2019, <https://www.lawfareblog.com/bringing-russias-new-nuclear-weapons-new-start>.

⁵⁴ W. Riqiang, "Trilateral Arms Control Initiative: A Chinese Perspective", *Bulletin of the Atomic Scientists*, 4 September 2019, <https://thebulletin.org/2019/09/trilateral-arms-control-initiative-a-chinese-perspective>.

greater transparency (especially from China), joint measures to reduce nuclear risk explicitly based on greater awareness of the implications of strategic technologies like cyber, space and HGVs, and commitments not to build up nuclear forces.⁵⁵

Nuclear-armed cruise missiles are one such capability crying out for restraint or, better yet, formal restriction. Over the past several years, some States and civil society organizations have developed the concept of 'cruise control' because they see nuclear-armed cruise missiles as particularly destabilizing and carrying a higher risk of causing nuclear weapons use via miscalculation or misinterpretation.⁵⁶ Some nuclear-armed States that have refrained from resuming these capabilities, such as the United Kingdom, have publicly acknowledged this risk.⁵⁷ An array of possible options exists toward the goal of an end to nuclear-armed cruise missiles whether launched by land, sea or air. One early measure that nuclear-weapon-possessing States not yet possessing nuclear-armed cruise missiles could enact would be to agree not to develop or acquire them. This could complement unilateral actions to limit systems by other nuclear possessors and broader political pledges that might, in time, presage legally binding arrangements.⁵⁸

⁵⁵ For several ideas, see T. Zhao, "Opportunities for Nuclear Arms Control Engagement With China", *Arms Control Today*, January/February 2020, <https://www.armscontrol.org/act/2020-01/features/opportunities-nuclear-arms-control-engagement-china>.

⁵⁶ A. Weber and C. Parthemore, "Cruise Control: The Logical Next Step in Nuclear Arms Control?", *Journal for Peace and Nuclear Disarmament*, 2019, p. 6, <https://doi.org/10.1080/25751654.2019.1681886>.

⁵⁷ P. Hammond, "The Alternatives to Trident Carry an Enormous Risk", *The Telegraph*, 2 February 2013, <https://www.telegraph.co.uk/news/uknews/defence/9843848/The-alternatives-to-Trident-carry-an-enormous-risk.html>.

⁵⁸ A. Weber and C. Parthemore, "Cruise Control: The Logical Next Step in Nuclear Arms Control?", *Journal for Peace and Nuclear Disarmament*, 2019, pp. 10-11, <https://doi.org/10.1080/25751654.2019.1681886>.

CONCLUSION

Recently, the demise of arms control-related agreements such as the INF and the Joint Comprehensive Plan of Action, and the looming prospect that New START will end, indicate additional legally binding arrangements may be more than the market can currently bear. It may thus be more feasible in the short run to focus on the three objectives outlined above for strategic technologies that impact on the strategic balance and crisis stability, with an immediate view to reducing strategic unpredictability. After all, each nuclear-armed State has a stake in avoiding a nuclear conflict from breaking out, and so this might be an initial basis for an alignment of incentives that might converge further as mutual confidence improves. Any such arrangements deriving from this could be captured in formal treaties, of course. More likely is a mixture of political statements and joint statements, commitment to restraint that is probably a prerequisite for any China–Russia–US arms control process, and normative ‘rules of the road’ (e.g. on ASAT weapons), with impetus to legally binding instruments emerging as strategic conditions stabilize and trust improves.

The ideas outlined are mostly modest, to be sure, and clearly do not capture new strategic technologies in the round. Nevertheless, this three-step approach—enhancing understanding about strategic technologies’ implications for transparency, predictability and stability; restricting or clarifying behaviours linked to new capabilities; and restricting capabilities—could contribute to additional predictability in the relations and assessments of the nuclear-armed States as well as others involved in a position to develop some of these technologies. As was noted at the dawn of strategic arms control in the Cold War, its essential feature “is the recognition of the common interest, of the possibility of reciprocation and cooperation even between potential enemies with respect to their military establishments”.⁵⁹ Reducing strategic unpredictability is a minimum floor on which this dialogue could be based, which would narrow the risk pathways to nuclear weapon use.⁶⁰ And it could contribute to more propitious conditions for nuclear arms control and disarmament in which legally binding agreements once again increase in salience.

⁵⁹ T.C. Schelling and M.H. Halperin, *Strategy and Arms Control*, 1961, p. 2.

⁶⁰ See W. Wan, *Nuclear Risk Reduction: A Framework for Analysis*, UNIDIR, June 2019, <https://unidir.org/publication/nuclear-risk-reduction-framework-analysis>.

RECOMMENDATIONS TO REDUCE NUCLEAR RISK LINKED TO TECHNOLOGY



Enhance understanding about implications of technology

- Explore jointly in advisory boards and military–military dialogue
- Include wider configurations of States in discussions
- Establish international conference dedicated to risk reduction issues



Clarify and/or restrict behaviours linked to new capabilities

- Expand P5 discussions to include emerging strategic technologies
- Attest as to nuclear/non-nuclear nature of systems
- Separate and secure non-strategic nuclear weapons from launchers
- Keep nuclear C3 infrastructure off-limits from hypersonic capabilities
- Adopt procedures on space activities, including test guidelines



Restrict certain capabilities

- Extend New START
- Consider limits or ban of nuclear-armed cruise missiles
- Take reciprocal unilateral measures (e.g. transparency, non-build-up of nuclear forces, acknowledging mutual nuclear vulnerability)

CHAPTER 5

NUCLEAR RISK IN THE EURO-ATLANTIC

Ulrich Kühn



SUMMARY

- The persistence of war, the manipulation of risk through weapons of mass destruction, and the demise of cooperative policies characterize the Euro-Atlantic region.
- Actors' risk perceptions pertaining to potential nuclear use are asymmetric at strategic, regional, and subregional levels, a result of asymmetries in capabilities, misperceptions as regards each other's nuclear doctrines, and poor risk analysis.
- In order to alleviate risk, the Russian Federation and the United States should hold on to the last remains of nuclear arms control and transparency while gauging possible non-treaty-based verification measures on INF-range systems.
- The establishment of subregional risk reduction centres for the Baltic and Black Sea regions could help limit the risks inherent to military accidents, coupled with a sustained effort led by the United Nations or the Organization for Security and Cooperation in Europe (OSCE) to better understand States' nuclear doctrines.

INTRODUCTION

The risk of nuclear weapon use—be it deliberately in an escalating crisis or war, in accordance with one’s own nuclear doctrine or due to inadvertent events—has grown in the Euro-Atlantic region, mainly as a function of the recurring competition between the Russian Federation and the United States. As this chapter argues, decision makers are correct to see a riskier environment. Yet in considering the risk of nuclear weapon use, analysts and policymakers alike are assessing threats by often focusing on high-impact/low-probability scenarios, driven by misreading of one another’s plans and intentions. As a result, they are assessing the risks wrongly, and respond to the wrong things. This chapter first addresses actors, interests, and political change at three levels of analysis. It then establishes a menu for manipulating and perceiving risk, focusing on asymmetric capabilities, (unofficial) doctrines, and poor risk analysis. It concludes with a set of recommendations on how to mitigate the most pressing risks of nuclear use in the Euro-Atlantic.

»» THE EURO-ATLANTIC REGION: COMPLEX AND VOLATILE

The risk environment in the Euro-Atlantic region is both complex and volatile and has grown riskier throughout the last years. It is volatile as a result of significant political change during the last thirty years. It is also complex due to the diverse nature and interests of the actors as well as the different levels of competition that are shaping this geographical space. Three levels of competition can be identified when looking at the major actors shaping security and insecurity in the Euro-Atlantic region.

COMPLEXITY AT THREE LEVELS

At the strategic level, the Russian Federation and the United States are (once more) engaged in a contest about power, influence, and the relative distribution of security. Both erstwhile Cold War contenders compete by using most measures short of waging direct warfare against each other. That includes nuclear and conventional arms modernizations and deployments, economic coercion, propaganda and rhetorical threats as well as other instruments to influence public opinion. The manipulation of risk is an integral part of the relationship. It works in multiple ways, as this chapter explains later.

Below the strategic level is the regional level, meaning geographical Europe extending up to the Ural Mountains to the East and including Turkey to the South. Here, the number of actors, interests, and pairings of competition multiplies by a significant factor. Making things more complicated, transnational and supranational actors like NATO, the European Union, and both the Russian Federation-led Collective Security Treaty Organization and the Customs Union have a particular influence on the region. At that level, nuclear-armed dyads such as the United Kingdom and the Russian Federation, France and the Russian Federation, or NATO and the Russian Federation entertain more or less open deterrence relationships. Inhabiting this diverse space are further States under an extended nuclear deterrence guarantee provided by the United States (i.e. 27 other NATO member States), those actively taking part in the sharing of nuclear weapons (Belgium, Germany, Italy, the Netherlands, and Turkey) and States striving for the global abolition of nuclear arms (such as Austria and Ireland).

A further step below, at the subregional level, are two subregions that are particularly prone to competition and conflict. In the Baltic subregion, the Russian Federation and NATO members Estonia, Latvia, Lithuania, and Poland as well as the entire North Atlantic alliance exist in a compact geographical neighbourhood. Each side has to deal with a specific geographical–military Achilles' heel: NATO with its hard-to-defend Baltic allies and the Russian Federation with its exclave of Kaliningrad. In the Black Sea subregion, not only competition but also open warfare and protracted conflicts are

present. Here, the Russian Federation, Ukraine, Georgia, the Republic of Moldova, NATO as well as NATO member Turkey—and, by extension, the war in Syria—play crucial roles. The wars, happening at the subregional level are nevertheless of strategic interest to the Russian Federation while, at the same time, they are manifestations of the strategic competition between the Russian Federation and the West, thereby adding to political complexity in the region.

POLITICAL VOLATILITY

In addition to complexity at three levels of competition, political volatility continues to have a significant impact on risk and the perception of risk in the entire region. A number of critical political changes occurred during the last decade.

The first and most significant change is the reoccurrence of war within and at the periphery of the region. The short Georgian–Russian war of 2008, the Russian annexation of Crimea coupled with Moscow’s involvement in the war in the Donbas region since 2014 as well as the Russian Federation’s continued military intervention in the civil war in Syria since 2015 can be described as strategic game changers. They led NATO members and the European Union to perceive the Russian Federation as a general threat and to implement political, economic, and military countermeasures. As a result of this development, a new frontline zone with clear similarities to the Cold War has emerged.¹ In terms of behaviour, Cold War-like belligerent rhetoric, mutual acts of military brinkmanship, outsized military exercises, and diplomatic disengagement have returned.

The second significant change pertains to the manipulation of risk through weapons of mass destruction.² Chemical agents have been employed in the poisoning of Sergei Skripal and in the Syrian civil war and have thus eroded the long-standing norm of non-use.³ Nuclear arms have regained political centrality in the dealings between the United States, NATO, and the Russian Federation. The Russian Federation is pushing an ambitious nuclear modernization programme, including the development of new second-strike platforms and the likely development and deployment of an intermediate-range nuclear-capable system. In addition, rhetorical nuclear threats

¹ W. Zellner et al., *Reducing the Risks of Conventional Deterrence in Europe. Arms Control in the NATO–Russia Contact Zones*, OSCE Network, December 2018, http://osce-network.net/file-OSCE-Network/Publications/RISK_SP-fin.pdf.

² This chapter uses the term ‘manipulation of risk’ as a very broad concept where one actor’s politico-military choices directly affect the opponent’s perception of risk, stemming from those choices. That way, every action leads to a reaction and the manipulation of risk can result in an increase in risk perception as well as in a decrease, depending on the action and the perception thereof.

³ See U. Becker-Jakob, *Countering the Use of Chemical Weapons in Syria: Options for Supporting International Norms and Institutions*, EU Non-Proliferation and Disarmament Consortium no. 63, June 2019, https://www.sipri.org/sites/default/files/2019-06/eunpdc_no_63.pdf.

from Moscow accompanied the crisis of 2014.⁴ The United States, since 2007, has started to build up a missile defence system in Europe, abrogated the INF in 2019, and is currently in the process of deploying an updated version of a nuclear warhead with lower yields in its sea-based leg of the nuclear triad. Both sides seem to perceive the other as dangerously manipulating nuclear risk in order to gain strategic advantages.

The third important change happened in the realm of cooperation. Since the early 2000s, the US–Russian arms control relationship is in retreat—a development that accelerated under US President Donald J. Trump. With the demise of the Adapted Conventional Armed Forces in Europe Treaty, the original Conventional Armed Forces Treaty, the ABM Treaty, the INF, and perhaps the collapse of the Open Skies and New START agreements, the contractual relationship might soon be thrown back to a state last experienced in the early 1970s. A general problem is that political self-restraint in exchange for restraint from ‘the Other’ is not in fashion anymore. Again, that development is not a result of the Trump presidency alone. It started during the mid-1990s in the United States, gained speed in the Russian Federation after 2002, and has meanwhile also spread to a number of important regional actors such as Poland or Turkey.⁵

⁴ Following the immediate Crimea crisis, Vladimir Putin warned that foreign States should understand: “It’s best not to mess with us”. A. Anishchuk, “UPDATE 1-Don’t Mess with Nuclear Russia, Putin Says”, *Reuters*, 29 August 2014, <https://uk.reuters.com/article/russia-putin-conflict-idUKL5N0QZ3HC20140829>.

⁵ M.E. Sarotte, “How to Enlarge NATO: The Debate inside the Clinton Administration, 1993–95”, *International Security*, vol. 44, no. 1, 2019, http://doi.org/10.1162/ISEC_a_00353.

»» MANIPULATING AND PERCEIVING RISK

In the Euro-Atlantic region, as in any other part of the world, risk manipulation and risk perception do not happen in a vacuum. Instead, they contribute to the actual creation or amplification and the prolongation of risk. Before this chapter gets into the drivers of the former, it quickly describes how the prolongation of risk works. In that case, changes to risk perceptions drive changes to politics that initiate changes to military doctrines and, later, postures, which drive changes to the behaviour of 'the Other', which then again triggers changes to risk perceptions, and so forth.⁶

In terms of escalation pathways leading to potential nuclear use, risk asymmetries are informing perceptions about potential advantages in escalatory use scenarios. Interpretations of doctrines—or rather their unofficial variations—trigger misperceptions about doctrinal use. Much of that can be attributed to incomplete or poor risk analysis, which only helps to make a generally tense environment even worse.

RISK ASYMMETRIES

Risk perceptions of the main actors in the Euro-Atlantic region are rather asymmetric at the three levels of engagement, that is, at the strategic, regional, and subregional levels. This chapter uses the term asymmetry to describe different degrees of intensity of perceiving risk. Asymmetry in the perception of risk is a rather natural state in international affairs given the incomplete information with which States have to deal. However, the more asymmetric the perceptions, the more difficult for actors to arrive at cooperation as a means to mitigate risk jointly if both desire to do so.

At the strategic level, the United States—intentionally or as a by-product of unipolarity—has been successfully manipulating risk during the last two decades. The withdrawal from the ABM Treaty, the subsequent investment in strategic missile defence, and the build-up of increasingly precise guided munitions has created strong Russian risk perceptions about potential US advantages in escalatory use scenarios. In response, Moscow developed a host of new and sophisticated second-strike assets, capable of overcoming all current generations of missile defences.⁷ Indeed, by investing in those strategic assets, the Russian Federation is not only catching up but may soon assume the role of risk manipulator.⁸ Therewith, the prolongation of risk is about to unfold.

⁶ J.H. Herz, "Idealist Internationalism and the Security Dilemma", *World Politics*, vol. 2, no. 2, 1950.

⁷ D. Stefanovich, "New Russian Second Strike Systems", *Presentation at Institute for Peace Research and Security Policy at the University of Hamburg*, 20 August 2019, https://ifsh.de/file/person/Stefanovich_New_Russian_2nd_Strike_IFSH.pdf.

⁸ J.E. Barnes and D.E. Sanger, "Russia Deploys Hypersonic Weapon, Potentially Renewing Arms Race", *New York Times*, 27 December 2019, <https://www.nytimes.com/2019/12/27/us/politics/russia-hypersonic-weapon.html>.

At the regional level, the roles are reversed. Here, the Russian Federation has quite successfully manipulated risk to its advantage by purposefully creating ambiguity about its capabilities. For instance, Moscow has allegedly started to develop and deploy a limited number of new INF-range ground-launched cruise missiles while officially denying any such programme.⁹ At the same time, the Russian Federation rejects any transparency for its large arsenal of tactical nuclear weapons. While the United States is also not very transparent about its tactical nuclear arsenal in Europe, its numbers are significantly lower. Some NATO member States are concerned that the Russian Federation could use its nuclear superiority in Europe to gain advantages in a limited war scenario stemming from the subregional level. Here again, fears of escalatory use scenarios have triggered responses. NATO and the United States might deploy US conventional INF-range missiles in Europe and add US low-yield, sea-based nuclear warheads.¹⁰ Again, mutual perceptions of risk and subsequent policies could contribute to risk prolongation.

Finally at the subregional level, mutual risk perceptions accumulate in a difficult-to-disentangle setting where, at first glance, the Russian Federation acts again as the sole and most successful risk manipulator. Here, Moscow leverages its regionally superior conventional forces, particularly through means of large-scale exercises with aggressive scenarios (including up to nuclear use simulations) and via continued acts of intimidation and brinkmanship through dangerously close military encounters.¹¹ In conjunction with the Russian Federation's actions in Ukraine, Moscow's manipulation of risk has reached such severe levels that some NATO member States are fearful of the scenario of a limited Russian land grab in the Baltics, whereas others are genuinely concerned about military incidents as an unintended consequence of Russian brinkmanship.¹² In response, NATO is slowly catching up by increasing the readiness levels of specifically assigned forces, by adding more exercises, and by mirroring Russian brinkmanship behaviour over the Baltic and Black Seas. Once more, the prolongation of risk is on full display. What is often overlooked by Western analysts though is that Moscow has its own risk perceptions at the subregional level about its ability to defend the Kaliningrad exclave in a limited (conventional) war scenario with the entire Western alliance.¹³

⁹ "Report: Russia Has Deployed More Medium-Range Cruise Missiles Than Previously Thought", Radio Free Europe/Radio Liberty, 10 February 2019, <https://www.rferl.org/a/report-russia-has-deployed-more-medium-range-cruise-missiles-than-previously-thought/29761868.html>.

¹⁰ U. Kühn, "Between a Rock and a Hard Place: Europe in a Post-INF World", *The Nonproliferation Review*, vol. 26, no. 1-2, 2019, <https://doi.org/10.1080/10736700.2019.1593677>.

¹¹ T. Frear, L. Kulesa, and I. Kearns, "Dangerous Brinkmanship: Close Military Encounters Between Russia and the West in 2014", *Policy Brief*, European Leadership Network, 10 November 2014, <https://www.europeanleadershipnetwork.org/policy-brief/dangerous-brinkmanship-close-military-encounters-between-russia-and-the-west-in-2014/>.

¹² U. Kühn, *Preventing Escalation in the Baltics: A NATO Playbook*, Carnegie Endowment for International Peace, 2018, <https://carnegieendowment.org/2018/03/28/preventing-escalation-in-baltics-nato-playbook-pub-75878>.

¹³ For this perspective, see sources in Russian, including, A. Рамм and А. Козаченко, "Кадры летят на Запад: Балтфлот укрепят молодыми пилотами, Усиление калининградской авиагруппировки — один из ответов

(UNOFFICIAL) DOCTRINES

It is difficult to discard the effect of superior capabilities that might matter under escalatory use conditions. However, the factor of superior capabilities is not sufficient to explain certain forms of risk perception in the Euro-Atlantic. As an example, Russian conventional superiority in the Baltic subregion has been a constant for decades. It did not significantly change in recent years, not even as a result of the Russian Federation's modernizing its armed forces since 2010. What has changed, though, is the political environment and, as a consequence thereof, interpretations and perhaps misinterpretations of nuclear doctrines. Today, major concerns in the Euro-Atlantic are not so much about what official doctrines say about doctrinal use so much as what they do *not* say—that is, concerns are fuelled by allegedly secret strategies and ambitions.

This chapter has already touched upon two particularly prevalent examples. Even though official Russian documents do not support the claim, the majority of the US security establishment is convinced that the Russian Federation has a secret 'escalate to de-escalate' doctrine, which allegedly foresees the early escalatory use of a few nuclear weapons in a subregional (Baltic) conflict with NATO in support of offensive conventional Russian military actions.¹⁴ The 2018 US Nuclear Posture Review recommends the development and deployment of new sea-based tactical nuclear arms to counter the Russian Federation's alleged doctrine.¹⁵ Russian officials have tried to dispel concerns about 'escalate to de-escalate'. According to Russian Ambassador to the United States Anatoly Antonov: "The notorious concept 'escalation for de-escalation' allegedly stipulating the possibility of becoming the first to use 'a limited low-yield nuclear strike' is another flagrant example of the unwillingness to hear us. ... Certainly, this perception is wrong".¹⁶

But the United States is not the only nervous actor. An important part of the Russian security establishment, including President Vladimir Putin, seems to be convinced that the United States is striving for nuclear primacy. In his 2018 Presidential Address, Putin explained the rationale behind the Russian Federation's ongoing strategic

на развертывание дополнительных сил НАТО в Прибалтике и Польше", *Известия*, 26 October 2019, <https://iz.ru/935817/aleksei-ramm-aleksei-kozachenko/kadry-letiat-na-zapad-baltflot-ukrepiat-molodymi-pilotami>; Д. Юров, "Станет ли бред Запада реальностью: чем ответит Калининград на атаку НАТО", *Телеканал Звезда*, 5 February 2016, <https://tvzvezda.ru/news/forces/content/201602050939-yams.htm>.

¹⁴ A. Loukianova Fink, "The Evolving Russian Concept of Strategic Deterrence: Risks and Responses", *Arms Control Today*, vol. 47, no. 6, 2017; M. Kroenig, "Facing Reality: Getting NATO Ready for a New Cold War", *Survival*, vol. 57, no. 1, 2015; B. Roberts, *The Case for U.S. Nuclear Weapons in the 21st Century*, Stanford University Press, 2015.

¹⁵ US Department of Defense, *Nuclear Posture Review 2018*, February 2018, <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINALREPORT.PDF>.

¹⁶ "US Claims on Russia's 'Escalation for De-escalation' Doctrine are Wrong—Envoy", TASS, 9 April 2019, <https://tass.com/politics/1052755>.

modernization programme: “If we do not do something [against US missile defence], eventually this will result in the complete devaluation of Russia’s nuclear potential. Meaning that all of our missiles could simply be intercepted”.¹⁷ Following that logic, at some point the Russian Federation might face the risk of nuclear coercion by the United States, if not even the overblown scenario of a ‘bolt from the blue’ attack eliminating most of the Russian Federation’s second-strike capability. The current focus on survivability and effective penetration in the Russian Federation’s strategic modernizations (e.g., the development of the Sarmat and Avangard missile systems) seems to be driven, at least in part, by fears of strategic impotence.

In both cases, official documents and statements contradict the prevailing perceptions that secret doctrines or potentially sinister motives are the ‘real’ policy drivers behind what only on the surface seems to function as reality. But nothing has helped to overcome the prevailing perceptions of risk. Quite to the contrary, those perceptions have already led to very real changes to both doctrine and posture.

POOR RISK ANALYSIS

Looking at the massive potential for misreading or misinterpreting each other’s intentions, it is difficult not to conclude that poor risk analysis is at least partly responsible for the prevailing risk perceptions about escalatory and doctrinal use scenarios. Risk analysis in the Euro-Atlantic region suffers from three ills: high-impact fixation, poor plausibility check-up, and the influence of what this chapter refers to as ‘risk entrepreneurs’.

As explained above, much of the insecurity in the region stems from fixating on high-impact scenarios. The Russian fear of strategic impotence, as much as NATO’s fixation on a Russian land grab supported by an ‘escalate to de-escalate’ doctrine, are both examples of extremely outsized, high-impact scenarios producing very real political outcomes.¹⁸ Clearly, security officials also need to focus on such scenarios—it is simply part of their job. Even the partial ignoring of ‘the Other’s’ official language can be explained with a rather healthy leery attitude. But that does not explain the almost complete ignorance as regards probability and plausibility of the scenarios under discussion.

In terms of probability, recent history speaks against these nuclear fixations. The short-lived period of unipolar US global dominance did not result “in the complete

¹⁷ V. Putin, “Presidential Address to the Federal Assembly”, 1 March 2018, <http://en.kremlin.ru/events/president/news/56957>.

¹⁸ J. Ross, “Time to Terminate Escalate to De-Escalate—It’s Escalation Control,” *War on the Rocks*, 24 April 2018, <https://warontherocks.com/2018/04/time-to-terminate-escalate-to-de-escalateits-escalation-control/>.

devaluation of [the Russian Federation’s] nuclear potential”.¹⁹ Even at times when the Russian military was at its weakest, throughout much of the 1990s and 2000s, US military supremacy neither triggered escalatory use, nor led to nuclear coercion by Washington. And the most recent alliance turmoil under Donald Trump has not resulted in the Russian Federation harnessing the opportunity to occupy parts of the Baltics.

If risk is assessed by scaling probability and impact (see table 5.1 below), then US/NATO and Russian officials have focused a lot of their attention on high-impact scenarios while not critically checking the probability axis over time.²⁰

Figure 5.1: Risk Analysis Matrix

Probability \ Impact	1 Extremely Unlikely	2 Likely	3 Extremely Likely
1 Low	1	2	3
2 Medium	2	4	6
3 High	3	6	9

Perhaps even more disturbing, strategists on both sides seem to have missed connecting strategic means and ends when assessing each other’s strategies in terms of plausibility. How plausible are both high-impact scenarios in terms of providing real strategic advantage? Under what circumstances would US policymakers forcefully pursue nuclear primacy without having to take into account the resulting ‘use it or lose

¹⁹ V. Putin, “Presidential Address to the Federal Assembly”, 1 March 2018, <http://en.kremlin.ru/events/president/news/56957>.
²⁰ That is not to argue that militaries should not focus at all on high-impact scenarios with limited probability.

it' pressure on the Russian Federation? The same could be asked about the Russian Federation using a small number of nuclear warheads in its immediate neighbourhood to 'show resolve', back up its partial incursion into NATO territory, and coerce the world's pre-eminent military alliance into giving up its very *raison d'être*. The plausibility of both moves, seen from the strategic ends, seems rather divorced from reality.

Poor analysis can be a function of the influential work of professional 'risk entrepreneurs'. Risk entrepreneurs interpret security risks to the State, but on a very biased or at least incomplete basis. They are often occupying semi- or quasi-official positions, for instance in think tanks, academia, or military institutes close to the administration. Their work of interpreting the actions of 'the other' frequently results in misreading, misinterpreting, and misperceiving strategic intentions.²¹ Whether intentional or not, risk entrepreneurs almost always securitize the object of analysis, meaning they over-fixate on (potential) insecurities and prescribe military countermeasures as an omnipotent cure.

Their direct and indirect effects on lawmakers and the military alike should not be underestimated, for both Russian and US officials rely on this kind of expertise. In the worst case, risk entrepreneurs can function as the embodiment of the creation or amplification of risk. While a certain level of incomplete knowledge or missing information might even be beneficial for the purposes of deterrence in an inimical relationship, possibly misreading the red lines and supporting employment tactics of the other side altogether might have catastrophic consequences in a crisis. That way, analytically poor predictions, for instance about the circumstances of the early use of nuclear arms in a crisis, could well induce exactly that behaviour—perhaps even by the side that wanted to prevent such outcome in the first place.

²¹ That way, one semi-scholarly article by the Chief of the General Staff of the Armed Forces of the Russian Federation becomes an 'unofficial doctrine', a tree-covered strip of land in eastern Poland becomes the gateway to a large Russian tank invasion, and a number of war games becomes the ground for justifying calls for an unprecedented increase in US conventional forces in the Baltics. See, for the United States/NATO, M. Kroenig, "Facing Reality: Getting NATO Ready for a New Cold War", *Survival*, vol. 57, no. 1, 2015; M. Galeotti, "The Mythical 'Gerasimov Doctrine' and the Language of Threat", *Critical Studies on Security*, vol. 7, no. 2, 2019, <http://www.doi.org/10.1080/21624887.2018.1441623>; B. Hodges, J. Bugajski, and P.B. Doran, *Securing the Suwalki Corridor: Strategy, Statecraft, Deterrence, and Defense*, Center for European Policy Analysis, July 2018, <https://www.cepa.org/securing-the-suwalki-corridor>; D.A. Shlapak and M.W. Johnson, *Reinforcing Deterrence on NATO's Eastern Flank: Wargaming the Defense of the Baltics*, RAND Corporation, 2016, https://www.rand.org/content/dam/rand/pubs/research_reports/RR1200/RR1253/RAND_RR1253.pdf. See, for the Russian Federation, A. Ильницкий, "Гибридные войны: вызовы, угрозы, уязвимости У России мало времени, чтобы сформировать собственный образ будущего", *Национальная Оборона* №6 Июнь, 2019, <http://www.oborona.ru/includes/periodics/geopolitics/2019/0624/114126921/detail.shtml>; A. Ильницкий and A. Лосев, "Угроза из-за океана: чем защититься от США," *газета.ру*, 13 November 2017, <https://www.gazeta.ru/army/2017/11/03/10969946.shtml>; A. Подберезкин, *Роль США в формировании современной и будущей военно-политической обстановки*, Москва: ИД «Международные отношения», 2019, http://eurasian-defence.ru/sites/default/files/pdf/podberezkin_sshs_2019_v_tipografiyu.pdf.

COOPERATIVELY ADDRESSING RISK

Taken together, the main actors in the Euro-Atlantic are assessing threats mainly by focusing on high-impact/low-probability scenarios, which are driven by misreading each other's military doctrines and motives. In the end, they are assessing risks wrongly, and respond to the wrong challenges. Given the existing potential for inadvertent nuclear use in a crisis, this chapter explores a number of measures that might help to address some pathways potentially leading to nuclear use in the Euro-Atlantic region.

First, the main actors in the Euro-Atlantic are moving towards more symmetrical risk perceptions at the three levels of engagement identified above. What is clearly a bad sign in terms of arms race stability can in fact be a harbinger for renewed talks on arms control at some point. Drawing from a classical understanding of the impetus behind arms control, the current rearmament efforts on both sides might generate a more commonly shared interest in tackling mutual insecurities also by ways of diplomacy, restraint, and transparency.²² Arms control and confidence- and security-building measures can help to avoid the prolongation of risk. However, the current situation might also turn out to be the starting point of another security dilemma that will affect the region for years to come. In order to prevent the latter, the Russian Federation and the United States should hold on to the last remnants of the crumbling arms control order, given that the wider region is already negatively affected by the unparalleled decay in cooperative security institutions.²³ In practical terms, this means that both sides should extend the New START agreement before it expires in February 2021. They should also reinvigorate the multi-party verification and transparency instrument of the Open Skies Treaty, which has come under political stress in the United States.²⁴

Second, transparency and verification, even in an environment without treaties, are possible and could create a modicum of trust needed for more ambitious cooperative undertakings. Proposals for both, regarding non-strategic (or tactical) nuclear weapons on Russian as well as European NATO member States' soil, have been available for several years.²⁵ Some have recommended for the United States to open its Aegis Ashore missile defence sites in Romania and Poland to Russian experts.²⁶ It is

²² T.C. Schelling and M.H. Halperin, *Strategy and Arms Control*, 1961.

²³ U. Kühn, *The Rise and Fall of Cooperative Arms Control in Europe*, 2020.

²⁴ M. Chesnut and R. Farley, "Save the Open Skies Treaty", *The National Interest*, 8 December 2019, <https://nationalinterest.org/blog/buzz/save-open-skies-treaty-103112>.

²⁵ P. Ingram and O. Meier (eds), *Reducing the Role of Tactical Nuclear Weapons in Europe: Perspectives and Proposals on the NATO Policy Debate*, Arms Control Association and British American Security Information Council, May 2011, https://www.armscontrol.org/sites/default/files/files/Reports/Report_2011May_Perspectives_Proposals_NATO_Policy_Debate.pdf; A. Zagorski, *Russia's Tactical Nuclear Weapons: Posture, Politics and Arms Control*, Institute for Peace Research and Security Policy at the University of Hamburg, 2011, <https://ifsh.de/pdf/publikationen/hb/hb156.pdf>.

²⁶ H. Kristensen et al., "Preserving the INF Treaty", Deep Cuts Commission, 24 April 2017, http://deepcuts.org/files/pdf/Special_Brief_-_Deep_Cuts_INF.pdf.

high time to start thinking about serious political initiatives on how to put these proposals into practice. One approach could be for States that have hosted tactical arms to declare unused sites as training grounds for multi-party transparency exercises; Kazakhstan has done so in the past.²⁷ Another avenue, following the initiative by French President Emmanuel Macron in late 2019, could be to suggest concrete measures verifying the absence of nuclear warheads in a post-INF environment.²⁸

Third, the scenario of accidental nuclear use is still a rather high concern for those States bordering the Baltic and Black Sea subregions. Risks of accidental, and more broadly speaking inadvertent, use cannot be addressed using deterrence mechanisms.²⁹ Instead, such pathways call for establishing a modicum of mutual communication and information-sharing. Risk reduction agreements from the Cold War, such as the Incidents at Sea and Dangerous Military Activities Agreements accords, could well help to alleviate some of the prevailing concerns as regards the consequences of military accidents.³⁰ It is true that there is currently no appetite in a number of NATO member States to conclude Incidents at Sea-like agreements with the Russian Federation on a bilateral basis. However, States could strive for the establishment of subregional risk reduction centres—one for the Baltic and one for the Black Sea region. In this manner, States could build regional buy-in mechanisms for the establishment of subregional confidence- and security-building measures and, due to their multilateral set-up, prevent being singularized in their security relations with the Russian Federation or other States. Such subregional centres could for instance house military liaison officers and be tasked with military data exchange upon the request by interested parties.

Fourth, the inability of officials and experts alike to gauge each other's nuclear doctrines is disturbing. To be clear, it will not be possible, and sometimes it should not even be desirable, to entirely understand all aspects of 'the Other's' nuclear doctrine. States such as France or Israel are deliberately ambiguous about their nuclear strategies. But the current ambiguities in the Russo–American relationship are anything but helpful. For the moment, they are 'only' triggering nuclear modernizations and novel weapons systems. Much worse, they could become self-fulfilling prophecies in a rapidly escalating crisis if each side operates on false assumptions. Regular doctrinal seminars could help address some of the most pressing insecurities surrounding the US and Russian doctrines. Such seminars could

²⁷ This idea was first brought to my attention by my colleague Moritz Kütt.

²⁸ L. Hemicker and M. Wiegel, "Macron kommt Russland bei Atomraketen entgegen", *Frankfurter Allgemeine*, 27 November 2019, <https://www.faz.net/aktuell/politik/ausland/macron-will-putins-angebot-fuer-raketen-moratorium-pruefen-16506811.html>; P. Podvig, R. Snyder, and W. Wan, *Evidence of Absence: Verifying the Removal of Nuclear Weapons*, UNIDIR, 2018, <https://www.unidir.org/publication/evidence-absence-verifying-removal-nuclear-weapons>.

²⁹ F.E. Morgan et al., "Dangerous Thresholds: Managing Escalation in the 21st Century", RAND Corporation, 2008, <https://www.rand.org/pubs/monographs/MG614.html>.

³⁰ D.F. Winkler, *Incidents at Sea: American Confrontation and Cooperation with Russia and China, 1945–2016*, Naval Institute Press, 2017.

be conducted under the auspices of the United Nations or the OSCE, given that both organizations comprise all the relevant actors of the region. NATO, due to its role as a party to the conflict with the Russian Federation and also because it excludes non-aligned States of the region, is not the appropriate forum for such exchanges. Whatever the institutional set-up, an open, regular, and sustained exchange is critical.

Fifth, risk analysis by the main actors in the Euro-Atlantic must improve. The analysis of risk is in any case subjective and rather often driven by perceptions and emotions than by what is ideally called 'a sober or rational assessment'. Acknowledging that fact could be a good starting point in order to arrive at a more humble understanding of how fuzzy political risk analysis often works. A second step would be to encourage historians, scholars of regional studies, scientists, and nuclear and strategic studies experts to work together. Too often, nuclear studies are conducted by security scholars that work on multiple regions without any serious knowledge about the regions' history or culture. As a result, suggested policy responses are often unitary, technocratic or simplistic.

Sixth, some scenarios have received outsized or simply too much attention by analysts and policymakers. At the same time, that does not mean that low-attention scenarios might not harbour unexplored and therewith inconveniently surprising escalation pathways. One example could be a sudden political destabilization of Belarus, forcing Moscow's hand and triggering hectic military activism in a number of NATO's easternmost member States. One could think of a multitude of additional scenarios. The point is that more responsible risk analyses will have to carefully balance the need for strategic forecast with an inclination to securitize each and every aspect of international affairs or to simply fall for the latest fad in security studies.

CONCLUSION

The risk of nuclear weapons use in the Euro-Atlantic region is affected by a number of very different factors and has risen in recent years. Asymmetry in terms of risk perceptions and in terms of risk manipulation through developments in capabilities are serious drivers behind real and perceived insecurities. Nuclear doctrines, or rather the (mis)interpretation thereof coupled with poor risk analysis, are additional reasons for the currently overwhelming focus on escalatory and doctrinal use. That does not mean that such pathways of use have become more likely in the Euro-Atlantic. However, it could mean that misguided analysis becomes its own self-fulfilling prophecy in the end. In order to prevent such outcome, States should strengthen dialogue, information-sharing, and transparency mechanisms, and invest in better risk analysis.

RECOMMENDATIONS TO REDUCE NUCLEAR RISK IN THE EURO-ATLANTIC



Enhance implementation of existing agreements

- Extend New START
- Reinvigorate the Open Skies Treaty
- Use Incidents at Sea and Dangerous Military Activities Agreements

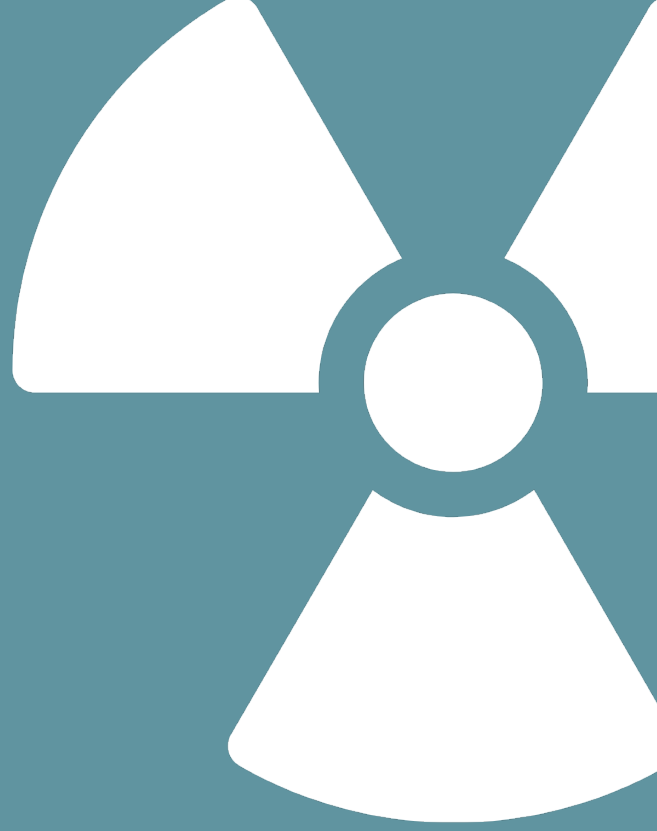


Expand dialogue, information-sharing, and transparency mechanisms

- Use former nuclear-related sites as training grounds for transparency exercises
- Verify the absence of nuclear warheads in relevant sites
- Opening of some US Aegis Ashore missile defence sites to Russian experts
- Establish subregional risk reduction centres in the Baltic and Black Sea regions
- Establish regular doctrinal seminars, in United Nations or OSCE context



Improve risk analysis, including by engaging wider communities



CHAPTER 6

NARROWING NUCLEAR USE PATHWAYS IN NORTHEAST ASIA

Tanya Ogilvie-White

SUMMARY

- Nuclear transparency in Northeast Asia is notoriously poor, but enough is known to conclude that nuclear use pathways are widening in the region and that those on the Korean Peninsula pose some of the most serious dangers.
- Drawing more international attention to these dangers, and identifying and implementing collaborative steps to reduce them, are key to preventing the emergence of a nuclear 'Wild West' in the region.
- An expansive approach is needed—one which addresses nuclear and non-nuclear realms (including new technologies and cross-domain challenges) via unilateral, bilateral and regional initiatives; policymakers and other communities all have important roles to play.
- Despite concerns about legitimizing its nuclear defiance, extensive and deep engagement of the Democratic People's Republic of Korea is necessary to reduce the likelihood of nuclear use, including through diplomatic initiatives and dialogue that could help build the trust and transparency required to transform the strategic environment.

»» INTRODUCTION

Wherever nuclear weapons exist, there is a risk that they will be used. In the insecure and rapidly changing strategic environment of Northeast Asia, these risks are growing—tensions and animosities from the Korean War remain unresolved; arms racing pressures are mounting; and nuclear use pathways are widening. In the absence of an effective regional security architecture, the NPT, US alliance system, and various diplomatic initiatives are helping limit the expansion of some of these pathways, but there are tensions between them and all are under strain. If these arrangements collapse, more States in Northeast Asia and beyond are likely to go nuclear and the chances of nuclear weapon use, either deliberately or inadvertently, will increase.

This presents the international community with an extremely difficult set of challenges. While the surest way to prevent nuclear use is via universal, verifiable nuclear disarmament, a profound lack of trust means there is little appetite for it among political leaders in the world's nuclear-armed and nuclear-dependent States. These dynamics are especially troubling where the Korean Peninsula is concerned, due to the rapid pace at which the Democratic People's Republic of Korea's nuclear and missile programmes are accelerating, the persistently provocative behaviour of the Kim Jong Un regime, and the hostile strategic environment in which this is taking place.

Preventing the emergence of a nuclear 'Wild West' in Northeast Asia is a shared interest of the international community, which should encourage cooperation on nuclear risk reduction where the likelihood of use is greatest.¹ This chapter takes on this daunting task, exploring use pathways and opportunities for joint action to lower the likelihood of nuclear use on the Korean Peninsula.

¹ J. Borrie, T. Caughley and W. Wan, "What North Korea Means—and Doesn't—for Nuclear Deterrence", *The Diplomat*, 15 September 2017, <https://thediplomat.com/2017/09/what-north-korea-means-and-doesnt-for-nuclear-deterrence/>; T. Ogilvie-White, "Responding to the Nuclear Crisis in Northeast Asia: The Dangers of Nuclear Fatalism", *Policy Forum*, 8 December 2017, <https://www.policyforum.net/dangers-nuclear-fatalism/>.

NUCLEAR USE PATHWAYS

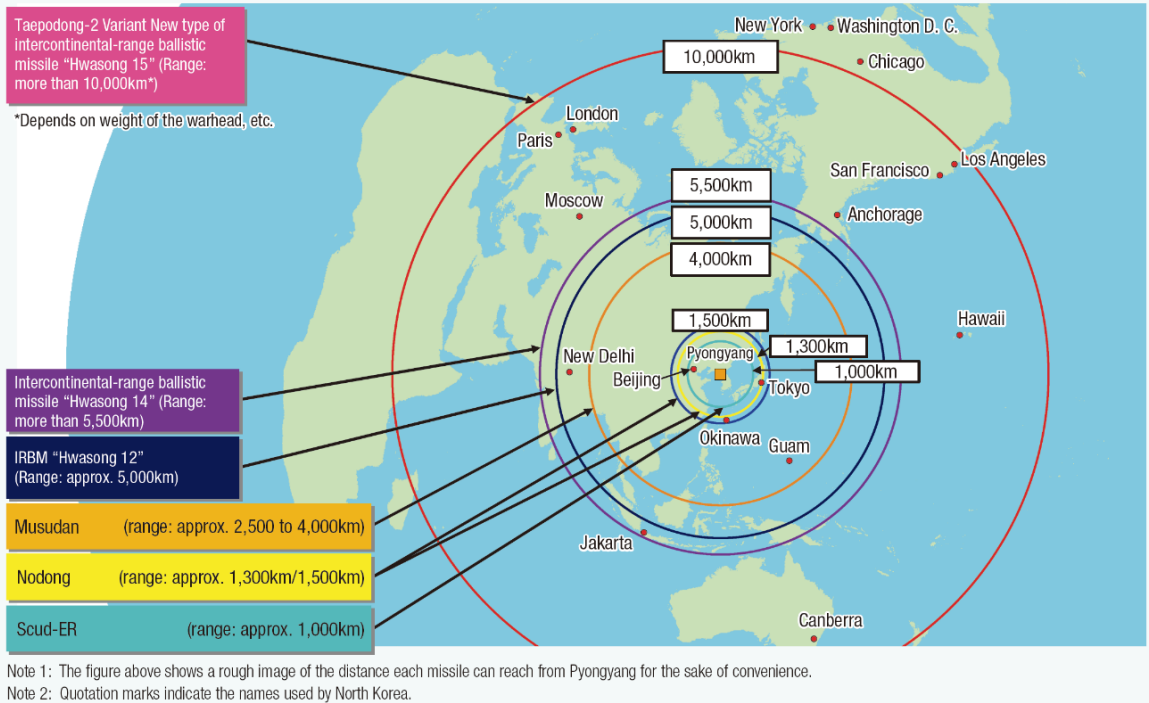
Expanding nuclear capabilities and deteriorating strategic relationships should focus attention on narrowing all nuclear use pathways across Northeast Asia, where the presence of three nuclear-armed States (China, the DPRK and the Russian Federation) and alliance commitments of a fourth (the United States) generate many complex nuclear dangers.² A combination of deep animosities, reckless leadership, rapid technological change, and uncertainty make the Korean Peninsula particularly vulnerable to these dangers. For this reason—and because this ought to galvanize urgent, collaborative nuclear risk reduction efforts, including by the nuclear weapon States—this chapter concentrates on addressing nuclear use pathways that involve the DPRK.

Efforts to assess the likelihood of nuclear use begin with trying to elucidate nuclear capabilities, which is especially difficult in Northeast Asia due to an extreme lack of transparency and total absence of nuclear arms control. Where the DPRK is concerned, this problem is compounded by the closed nature of the regime, but it is still possible to broadly track its nuclear and missile programmes. Indeed, rapid advances over the past few years have been announced to the world in a series of tests of increasingly sophisticated systems, which have displayed a single-minded determination to develop and maintain a powerful nuclear deterrent. Figures 6.1-6.4 summarize these advances, including the yields of the nuclear tests and estimated missile ranges. Other key developments include new warhead designs and re-entry technologies, the development of mobile missile launchers, work on a new submarine and submarine-capable ballistic missiles, and—according to some sources—the miniaturization of nuclear weapons to fit ballistic missile warheads.³

² For a discussion of the nuclear risks associated with great power competition between the United States, Russian Federation and China, including in Northeast Asia, see A. Panda's contribution to this volume.

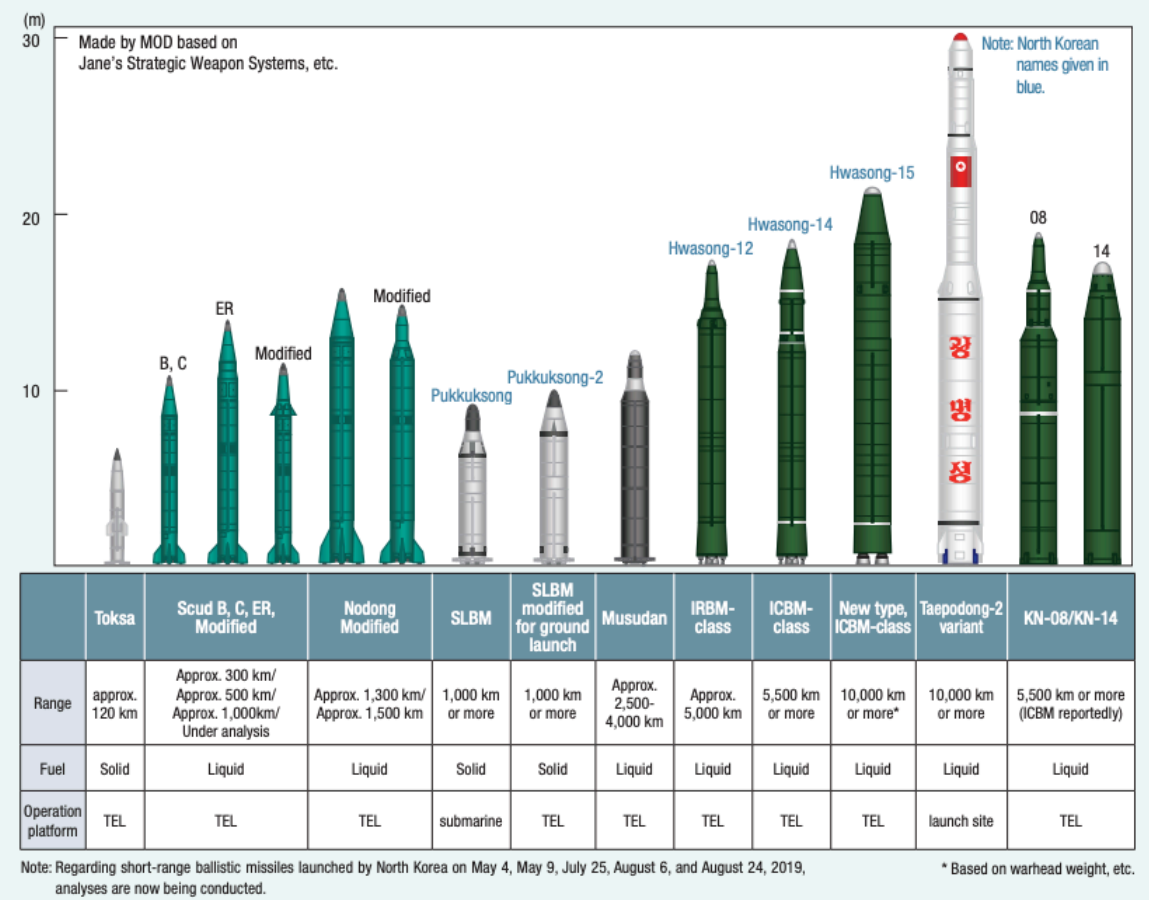
³ For more on the debate, see H.M. Kristensen and R.S. Norris, "North Korean Nuclear Capabilities, 2018", *Bulletin of the Atomic Scientists*, vol. 74, special issue, 2018, <https://doi.org/10.1080/00963402.2017.1413062>.

Figure 6.1: DPRK Ballistic Missile Ranges



Source: Defense of Japan 2019 (https://www.mod.go.jp/e/publ/w_paper/2019.html)

Figure 6.2: DPRK Ballistic Missiles

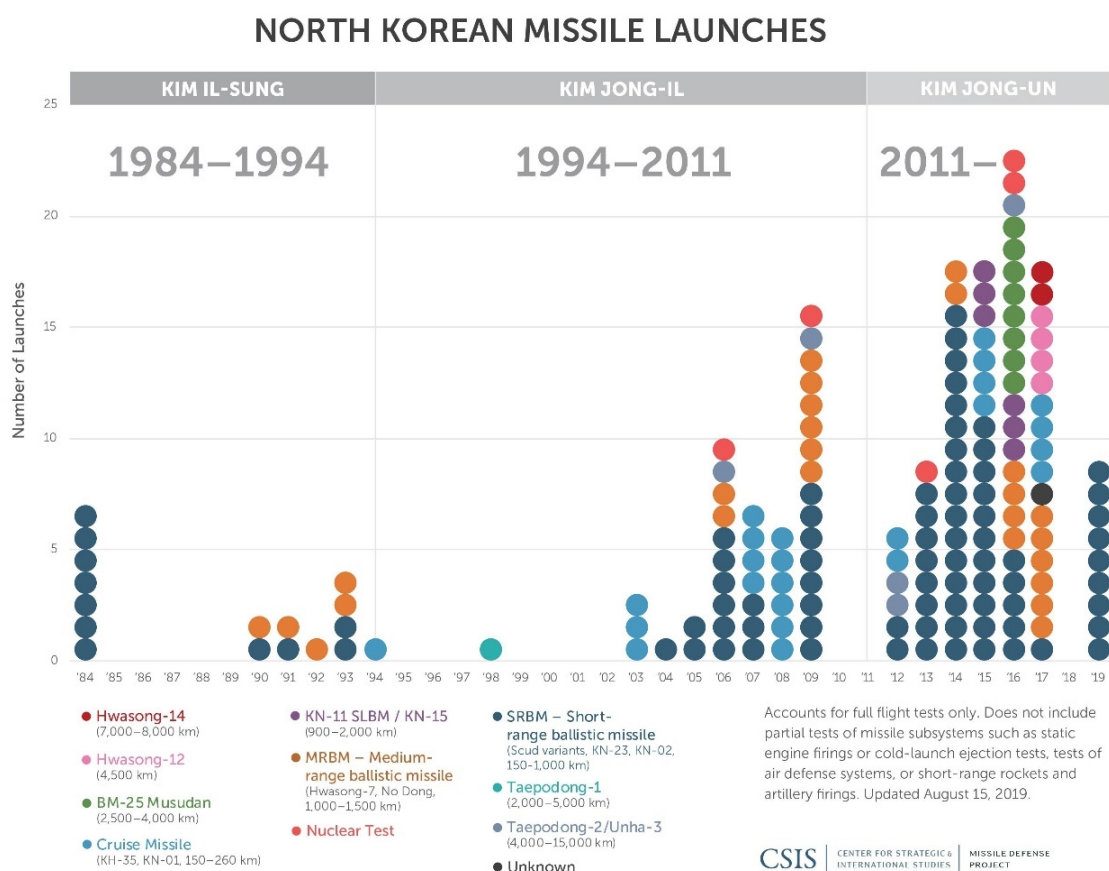


Source: Defense of Japan 2019 (https://www.mod.go.jp/e/publ/w_paper/2019.html)

The DPRK has achieved these milestones despite a programme of international sanctions that is unprecedented in its scope and oversight. The March and September 2019 reports of the United Nations panel of experts set up to oversee these sanctions describes how Pyongyang has evaded them, including via cyber-attacks on the global financial system and cryptocurrency exchanges, contributing an estimated \$2 billion to the State's weapons of mass destruction programmes.⁴

Improving sanctions implementation is just one part of a much bigger basket of diverse risk reduction measures that are needed on the Korean Peninsula. To fully grasp this point, the likelihood of nuclear use triggered by the DPRK's nuclear brinkmanship and—equally significant—regional and international reactions to it, need to be understood. The next part of this chapter explores these dangers, dividing them into the four pathways of potential nuclear use identified by UNIDIR's framework paper: doctrinal, escalatory, unauthorized and accidental.

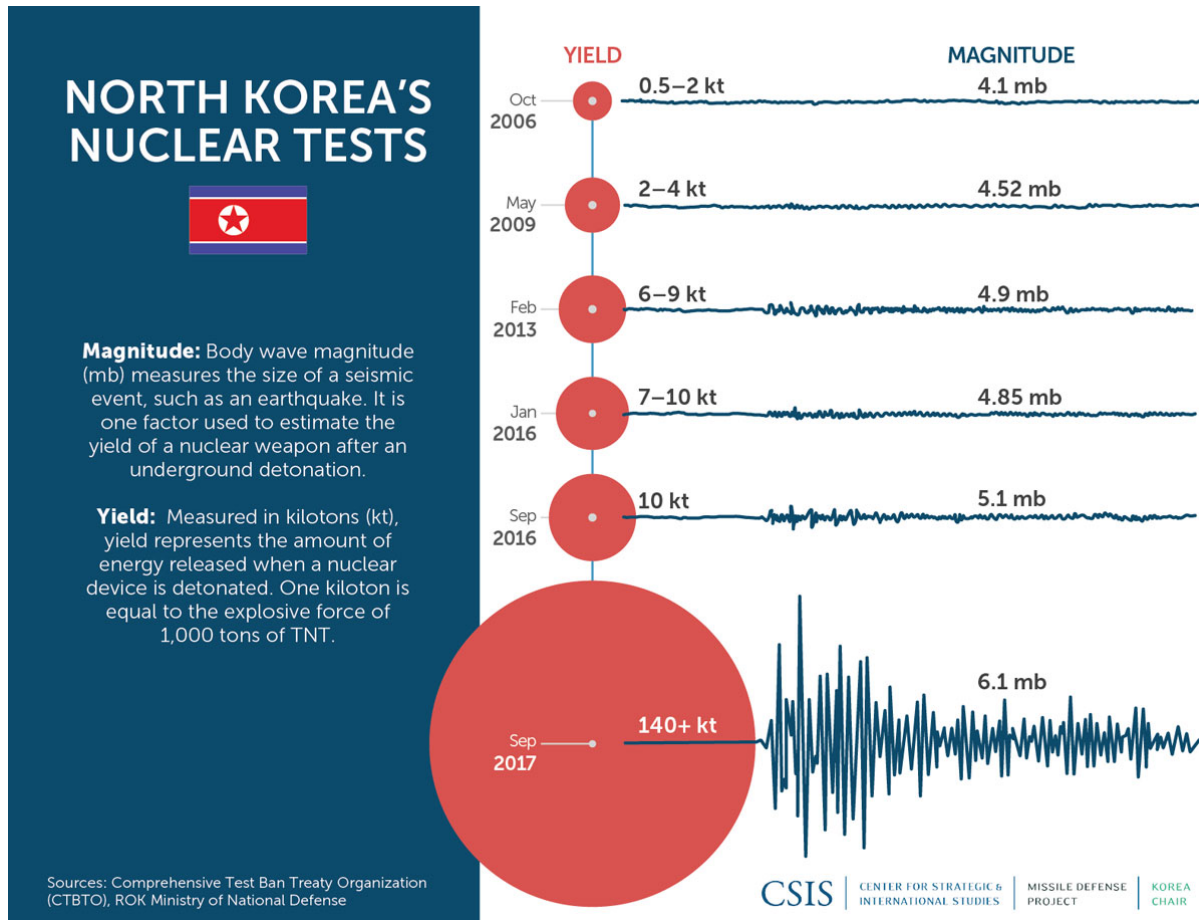
Figure 6.3: Timeline Showing Acceleration in DPRK Missile Programmes



Source: CSIS Missile Defense Project (<https://missilethreat.csis.org/north-korea-missile-launches-1984-present/>)

⁴ Security Council, Final Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009), UN document S/2019/171, 5 March 2019; Security Council, Letter Dated 27 August 2019 from the Panel of Experts Established Pursuant to Resolution 1874 (2009) Addressed to the President of the Security Council, UN document S/2019/691, 30 August 2019.

Figure 6.4: Chronology and Yields of DPRK Nuclear Tests



Source: CSIS Missile Defense Project (<https://missilethreat.csis.org/north-korea-missile-launches-1984-present/>)

DOCTRINAL PATHWAY

The DPRK has not published a clear official statement setting out the circumstances under which it would launch a nuclear strike, making analysis of the possible doctrinal pathways to nuclear use (and measures to prevent them) more difficult. However, open source materials emanating from Pyongyang provide an indication of how the State's nuclear thinking is evolving under Kim Jong Un.⁵ The term 'asymmetric escalation' has been used by US and European experts to describe it: the use of nuclear deterrence to deter more powerful adversaries from destroying the Kim Jong Un regime via conventional or nuclear attack, and the deliberate targeting of civilian as well as

⁵ Most of these open sources are provided by the official news outlets, KCNA and Rodong Shinmun; see KCNA, "Law on Consolidating the Position of Nuclear Weapons State", "Crucial Statement of KPA Supreme Command", and "Law on Consolidating the Position of Nuclear Weapons State Adopted", 1 April 2013, <http://www.kcna.co.jp/item/2013/201304/news01/20130401-25ee.html>; KCNA, "Crucial Statement of KPA Supreme Command", 23 February 2016, <http://www.kcna.co.jp/item/2016/201602/news23/20160223-27ee.html> (the KCNA website is sometimes down).

military targets to demonstrate resolve (see Figure 6.5, below).⁶ For this form of deterrence to work, Pyongyang's adversaries must believe the regime is willing to risk the likely consequences of launching a pre-emptive strike, that is, its own annihilation by the massively superior nuclear and conventional firepower of its opponent.

Although it is underpinned by defensive rather than aggressive goals, this posture is dangerously destabilizing because it relies on opacity and deliberate provocations to instil fear and uncertainty in adversaries. As a result, tensions are high, opportunities for confidence-building are low, and chances of misperception abound. When this posture combines with equally destabilizing actions and rhetoric by adversaries, as occurred early in the administration of US President Donald J. Trump, it increases the chances of deliberate and inadvertent military conflict, widening all four risk pathways.

⁶ V. Narang, *Nuclear Strategy in the Modern Era: Regional Powers and International Conflict*, 2014, pp. 19–20; L. Allard, M. Duchatel, and F. Godement, “Pre-empting Defeat: In Search of North Korea’s Nuclear Doctrine”, *Policy Brief*, European Council on Foreign Relations, November 2017, https://www.ecfr.eu/page/-/ECFR-237-In_search_of_North_Koreas_nuclear_doctrine.pdf.

Figure 6.5: Nuclear Strike Targets According to DPRK Sources

Country	Target	Arsenal	Target type
USA	'US mainland'	Nuclear	Civilian
USA	'Major American cities'	Nuclear	Civilian
USA	Manhattan	Nuclear	Civilian
USA	The White House	Nuclear	Civilian
USA	The Pentagon	Nuclear	Civilian
Asia-Pacific	'US military bases in the operational theatres in the Pacific'	Nuclear	Military
Asia-Pacific	Guam, Hawaii	Nuclear	Military
Asia-Pacific	US nuclear aircraft carrier	Nuclear	Military
ROK	Targets in the 'operation theatres of South Korea'	Nuclear	Military
ROK	'US military bases in South Korea', Osan, Kunsan, Busan	Unspecified	Military
ROK	Pyeongtaek, Jungwon, Degu, Gyeryongdae	Unspecified	Military
ROK	Seoul	Unspecified	Civilian
ROK	'Blue House' and 'reactionary governmental agencies'	Unspecified	Civilian
Japan	'US military bases in Japan and Okinawa'	Nuclear	Military
Japan	Yokosuka, Misawa, Okinawa	Unspecified	Military
Japan	'Japanese mainland', Tokyo, Osaka, Yokohama, Nagoya, Kyoto	Unspecified	Civilian

Adapted from source: European Council on Foreign Relations, 2017 (L. Allard, M. Duchatel, and F. Godement, "Pre-empting Defeat: In Search of North Korea's Nuclear Doctrine", European Council on Foreign Relations, November 2017, https://www.ecfr.eu/page/-/ECFR-237-In_search_of_North_Koreas_nuclear_doctrine.pdf.)

It is important to note, however, that in purely doctrinal terms, the biggest risk of nuclear use on the Korean peninsula stems from US nuclear doctrine and strategy. Whereas Pyongyang's nuclear doctrine is limited by technological and capacity constraints, some argue the 2018 US Nuclear Posture Review could be construed as the United States envisaging circumstances in which nuclear weapons could be employed early in conventional conflicts, in response to massive cyber-attacks, and to achieve counter-proliferation goals.⁷ In times of extreme tension in US–DPRK relations,

⁷ A. Mount and A. Stowe-Thurston, "What is US Nuclear Policy, Exactly?", *Bulletin of the Atomic Scientists*, 18 April 2018, <https://thebulletin.org/2018/04/what-is-us-nuclear-policy-exactly/>; T. Suzuki and S. Hirose, "Report of Panel on Peace and Security of Northeast Asia (PSNA) 2018", *Journal for Peace and Nuclear Disarmament*, vol. 2, no. 1, May 2019, pp. 378–386; US Department of Defense, *Nuclear Posture Review 2018*, February 2018, pp. 32–33, <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF>; US Joint Chiefs of Staff, *Joint Operations*, https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_0ch1.pdf?ver=2018-11-27-160457-910.

US political leaders and defence officials have emphasized that ‘all options are on the table’ in dealing with nuclear and missile developments in Pyongyang, and declassified documents show that these threats are not pure rhetoric.⁸

Even putting aside Trump’s inflammatory threats in 2017 to unleash “fire and fury” and “totally destroy [the Democratic People’s Republic of Korea]”, there have been occasions when US Presidents have come close to carrying out disarming strikes against Pyongyang.⁹ In June 1994, for example, President Bill Clinton reportedly neared authorizing an attack on the Yongbyon nuclear reactor, despite estimates that up to a million lives could be lost.¹⁰ The plan was aborted after the President of the Republic of Korea strongly opposed it, and Jimmy Carter made a personal intervention. Even President Barack Obama, who favoured a diminished role for US nuclear weapons during his presidency and who pondered a ‘no first use’ doctrine, is said to have weighed a disarming strike on the DPRK in September 2016, after Pyongyang conducted its fifth nuclear test and test-fired ballistic missiles near Japan.¹¹

It is unclear what impact progress in the DPRK’s nuclear weapons capabilities (including in the range, sophistication and diversification of its delivery systems) will have on this risk pathway. The DPRK’s technological advances increase the potential costs of a US first strike, including the risk of unintended consequences, which should in theory reduce its strategic appeal. At the same time, US war planning continues to envisage a role for nuclear weapons in the defence of the Republic of Korea and Japan, and the US nuclear modernization programme includes work on earth-penetrating nuclear weapons (the upgraded B61-12), which could convince military planners that a disarming first strike against the DPRK remains an option.¹² Awareness of these and other developments (including confirmation of US deployment of the W76-2 low-yield submarine-launched ballistic missile warhead), would almost certainly heighten DPRK

⁸ J. McCurry, “Trump on North Korea: All Options are on the Table”, *The Guardian*, 30 August 2017, <https://www.theguardian.com/world/2017/aug/29/donald-trump-on-north-korea-all-options-are-on-the-table>.

⁹ J. Pramuk, “Trump Warns North Korea Threats ‘Will be Met with Fire and Fury’”, CNBC News, 8 August 2017, <https://www.cnn.com/2017/08/08/trump-warns-north-korea-threats-will-be-met-with-fire-and-fury.html>; The White House, *Remarks by President Trump to the 72nd Session of the United Nations General Assembly*, 19 September 2017, <https://www.whitehouse.gov/briefings-statements/remarks-president-trump-72nd-session-united-nations-general-assembly/>.

¹⁰ B. Cumings, “Time to End the Korean War”, *The Atlantic*, February 1997, <https://www.theatlantic.com/magazine/archive/1997/02/time-to-end-the-korean-war/376775/>; L.V. Sigal, *Disarming Strangers: Nuclear Diplomacy with North Korea*, 1999; B. Cumings, “After Hanoi, Remember the Risks of Not Engaging North Korea”, *Bulletin of the Atomic Scientists*, 4 March 2019, <https://thebulletin.org/2019/03/after-hanoi-remember-the-risks-of-not-engaging-north-korea/>.

¹¹ J. Johnson, “Obama Weighed Pre-emptive Strike Against North Korea After Fifth Nuclear Blast and Missile Test Near Japan in 2016, Woodward Book Claims”, *Japan Times*, 12 September 2018, <https://www.japantimes.co.jp/news/2018/09/12/asia-pacific/politics-diplomacy-asia-pacific/obama-weighed-pre-emptive-strike-north-korea-fifth-nuclear-blast-missile-tests-near-japan-2016-woodward-book-claims/#.XZVc2m5uluU>.

¹² H.M. Kristensen and M. Korda, “Tactical Nuclear Weapons, 2019”, *Bulletin of the Atomic Scientists*, 30 August 2019, <https://doi.org/10.1080/00963402.2019.1654273>.

threat perceptions, possibly increasing the chances of sudden, unexpected conflict escalation, including a ‘use it or lose it’ nuclear strike by the DPRK.¹³

It is also possible that if the DPRK continues to expand, diversify and improve its nuclear arsenal, Kim Jong Un may eventually be emboldened to abandon his current defensive nuclear doctrine irrespective of US developments.¹⁴ Indeed, Japanese defence officials believe that Kim is already on this path. Japan’s 2019 Defence White Paper assesses that in addition to developing Transporter-Erector-Launchers (which make it difficult to detect an imminent missile launch) and submarine-launched ballistic missiles, the DPRK likely has the capability to miniaturize nuclear weapons to fit ballistic missile warheads, and may already have successfully done so.¹⁵ Theoretically, this increases the risk of a surprise attack by the DPRK, which is portrayed in Japan’s White Paper as an intolerable threat. In the current context, despite Kim Jong Un’s bellicose threats during the 2017 missile crisis, the likelihood that Pyongyang would deliberately launch a surprise nuclear attack on Japan (or the Republic of Korea, the United States, or any other country) is low, but this could theoretically change if Pyongyang continues to work on thermonuclear weapons and on the survivability of its nuclear forces.¹⁶ Its underwater test of a submarine-capable ballistic missile in October 2019—in violation of United Nations sanctions and in defiance of negotiations with the United States—feeds these concerns.¹⁷

A more likely scenario of doctrinal use in the foreseeable future would stem from a calculation by the United States that it has the necessary intelligence and military capabilities (nuclear, missile, cyber and other) to strike first and disable the DPRK’s nuclear weapons programme before it reaches the second-strike threshold. While the history of US intelligence failures concerning nuclear weapons developments in the DPRK, the Islamic Republic of Iran, Iraq, Libya, and Pakistan, among others, should combine with other barriers to block this path, there is no guarantee that they will.¹⁸ It may also be the case that the DPRK could still retaliate from hidden locations in

¹³ M. Fabey, “Pentagon Confirms Deployment of W76-2 Low-yield Submarine-launched Ballistic Missile”, *Jane’s Defence Weekly*, 4 February 2020, <https://www.janes.com/article/94100/pentagon-confirms-deployment-of-w76-2-low-yield-submarine-launched-ballistic-missile>.

¹⁴ T. Roehrig, “North Korea, Nuclear Weapons and the Stability-Instability Paradox”, *Korean Journal of Defense Analysis*, vol. 28, no. 2, 2016, pp. 181–198.

¹⁵ Japan Ministry of Defense, *Defense of Japan 2019*, September 2019, p. 93, https://www.mod.go.jp/e/publ/w_paper/2019.html.

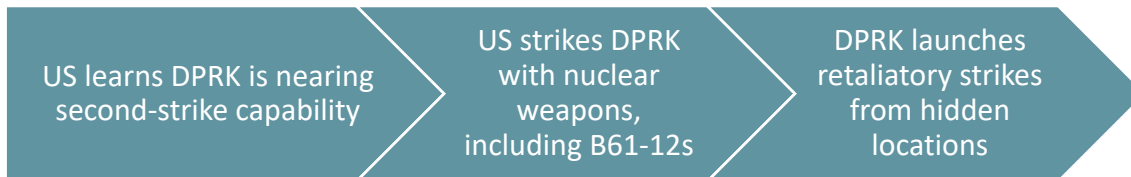
¹⁶ J. Kim and K. Takenaka, “North Korea Threatens to Sink Japan and Reduce U.S. to ‘Ashes and Darkness’”, *Reuters*, 14 September 2017, <https://www.reuters.com/article/us-northkorea-missiles/north-korea-threatens-to-sink-japan-reduce-u-s-to-ashes-and-darkness-idUSKCN1BP0F3>.

¹⁷ J. Lee, “North Korea Says It Successfully Tested New Submarine-launched Ballistic Missile”, *Reuters*, 3 October 2019, <https://www.reuters.com/article/us-northkorea-missiles/north-korea-says-successfully-tested-new-submarine-launched-ballistic-missile-kcna-idUSKBN1WH2GS>.

¹⁸ K. P. Mueller et al., *Striking First: Preemptive and Preventive Attack in U.S. National Security Policy*, RAND Project Air Force, 2006, https://www.rand.org/content/dam/rand/pubs/monographs/2006/RAND_MG403.pdf; D.E. Sanger and W.J. Broad, “How U.S. Intelligence Agencies Underestimated North Korea”, *The New York Times*, 6 January 2018, <https://www.nytimes.com/2018/01/06/world/asia/north-korea-nuclear-missile-intelligence.html>.

response to a disarming strike by the United States, or that it could or would pre-empt such action if the leadership believed (accurately or not) that an attack was imminent and regime survival was at stake.

Figure 6.6: Hypothetical Doctrinal Use Scenario (Counter-Proliferation)



ESCALATORY PATHWAY

Whereas the likelihood of doctrinal nuclear use on the Korean peninsula is relatively low, the same cannot be said of deliberate escalatory use, which would most likely be triggered by a conventional conflict involving the DPRK and US allies: Japan and the Republic of Korea. An underlying condition of risk is Pyongyang's policy of self-reliance, which promotes economic self-sufficiency and rejects integration into the global economy (beyond its dependence on China), undermining the stabilizing effects of interdependence in East Asia. Another underlying condition involves the (over)confident, risk-taking personalities of Kim Jong Un and Trump—though a thaw later ensued, both failed to exercise the diplomatic caution warranted by worsening tensions in 2017.¹⁹

These are serious problems in a region of deep fault lines in DPRK–ROK–Japan strategic relations, including the lack of a peace treaty formally ending the Korean war, the outstanding issue of Korean reunification, the lack of cooperation between Tokyo and Seoul, and hostile relations between the DPRK and Japan. These tensions mean that any military crisis is escalation-prone, requiring very careful management. Military provocations by the DPRK against the Republic of Korea and Japan constitute a serious cause of concern, as it is all too easy to foresee future scenarios that fail to resolve peacefully, pulling the United States into an escalating conventional conflict, which in turn could draw China into the confrontation, and leading to the deliberate or inadvertent use of nuclear weapons by the United States or any of the region's nuclear-armed States.

Insecurities stemming from these risks have tended to drive behaviour that has exacerbated them further—a dangerous manifestation of the so-called 'security

¹⁹ V. Jackson, *On the Brink: Trump, Kim, and the Threat of Nuclear War*, 2019; J. Nilsson-Wright, "Nuclear Crisis on the Korean Peninsula: Strategic Adaptation, the Abe Administration and Extended Deterrence in the Face of Uncertainty", *Japan Forum*, vol. 31, no. 1, 2019, p. 117, <https://doi.org/10.1080/09555803.2018.1451355>.

dilemma'.²⁰ Regular combined military exercises between the United States and the Republic of Korea, for example, which are defensive in nature and are intended to assuage Seoul's concerns, signal alliance resolve, and prepare an effective response in the event of a military crisis, have increased tensions and heightened risks. Pyongyang's missile tests, for example, are often timed to coincide with these displays of alliance strength.²¹ In this sense, DPRK actions are intentionally provocative, but they stem from deep insecurity caused by alliance war planning.

The potential for future action–reaction dynamics to result in deliberate military confrontation should not be underestimated, particularly if domestic political pressures come into play.²² Scholars point to the DPRK's deliberate shelling of Yeonpyeong Island in November 2010 (following artillery exercises by the Republic of Korea) as an example of the type of low-level military exchange, which, if poorly handled, could unleash alliance commitments that escalate to nuclear use.²³ In that instance, Seoul acted with restraint, but a future president might feel pressured to respond more forcefully, creating a situation in which the United States or the DPRK uses nuclear weapons to try to coerce the other side into backing down.

Another potential escalatory pathway would involve a conventional skirmish leading to escalation and nuclear use resulting from misjudgment or misperception—a risk that is increasing as a result of asymmetric technological advances and compounded by military opacity, mistrust and poor communication. Examples could include an unintended strike on land-based mobile nuclear missiles or on strategic nuclear submarines (particularly if unmanned underwater vehicles result in a false alarm), or an erroneous belief that an adversary's advanced conventional weapons (missile defence interceptors, high-precision conventional missiles, anti-satellite weapons, dual-capable bombers, and even cyber weapons) pose an imminent threat to nuclear assets, including by compromising C3 and intelligence capabilities. The lack of constraints on Northeast Asia's arms racing dynamics combined with recent developments in cyber and other technological capabilities mean these dangers are growing.²⁴

²⁰ See comments by G. Yang on excessive reliance on 'alliance deterrent' (extended deterrence), *The 2nd China–R.O.K. East Asia Security Forum*, summary report, East Asia Foundation–Nanjing University, 8 April 2016, p. 51, http://www.keaf.org/_inc/CommonDown.php?seq=MAg3CDIIMTII.

²¹ See, for example, A. Panda and V. Narang, "Why North Korea is Testing Missiles Again", *Foreign Affairs*, 16 May 2019, <https://www.foreignaffairs.com/articles/north-korea/2019-05-16/why-north-korea-testing-missiles-again>

²² H. Tanaka, "Five Factors That Could Lead to War with North Korea", *East Asia Insights*, September 2017, <http://www.jcie.or.jp/insights/201709.pdf>.

²³ J. Acton, "Technology, Doctrine, and the Risk of Nuclear War", in N. Tannenwald, J.M. Acton, and J. Vaynman (eds), *Meeting the Challenges of the New Nuclear Age*, American Academy of Arts and Sciences, April 2018, p. 15, <https://www.amacad.org/publication/emerging-risks-declining-norms/section/4>.

²⁴ A. Futter, *Hacking the Bomb: Cyber Threats and Nuclear Weapons*, 2018, pp. 35–52; E. Geist and A.J. Lohn, "How Might Artificial Intelligence Affect the Risk of Nuclear War?", *Perspective*, RAND, 2018, https://www.rand.org/content/dam/rand/pubs/perspectives/PE200/PE296/RAND_PE296.pdf.

Figure 6.7: Hypothetical Escalatory Use Scenario (Deliberate)



UNAUTHORIZED PATHWAY

The isolation and extreme secrecy of the Kim Jong Un regime make it difficult to assess the risk of unauthorized use of nuclear weapons on the Korean Peninsula. Theoretically, however, there are at least three potential scenarios of nuclear weapons use in East Asia and beyond as a result of unauthorized access to DPRK nuclear weapons: 1) the unauthorized acquisition of nuclear and missile technology by external non-State actors, leading to a nuclear terror attack beyond the State's borders; 2) the collapse of the Kim Jong Un regime leading to nuclear use by an internal political faction; or 3) imminent or actual regime collapse leading to a power grab by neighbouring States, escalating to nuclear war.

The risk of clandestine nuclear weapons proliferation by the DPRK has long been a concern of the international community, and for good reason. Intelligence monitoring and reports by international bodies have exposed a history of illicit arms and technology transfers between the DPRK and third States, and while most of these have not involved sensitive nuclear technology, some have.²⁵ Curbing this trade has been one of the main objectives of a string of Security Council sanctions, which have sought not only to hamper Pyongyang's efforts to import components needed for its own nuclear and missile programmes, but also to stop the transfer of sensitive DPRK technology to other State and non-State actors.

Recent reports on sanctions implementation reveal that Pyongyang is using sophisticated techniques to evade these controls, and has been expanding its arms trade and military cooperation with States in the Middle East, Africa, and South America.²⁶ Most of this trade involves the sale of small arms and light weapons, but (particularly if these and other means of acquiring hard currency become more difficult), the potential for the Kim Jong Un regime to risk selling sensitive nuclear materials and missile components, and for these to end up in the hands of non-State actors that are willing and able to use them, is real. Moreover, given recent changes in

²⁵ A. Berger, *Target Markets: North Korea's Military Customers in the Sanctions Era*, Routledge, 2016.

²⁶ Security Council, Note by the President of the Security Council, UN document S/2019/171, 5 March 2019.

the nuclear doctrines of key nuclear-armed States, which have expanded the conditions under which nuclear weapons would be employed, the risk of nuclear weapon use against a State-sponsored terrorist group must also be taken seriously, as must the potential for such a crisis to escalate to all-out war.

It is also worth exploring the causes and consequences of DPRK regime collapse, and the risks of unauthorized and escalatory use in that context. It is well known that even patchy sanctions have unintentionally exacerbated the suffering of ordinary Koreans, hampering access to food and basic services, and a situation in which economic crisis and political discontent combine to topple the Kim regime cannot be altogether excluded.

These events could provoke a regional crisis, which could include a struggle to assert control over the State's extensive weapons of mass destruction and missile programmes. One such scenario could see a domestic military faction overthrow Kim Jong Un, gain access to the nuclear arsenal and use it as a political weapon to blackmail the international community into accepting their authority, or a strategic weapon to repel an external intervention.²⁷ Another scenario could see a domestic power vacuum exploited by States that compete to secure DPRK territory and assets, sparking a conflict that could escalate to nuclear war.

Figure 6.8: Hypothetical Unauthorized Use Scenario (Regime Collapse)



ACCIDENTAL PATHWAY

The risk of technical malfunction (including cyber-induced), resulting in an accidental missile strike and leading to crisis escalation including nuclear use must be taken very seriously. The events of April 2017 highlight this risk: During a test firing from Pukchang Airfield, a Hwasong-12/KN17 intermediate range ballistic missile failed about a minute into powered flight, crashing in the city of Tokcho. According to

²⁷ G. Gentile et al., "Four Problems on the Korean Peninsula: North Korea's Expanding Nuclear Capabilities Drive a Complex Set of Problems", RAND Corporation, 2019, <https://www.rand.org/pubs/tools/TL271.html>.

reports, which can be corroborated using commercial satellite imagery, the impact damaged a complex of agricultural buildings near a residential area.²⁸

The accident caused alarm among nuclear experts, who have argued that the safety risks associated with the State's nuclear and missile programme tend to be overlooked. While the impact of the Tokcho accident was relatively modest (it has not been possible to verify whether there were any deaths or injuries), the incident brings into focus the possibility of other accidents, which could have serious or even catastrophic consequences. One of the problems is that liquid-fuel missiles like the Hwasong-12, Hwasong-14, and Hwasong-15 all use a highly volatile combination of chemical agents that can produce massive explosions, depending on how they fail.

Adding to this danger, two recent developments in Pyongyang's missile testing programme are worrying in terms of their potential to turn a technical malfunction into a crisis. The first is the use (probably as part of a strategy to avoid decapitation strikes by the United States) of civilian facilities for ballistic missile assembly and testing. For example, in 2017 ballistic missiles were launched from Pyongyang's Sunan airport, which serves as the country's entry point for most non-Chinese foreign visitors. The potential for an accident to occur at Sunan airport or other civilian facility—leading to casualties of citizens and foreign nationals—is significant, and could trigger an international crisis.²⁹

The second development is even more troubling: in the past few years, Pyongyang has been test firing ballistic missiles over Japan, and the consequences of a missile malfunction over Japanese territory could be dire. If in the future a missile fails during overflight, it could be mistaken for an attack even if it is carrying a dummy payload, sparking a military response that could escalate to nuclear use.³⁰ The lack of formal launch warnings provided by the DPRK, and technological advances that have allowed the Kim regime to diversify its launch sites and conceal launch preparations, exacerbate this risk, making it more likely that an accident would be misinterpreted as a deliberate and unprovoked attack.³¹

Developments in civilian technologies could also increase the risk of accidental use in the conflict-prone relationships in Northeast Asia. Experts have noted that social media

²⁸ A. Panda and D. Schmerler, "When a North Korean Missile Accidentally Hit a North Korean City", *The Diplomat*, 3 January 2018, <https://thediplomat.com/2018/01/when-a-north-korean-missile-accidentally-hit-a-north-korean-city/>.

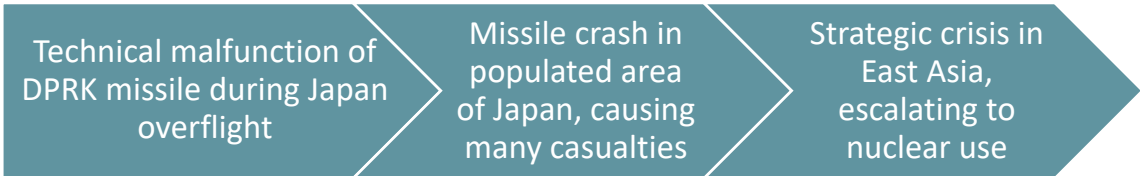
²⁹ Security Council, Final Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009), UN document S/2019/171, 5 March 2019.

³⁰ A. Panda and D. Schmerler, "When a North Korean Missile Accidentally Hit a North Korean City", *The Diplomat*, 3 January 2018, <https://thediplomat.com/2018/01/when-a-north-korean-missile-accidentally-hit-a-north-korean-city/>.

³¹ Officials from across East Asia have expressed alarm over the possible consequences of test failures, as debris from the tests has fallen within or close to their territory. See, for example, "Philippines Protests Against N. Korean Rocket Launch", *Bangkok Post*, 1 April 2012, <https://www.bangkokpost.com/world/286993/philippines-protests-against-n-korea-rocket-launch>.

storms have the potential to trigger nuclear early warning systems, and have also warned of false alarms sparked by unreliable news reports, the activities of cyber criminals and other losses of control linked to technological developments.³²

Figure 6.9: Hypothetical Accidental Use Scenario (Missile Malfunction)



³² Peter Hayes’ comments as summarized in T. Suzuki and S. Hirose, “Report of Panel on Peace and Security of Northeast Asia (PSNA) 2018”, *Journal for Peace and Nuclear Disarmament*, vol. 2, no. 1, 2019, p. 383; E. Geist and A.J. Lohn, “How Might Artificial Intelligence Affect the Risk of Nuclear War?” *Perspective*, RAND, 2018, https://www.rand.org/content/dam/rand/pubs/perspectives/PE200/PE296/RAND_PE296.pdf.

NUCLEAR RISK REDUCTION

Scholars and practitioners alike acknowledge the genuine danger of nuclear use resulting from strategic tensions on the Korean peninsula, but risk reduction efforts have had limited success. A lack of trust and transparency are among the most serious obstacles to progress, complicated by the widely shared desire to avoid legitimizing Pyongyang's nuclear status or rewarding its nuclear defiance.

Concern over the emergence of new technologies combined with the deterioration of Northeast Asia's strategic environment bring into sharper focus the question of how to pursue nuclear risk reduction without legitimizing nuclear breakout. Consistently denying Pyongyang nuclear status makes sense from the perspective of upholding the NPT: relaxing this position would set a negative precedent for handling future breakout crises, potentially making nuclear non-proliferation and disarmament even harder to achieve. At the same time, the urgent goal of nuclear risk reduction requires deeper levels of engagement with the DPRK, including through technical dialogue—a process that could unintentionally bestow a level of legitimacy on Pyongyang's nuclear activities. Pursuing each goal without compromising the other is virtually impossible, creating a serious policy dilemma which is easy to acknowledge but extremely difficult to resolve.

The second half of this chapter explores proposals to narrow the four use pathways in Northeast Asia in the context of this dilemma. The overarching argument is that an expansive approach is needed to reduce nuclear dangers in the region. Urgent steps inside and outside the nuclear realm are needed, at multiple levels (unilateral, bilateral, and regional), and among various constituencies—all directed at narrowing use pathways while attempting to improve Northeast Asia's strategic environment more broadly by increasing predictability.

MANAGING DOCTRINAL RISK

There are numerous unilateral steps that States could take to narrow doctrinal use pathways.

For example, the United States could change its nuclear doctrine by ruling out nuclear use in disarming first strikes, in response to cyber-attacks, to achieve regime change, and in all circumstances other than the most extreme. This proposal may not find support in the Trump Administration (which, if anything, has embraced a more expansive nuclear doctrine) but it could become more feasible if a new US President were to be elected in 2020.³³ For its part, China could reaffirm its commitment to 'no

³³ US Department of Defense, *Nuclear Posture Review 2018*, February 2018,

first use' and the DPRK could declare that its nuclear weapons are genuinely weapons of last resort.

It is also possible to constrain the doctrinal pathway via bilateral means, including the US–DPRK Summit process, with the goal of easing tensions through dialogue. The summits offer a vital communication channel, and although their slow progress is criticized from all sides, they have offered space for pragmatic risk reduction, including by tamping down the more extreme rhetoric and action–reaction military provocations that dominated US–DPRK relations in 2016–2017. They have also provided opportunities to incrementally manage risks in ways that have not required any formal change in nuclear postures of the United States or the DPRK, including via reciprocal confidence-building measures (suspending joint military exercises and agreeing testing moratoriums, for example), which at least stall doctrinal pathways. Next steps for the summit process could include the development of a roadmap setting out specific risk reduction measures across nuclear and non-nuclear realms in Northeast Asia, including launching an expanded, regionally inclusive dialogue process focusing on cross-domain risk reduction.

The region's non-nuclear weapon States could take independent steps to narrow the scope for doctrinal nuclear use in East Asia. For example, States that rely on US nuclear weapons for their security (Australia, Japan, and the Republic of Korea) could restrict the role of nuclear weapons in their defence doctrines by issuing joint statements that stigmatize the use of nuclear weapons except as weapons of last resort, and by pledging that they would not welcome the introduction/reintroduction of US tactical nuclear weapons on their territory.³⁴

MANAGING ESCALATORY RISK

Limiting provocative language and behaviour of all kinds and by all sides is critical in reducing the likelihood of deliberate and inadvertent escalatory use of nuclear weapons. Kim Jong Un and Trump both have a record of reckless bellicosity and therefore bear an unparalleled responsibility to change their behaviour. This is risk reduction at its most basic and is the very least that the international community should demand from those that have the capacity to launch nuclear strikes that could kill millions of people and cause total devastation. Related to this point, States that currently rely on the United States for their security should be more willing to use their combined political leverage to rein in the US President's intemperate outbursts, just as China is expected to admonish Kim.

<https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF>.

³⁴ T. Ogilvie-White, "It's Time to Fill Asia's Arms Control Void", *The Interpreter*, 16 November 2018, <http://www.lowyinstitute.org/the-interpreter/time-fill-asia-arms-control-void>.

From this perspective, while the Trump–Kim summit process is criticized for its lack of concrete achievements on nuclear disarmament, it has created the space for respectful dialogue, and it also resulted in the suspension of Pyongyang’s nuclear and long-range missile tests, following the dangerous nuclear brinkmanship of 2017. Both are important achievements in crisis management, so while the process has been patchy and its longevity is uncertain, it would be a mistake to allow it to be derailed by unrealistic expectations. Expressing broad support for the process and urging its continuation, despite its difficulties, should be a priority for domestic legislators, political leaders and diplomats alike.

Korean rapprochement efforts also play an important role in narrowing escalatory pathways by keeping open crisis communication channels. In recent times, this has included direct engagement of Kim Jong Un by President Moon Jae-in in a series of face-to-face trust-building meetings, as well as efforts by Moon to serve as an intermediary in the US–DPRK Summit process, the establishment in April 2018 of a crisis hotline between Seoul’s presidential Blue House and Pyongyang’s State Affairs Commission, and the entry into force of the 2018 Inter-Korean Military Agreement, which seeks to reduce conventional military risks along the Military Demarcation Line.³⁵ Finding ways to consolidate, implement and expand these initiatives, despite episodes of extreme provocation by the DPRK and pressure from domestic constituencies in the Republic of Korea for a forceful response, presents a major challenge for President Moon.³⁶ The international community can help by issuing joint statements of support, and by engaging in dialogue on how third parties can assist.

Practical risk reduction measures that could be negotiated in the US–DPRK summit talks, via an expanded regional diplomatic process, or in ad hoc negotiations, include formally ending the Korean war, re-suspending joint US–ROK military exercises (or circumscribing the exercises so that they are not perceived as involving preparations for the ‘decapitation’ of the Kim Jong Un regime) and addressing evolving nuclear risks as they relate to new technology and cross-domain challenges, particularly in space and cyberspace. Again, engagement on these issues requires input and support from US allies in East Asia, given the relationship between their strategic expectations, US behaviour in the region, and the way this is perceived by Pyongyang. Inclusive, regional dialogues could be most productive in this sense, addressing nuclear risk on the Korean Peninsula in the context of broader issues of strategic stability in Northeast Asia, East Asia and the Indo-Pacific.

³⁵ “The Inter-Korean Military Agreement: Risk of War Diminished?” *Policy Brief no. 208*, Institute for Security & Development Policy”, 2 November 2018, <https://isdpeu/content/uploads/2018/11/2018-208-The-Inter-Korean-Military-Agreement-1.pdf>

³⁶ D. Son, “Flawed Assumption in Pro-Nuclear Arguments and South Korea’s Strategic Choice”, *Asian Perspective*, vol. 43, no. 1, Winter 2019, <https://muse.jhu.edu/article/716353>

This type of engagement, while potentially problematic from a legitimization perspective, would help foster a shared understanding of cross-domain misperception, overreaction and escalation scenarios, which could encourage greater strategic restraint by States in the region at times of heightened tension. This would reduce the incentives for the Kim regime to engage in provocative behaviour, increasing the chances of achieving a formal moratorium on nuclear and missile tests. Additional confidence-building measures could be agreed as part of bilateral and regional dialogues, including pre-notification of nuclear and missile tests (including test locations and flight paths), avoiding overflight of Japanese airspace and territory, notifying neighbours of accidents involving nuclear and missile activities, and issuing clearer, more consistent statements on nuclear doctrine. These actions would help to increase predictability and prevent some of the most dangerous triggers of crisis escalation.

There are also some unilateral steps the United States can take to narrow escalatory pathways, with or without the support of its allies in East Asia. Implementing organizational reform to address the disconnect between conventional and nuclear war procurement and planning would be a good place to start.³⁷ At present, these tasks are undertaken by separate commands (Pacific Command deals with the conventional realm whereas Strategic Command handles nuclear), which hinders consideration of escalation risks and increases the chance the United States could blunder into a nuclear war. Encouraging joint consideration of escalation risks by military commands (and among other key military and civilian organizations in the United States) would improve awareness of escalation dangers and encourage a joined-up response. It could also function as an oversight mechanism that could advise the White House and President on the consequences of nuclear use.

The general public also has a role to play in reducing the prospects of escalation-driven nuclear use. Raising awareness of the risk of nuclear escalation is a critically important task, given the lack of public consciousness of nuclear risks and high levels of societal complacency (a global, post-Cold War phenomenon). Where popular pressure to construct a multilevel risk reduction framework for East Asia ought to exist, instead publics are pushing their governments to respond more forcefully to nuclear provocations, creating a permissive environment for irresponsible nuclear brinkmanship. Addressing this bottom-up pressure on nuclear doctrine and strategy is an indirect approach to managing escalation risks: the more aware publics are of genuine escalation dangers, the less likely they are to encourage or tolerate policies that routinely put lives at risk. One means towards this end is through domestic education campaigns led by non-governmental organizations.

³⁷ J. Acton, "Technology, Doctrine, and the Risk of Nuclear War", in N. Tannenwald, J.M. Acton, and J. Vaynman (eds), *Meeting the Challenges of the New Nuclear Age*, American Academy of Arts and Sciences, April 2018, <https://www.amacad.org/publication/emerging-risks-declining-norms/section/4>.

MANAGING UNAUTHORIZED RISK

Although the level of risk associated with the unauthorized use of Pyongyang's nuclear weapons is unclear, its consequences could be so dire that it should be possible to generate support for joint action on risk reduction. Finding ways to minimize and manage risks is key, including by curbing illicit arms and technology transfers. This means pursuing an appropriate balance between sanctions and other measures; working collaboratively on preparing a joint, coordinated response to potential regime collapse; and taking steps to prevent the escalation of tensions between States with competing strategic interests on the Korean peninsula.

Any number of existing formal and informal dialogue forums could be put to this task, but it would make sense to use the P5 process and for the nuclear-weapon States to invite high-level participation from the Republic of Korea and Japan. A priority agenda item should involve how to deal with regime collapse, including the question of how to secure the DPRK's dispersed and expanding nuclear and missile facilities in aboveground and underground locations. The fact that this crisis planning dialogue can take place without the need for difficult negotiations with the Kim leadership and within a pre-existing diplomatic process increases its feasibility, and should be viewed positively by the P5, which have an interest in preventing unauthorized access to Pyongyang's nuclear arsenal, and also have a responsibility to demonstrate leadership on fostering strategic stability.

MANAGING ACCIDENTAL RISK

Reducing the risk of accidental nuclear use on the Korean Peninsula is urgent and—depending on proposals—feasible, given the widespread alarm surrounding the unexpected pace of DPRK nuclear and missile advances. Whether it will be possible to achieve the essential task of engaging Pyongyang in cooperative efforts is another matter, however. Kim Jong Un's nuclear brinkmanship over the past few years reflects a gambler's mentality: when the stakes are high, he is willing to engage in extremely high-risk behaviour, deliberately instilling fear in his neighbours. His decision to fire ballistic missiles over Japan in August 2017, just six months after a missile of the same type (the Hwasong-12) malfunctioned and crashed in Tokcho, is evidence of this.

But even hardened gamblers have limits, and it is possible Kim Jong Un could be persuadable on matters of nuclear safety. It is also possible that China could be open to taking a more proactive role in helping the DPRK minimize the risk of nuclear accidents. This assessment is based on the Kim regime's decision to close the Punggye-ri test site (where Pyongyang conducted five of its six nuclear tests) in May 2018, following a September 2017 report by Chinese geologists, who warned it was at risk of collapse. Experts believe Chinese concerns about the test site were likely towards the top of the list of issues that China's President Xi Jinping discussed with

Kim during his visits in early 2018, and that Chinese pressure played a key part in the site's dismantlement.³⁸

If external risk assessments and pressure did indeed influence the Punggye-ri decision, this bodes well for future joint action on nuclear risk reduction involving the DPRK and its neighbours. The site's closure would have been extremely costly for the Kim regime, particularly at this stage in the State's nuclear development, which offers hope that other risk reduction measures could also be discussed and implemented. This could include the confidence-building and transparency measures discussed in the previous section on escalatory risk, as well as expert-level workshops on nuclear safety.

More radical risk reduction proposals are also worth considering, including one presented as "a necessary evil in the new nuclear world" in which international missile experts would train their DPRK counterparts in damage control and critical repair of launch systems.³⁹ Although it would be difficult to generate support from the United States or its allies for this type of initiative, bilateral safety-focused workshops with China or the Russian Federation could be feasible. Over the longer term, the establishment of an intergovernmental oversight body focusing on missile safety is worth exploring as a multilateral approach to narrowing accidental use pathways.

³⁸ S. Hecker, "Why Did Kim Jong Un Blow Up His Nuclear Test Site?", *The Washington Post*, 30 May 2018, <https://www.washingtonpost.com/news/theworldpost/wp/2018/05/30/north-korea-test-site/>.

³⁹ M. Auslin, "Trump Should Help North Korea Keep Its Nukes Safe", *The Atlantic*, 5 November 2017, <https://www.theatlantic.com/international/archive/2017/11/trump-help-nuclear-north-korea/544664/>.

CONCLUSION

Narrowing nuclear use pathways in the troubled strategic environment of Northeast Asia is admittedly challenging, but it is worth remembering that, historically, some of the most significant progress in arms control has occurred at times of heightened tensions between nuclear-armed adversaries. Today, entrenched mistrust and deep insecurities in Northeast Asia contribute to an insecure strategic environment, fuelling behaviours that could result in deliberate, unintended, or accidental nuclear use. Rather than allowing these dynamics to persist and even worsen, opportunities exist to garner international support for a basket of feasible, immediate, short- and medium-term nuclear risk reduction initiatives (summarized below). Although some of the latter raise valid questions over the potential for unintentionally endowing Pyongyang with nuclear legitimacy, they could help build the trust and transparency needed to radically improve Northeast Asia's strategic outlook and in doing so facilitate longer-term disarmament goals.

Timing plays a crucial role in all successful diplomatic initiatives, as events—positive and negative—generate momentum for change. In this case, heightened awareness of the nuclear dangers in Northeast Asia and growing concern over new technologies and cross-domain threats have coincided with an important milestone: preparations for the 2020 Review Conference and the fiftieth anniversary of entry into force of the NPT. This presents a golden opportunity for discussion and adoption of nuclear risk reduction initiatives.

RECOMMENDATIONS TO REDUCE NUCLEAR RISK IN NORTHEAST ASIA



Expand dialogue, information-sharing, and transparency mechanisms

- Extend North–South communications and reciprocal confidence-building
- Expand US–DPRK Summits to address broader strategic concerns, e.g. missile defence, cyber threats, space weaponization, and new technologies
- Create regional system of pre-notification of missile testing



Reinforce the normative taboo against use

- Nuclear-armed States statements on nuclear restraint and non-use
- Nuclear-allied States statements to renounce use, call for restraint, and dismiss possibility of stationing nuclear weapons on their territory
- US organizational reform to address disconnect between conventional and nuclear war procurement and planning



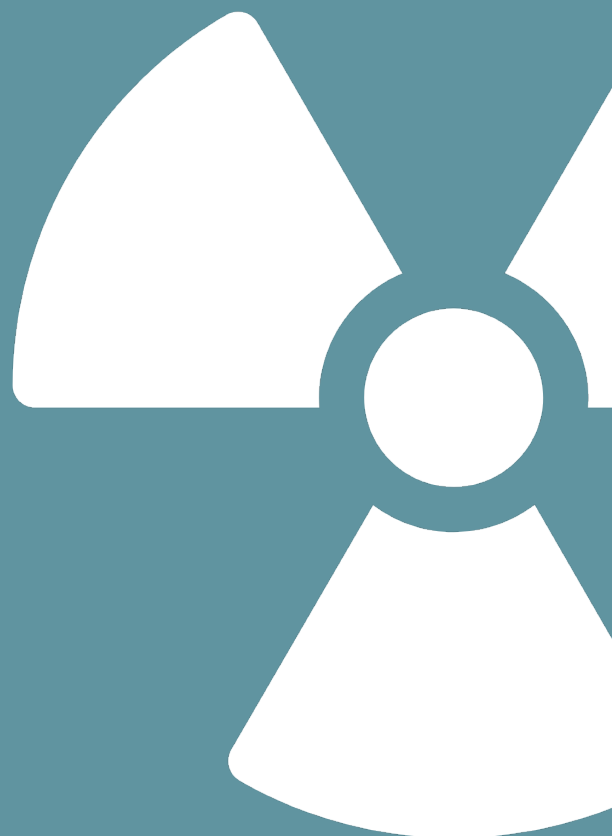
Create greater awareness of nuclear risk issues

- Convene dedicated regional dialogue or P5 conference
- China–DPRK or Russia–DPRK workshops focusing on preventing accidental use
- Foster network of technology experts

CHAPTER 7

NUCLEAR RISKS IN SOUTHERN ASIA: THE CHAIN CONUNDRUM

Manpreet Sethi



SUMMARY

- Southern Asian nuclear dynamics comprise a nuclear chain. It is impacted by three adversarial nuclear dyads: India–Pakistan, India–China, and US–China. Meanwhile, a fourth relevant nuclear dyad, Pakistan–China, exists as a strategic partnership.
- Emergence of new nuclear capabilities, doctrines or postures in any of the constituent States has a cascading effect across others.
- The region is dotted with unique features: nuclear-armed States sharing contiguous, contested borders; each sitting at a different perch of nuclear capability; the presence of cross-border terrorism; and a general lack of shared perception or understanding of nuclear risks. These realities, by themselves, and when juxtaposed with emerging global developments, create new risks or aggravate existing ones.
- Risk reduction in Southern Asia may be best approached through a multilateral process rather than strictly regional approaches. Nevertheless, a ‘mop where you can’ approach is recommended to seize openings where they exist between any of the four actors.

»» INTRODUCTION

There is no sign that any kind of nuclear arms race is in the offing—not, anyway, among the current nuclear powers. Prospects are good for substantial reduction of nuclear arms among the two largest arsenals, Russian and American. That should contribute to nuclear quiescence ... Except for some ‘rogue’ threats, there is little that could disturb the quiet nuclear relations among the recognized nuclear nations.¹

These words were written by the renowned nuclear strategist Thomas Schelling only a decade ago. He foresaw a period of nuclear quiet because he believed that the nuclear superpowers had worked out a stable *modus vivendi* based on a good understanding of the concept and execution of strategic stability. He doubted if a nuclear-free world could be superior to a world with some nuclear weapons and hence argued in favour of status quo. He believed that the phenomenon of ‘the taboo and mutual deterrence’ would keep nuclear risks low.² The only major threat of nuclear use was perceived from ‘rogue’ use of nuclear weapons, primarily by non-State actors.

The global nuclear landscape has altered dramatically from then to now. The risk of use of nuclear weapons has perceptibly grown, though the degree of probability of the manner in which use could happen is varied.³ For instance, the chances of a deliberate, pre-meditated decision to use nuclear weapons is relatively the lowest, though it is not zero, owing to the existence of ‘escalate to de-escalate’ strategies that favour using low-yield nuclear weapons to fight a ‘limited nuclear war’. One hopes that classical rationality that enables lucid cost–benefit calculations would keep a check on such nuclear use. The second category of nuclear use risks includes accidental use due to miscalculation or unauthorized breach of nuclear C3 in a crisis situation. This possibility, however, is sought to be minimized by instituting adequate negative controls in nuclear C3 structures. The third type of nuclear use risks are borne out of misperceptions or miscalculations exacerbated by the fog of war. These are the most worrisome and challenging in today’s security environment owing to many factors: stressed inter-state relations, unregulated modernization of nuclear arsenals; emergence of new technologies intersecting with nuclear deterrence and creating new

¹ T.C. Schelling, “A World without Nuclear Weapons”, *Daedalus*, vol. 138, no. 4, 2009, <https://doi.org/10.1162/daed.2009.138.4.124>.

² In his article in 2013, Lawrence Freedman too explained the significance of the norm of non-use and argued in favour of accepting the responsibility of restraint. For more, see L. Freedman, “Disarmament and Other Nuclear Norms”, *Washington Quarterly*, vol. 36, no. 2, 2013, <https://doi.org/10.1080/0163660X.2013.791085>.

³ One example of such a perception is presented in a recently conducted survey by the Red Cross wherein 47% of the respondents to the poll of 16,000 young people believed that “There will be a nuclear attack somewhere in the world in the next decade”; “What is the Biggest Fear of Millennials? A Nuclear Attack in the Next Decade”, *Financial Express*, 16 January 2020, <https://www.financialexpress.com/lifestyle/what-is-the-biggest-fear-of-millennials-a-nuclear-attack-in-next-decade/1825569/>.

anxieties, breakdown of arms control architecture, etc. Ideally, every nuclear dyad must seek strategic stability so that the risks of use that accompany nuclear weapons can be minimized. Unfortunately though, the contemporary situation is a far cry from the ideal.

Asia is dotted by the presence of several nuclear dyads. These include the adversarial relations between US–Russia, US–China, US–DPRK, China–India, and India–Pakistan. At the same time, several of these dyads elongate into nuclear chains that are formed when nuclear developments in one actor/dyad percolates down to others for example, US–Russia–China, US–China–DPRK, US–China–India–Pakistan, or China–India–Pakistan. Emergence of new nuclear capabilities, doctrines or postures in any of the ‘chain’ States has a cascading effect across others. Therefore, none of the dyads in Asia has the luxury of acting in splendid isolation. Impact of developments travels across States, regions, dyads and chains and leads to a multiplicity of consequences.

This is particularly true of Southern Asia, a region whose nuclear dynamic cannot be adequately understood in the narrow confines of the geographical construct of ‘South Asia’, and must include China, the nuclear and missile capabilities of which impact India and Pakistan, albeit in different ways. There exists a strategic relationship between China and Pakistan. For India, though, China is a more ominous and threatening nuclear neighbour. Therefore, from India’s perspective, no conversation on nuclear risk management or reduction could take place without China. Beijing, meanwhile, in formulating its nuclear posture looks over its shoulder at the United States. The driver for its nuclear arsenal lies outside the region, even though the downstream effects of its capability impact the region.

Given this reality of Southern Asia as a nuclear chain, nuclear risk reduction of the kind that envisages nuclear disarmament or Cold War-style arms control that emphasized ceilings on numbers is difficult to envisage within the narrow confines of the region. Such actions can only be conceived in a more multilateral, global setting, a situation that does not appear feasible in the short term. However, some other, more innovative kinds of nuclear risk reduction measures may be possible through bilateral, trilateral or multilateral mechanisms. The paper tries to identify these after offering a description of the nature and challenges of the nuclear chain conundrum.

The paper is divided into three broad sections. The first section explores the underlying regional conditions which when juxtaposed with global developments exacerbate nuclear risks in the region. It also unpacks ‘real’ nuclear risks from those that are overly inflated, often to play to domestic and international audiences. The second section examines the problems of regional nuclear confidence-building measures for risk reduction. The final section offers some measures to reduce nuclear risks and improve strategic stability.

»» UNDERLYING REGIONAL CONDITIONS AND OVERARCHING GLOBAL DEVELOPMENTS

In Southern Asia, the triangular relationship between the three nuclear actors translates into two adversarial nuclear dyads—India–Pakistan and India–China—with the third nuclear dyad, Pakistan–China, constituting a strategic partnership with alleged cooperation on nuclear and missile capabilities.⁴ India’s nuclear threats arise from both sides of its border. For Pakistan, India is the only nuclear threat. Meanwhile, Chinese strategic calculations prioritize the United States. In order to understand the nature of nuclear risks generated by this complex nuclear chain that actually comprises four States, six underlying factors are briefly outlined in the following subsections.

GEOGRAPHY

The first of these factors pertains to geography. The three regional nuclear-armed States are not just physically close but geographically contiguous. Even more importantly, they suffer from unresolved territorial issues. Territorial sovereignty remains a sensitive issue given that several thousands of square kilometres are contested, including over Kashmir (parts of which are under control of India and Pakistan), and Aksai Chin and Arunachal Pradesh (between China and India).⁵ The absence of clearly defined international boundaries leaves room for misinterpretation. Mutual accusations of illegal presence of each other’s troops in territory claimed by the other have often taken place. Cross-border incursions and tensions over undemarcated boundaries are, therefore, routine. Though none of the crises, fortunately, has escalated to the level of a full-blown conflict or declaration of war since 1998, the risk of escalation, in theory, always exists whenever a crisis takes place, especially as each of the three States perceives nuclear weapons as central to safeguarding national territory.

ROLE OF NUCLEAR WEAPONS

A second layer of complexity is added by the difference in each State’s understanding of how deterrence works and the role they ascribe to nuclear weapons. China and India, for instance, have defined a purely defensive, narrow role to safeguard themselves against use or threat of use of nuclear weapons. Their publicly announced nuclear doctrines do not signal the use of nuclear weapons for conventional contingencies. Rather, both have declared ‘no first use’ of nuclear weapons. Accordingly, their arsenal build-up shows greater focus on capabilities that would ensure survivability of

⁴ See T.V. Paul, “Chinese–Pakistani Nuclear/Missile Ties and the Balance of Power”, *The Nonproliferation Review*, vol. 10, no. 2, 2003, <https://doi.org/10.1080/10736700308436928>.

⁵ J. Singh, *India’s Security in a Turbulent World*, National Book Trust, 2013, p. 79.

retaliatory forces. Mobility of land-based missiles, dispersal of nuclear forces over a triad, construction of underground facilities, and redundancy of C3 remain the focus areas in both States. Both have been working towards an operationalization of ballistic missile submarines. Both believe that confidence in survivability would reinforce their commitment to no first use. Though some discordant voices have been heard in both States on continuance of no first use, these are non-official. It remains the official declared policy of both for the time being.

The role of Pakistan's nuclear weapons is primarily oriented to deter conventional war with India. It justifies this policy by reference to its lack of geographical depth and an asymmetry in conventional forces. Accordingly, it indicates a low nuclear threshold and derives deterrence by propagating the nuclear weapon for 'total defence' to deter both nuclear and conventional attack and against counter-force and counter-value targets. Lt. Gen. Kamal Matinuddin (Retd.) wrote in 2002 that:

population centres, industrial assets, resources and nuclear or conventional forces of the enemy can all be targeted ... while giving primacy to counter-value targets, the enemy's concentration of armoured formations in the rear should also be considered as targets for a nuclear strike.⁶

In order to make such broad-spectrum threats look credible, Pakistan has articulated the concept of full-spectrum deterrence and is investing in requisite capabilities.⁷ These include short-range ballistic missiles to carry low-yield nuclear weapons for battlefield use and also long-range missiles for counter-value targets. Though the first test of Nasr, a tactical nuclear weapon, was undertaken in 2011, the idea of such a weapon had been around as far back as 2000.⁸

Critics decry Pakistan's idea of tactical nuclear weapons for two reasons: one, because any use of the nuclear weapon would have a strategic effect and could lead to a nuclear exchange that would be difficult to control; secondly, tactical nuclear weapons create the possibility of unauthorized use by a theatre commander once C3 has been delegated. Pakistan suggests that it has no intention to pre-delegate authority.⁹ To use tactical nuclear weapons for deterrence of a conventional conflict, Pakistan will need to signal their deployment and readiness during crisis. But these "weapons hold only the promise of lowering the nuclear threshold ... [and] will vastly complicate both

⁶ As cited in R. Hussain, *Nuclear Doctrines in South Asia*, SASSU Research Report no. 4, December 2005, p. 13, <http://sassi.org.pk/wp-content/uploads/2017/03/Nuclear-Doctrines-in-South-Asia.pdf>.

⁷ See M. Khan, "Understanding Pakistan's Full Spectrum Deterrence", *Journal of Strategic Affairs*, vol. 1, no. 2, 2016, <https://ssii.com.pk/wp-content/uploads/2018/06/Understanding-Pakistans-full-spectrum-deterrence-moiz-khan.pdf>.

⁸ Brig. Saeed Ismat (reted), "A Conceptual Nuclear Doctrine", *Defence Journal*, vol. 3, no. 8, March 2000, <http://www.defencejournal.com/2000/mar/doctrine.htm>.

⁹ See S. Joshi, "Pakistan's Tactical Nuclear Nightmare: Déjà Vu?", *The Washington Quarterly*, vol. 36, no. 3, 2013, <https://doi.org/10.1080/0163660X.2013.825557>.

security and C3 on the Pakistan side".¹⁰ Brig. Feroz Khan, a Pakistani Army officer among the founders of Strategic Plans Division Force, the security branch of Pakistan's National Command Authority, has also opined that Nasr "will pose a 'use it or lose it' choice, precipitating a war that may not be intended".¹¹ Deployment of such weapons is a slippery slope fraught with many nuclear risks.

Meanwhile, an implication of global developments on nuclear doctrines of the Southern Asian States can be seen in the mainstreaming of deterrence strategies that signal 'escalate to de-escalate' postures. While this has been largely ascribed to the Russian Federation (though never officially proclaimed by Moscow), the US Nuclear Posture Review of 2018 hints at similar principles by signalling limited use of nuclear weapons through a tailored nuclear response.¹² In Southern Asia, Pakistan's strategy of projecting use of tactical nuclear weapons to de-escalate a conventional conflict is along similar lines. These factors *could* put pressure on the other actors in the Southern Asia nuclear chain to reconsider their no first use posture, which would significantly enhance nuclear risk. China and India's current doctrines of no first use ease the pressure of use or lose on the adversary. As mentioned earlier, discontentment with this doctrine has been expressed by some quarters in both States. While Beijing and New Delhi appear currently steadfast in their positions, they could be influenced by global developments.

CROSS-BORDER TERRORISM

A rather unique feature of Southern Asia is the presence of cross-border terrorism involving nuclear-armed States. On several occasions, Pakistan has been accused by India and other States of using proxy organizations, including those on designated terrorist lists, to wage a campaign of violence against India. Pakistan has denied these allegations; however former President and Chief of Army Staff Pervez Musharraf has acknowledged past support and training of militants operating in Kashmir.¹³ Many in India and elsewhere believe that Pakistan's possession of nuclear weapons since the 1980s can be seen as a shield, checkmating a punitive Indian response by implicitly

¹⁰ Articulated by an ex-US Army officer specializing in Pakistan in the office of the US Undersecretary of Defense; see D.O. Smith, "The US Experience with Tactical Nuclear Weapons: Lessons for South Asia", Stimson Center, 2013, p.44. <https://www.jstor.org/stable/resrep10878>.

¹¹ F. Khan, "Challenges to Nuclear Stability in South Asia", *The Nonproliferation Review*, vol. 10, no. 1, 2003, <https://doi.org/10.1080/10736700308436917>.

¹² For further exploration, see M. Sethi, "US Nuclear Posture Review 2018: Unwisely Re-opening 'Settled' Nuclear Issues", *India Quarterly*, vol. 74, no. 3, <https://doi.org/10.1177%2F0974928418785456>.

¹³ He initially did so in an interview in November 2010 and again recently. "We trained Kashmiri terrorists in Pakistan, Mujahideens like Hafiz Saeed & Osama were our heroes: Pervez Musharraf", *Economic Times*, 15 November 2019, <https://economictimes.indiatimes.com/news/defence/we-trained-kashmiri-terrorists-in-pakistan-mujahideens-like-hafiz-saeed-osama-were-our-heroes-pervez-musharraf/articleshow/72051024.cms>; For details on the monies spent by Pakistan's intelligence agencies on transnational arms supplies see J. Singh, *India's Security in a Turbulent World*, National Book Trust, 2013, p. 122.

threatening escalation to the nuclear level. For instance, more than one nuclear analyst has explained how Pakistan's "revisionist objectives towards India" have been "emboldened by its nuclear capabilities that can now deter Indian conventional and nuclear retaliation", allowing it to "more aggressively pursue these objectives against India with virtual impunity".¹⁴ It could be argued that Indian surgical strikes in 2016 and 2019 were a result of mounting frustration and a desire to punish such acts. Both Indian and Pakistani prime ministers escalated their rhetoric around the 2019 strike in Balakot, with Imran Khan explicitly evoking the spectre of nuclear war in the region.¹⁵

The presence of terrorist actors in Southern Asia creates myriad risks that deserve attention. It is evident that Pakistan has worked to secure its nuclear infrastructure, including reportedly with the help of the United States.¹⁶ However, past attacks have occurred on sensitive military and what some have alleged to be nuclear establishments.¹⁷ This continues to be a cause for concern in a State that has the acknowledged presence of terrorist organizations, given the attacks that Pakistan itself has suffered.¹⁸ In addition, any raising of nuclear risks as a strategy of deterrence entails actions in the service of credibility (interestingly, one analyst has drawn attention to a pattern in which nuclear threats are louder at the beginning or end of a crisis as compared to during it).¹⁹ The development of tactical nuclear weapons or the placement of nuclear-tipped missiles on surface ships and diesel-powered electric submarines, seen by Pakistan as a means of increasing deterrence or to ensure survivability of its nuclear forces, can be perceived by India as means to avert a conventional confrontation.²⁰ This drives the risk of inadvertent use due to miscalculation or accident.

¹⁴ C. Clary and V. Narang, "Doctrine, Capabilities, and (In)Stability in South Asia", in M. Krepon and J. Thompson (eds), *Deterrence Stability: Escalation Control in South Asia*, Stimson Center, 2014, p. 95, https://www.stimson.org/wp-content/files/file-attachments/Deterrence_Stability_Dec_2013_web_1.pdf; S. Ganguly, "Nuclear Stability in South Asia", *International Security*, vol. 33, no. 2, 2008, pp. 45–70, <https://www.jstor.org/stable/40207131>; S. Paul Kapur, *Dangerous Deterrent: Nuclear Weapons Proliferation and Conflict in South Asia*, 2007.

¹⁵ See S.A.Z. Jaffery, "What Happens After India and Pakistan Clash Over Kashmir?", *The National Interest*, 28 October 2019, <https://nationalinterest.org/feature/what-happens-after-india-and-pakistan-clash-over-kashmir-91681>; J. Lewis, "'Night of Murder': On the Brink of Nuclear War in South Asia", NTI, 6 November 2019, <https://www.nti.org/analysis/articles/night-murder-brink-nuclear-war-south-asia/>.

¹⁶ See D.E. Sanger and W.J. Broad, "US Secretly Aids Pakistan in Guarding Nuclear Arms", *New York Times*, 18 November 2007, <https://www.nytimes.com/2007/11/18/washington/18nuke.html>.

¹⁷ Recall the attack on Pakistan naval base PNS Mehran in May 2011 by TTP and Al-Qaida; attempted hijacking of PNS Zulfiqar in 2014 by a young naval officer that indicated militant infiltration into Pakistani Navy. See A. Singh, *Maritime Terrorism in Asia: An Assessment*, ORF Occasional Paper, 14 October 2019, <https://www.orfonline.org/research/maritime-terrorism-in-asia-an-assessment-56581/>; also S. Gregory, "Terrorist Tactics in Pakistan Threaten Nuclear Weapons Safety", *CTC Sentinel*, vol. 4, no. 6, June 2011.

¹⁸ One indication of continued presence is the Financial Action Task Force maintaining Pakistan on the Grey List, owing to its insufficient compliance with measures to address the problem of terrorist networks in its territory. See also K. Ahmed, "When Reality Outruns Strategy", *Indian Express*, 3 May 2014, <https://indianexpress.com/article/opinion/columns/when-reality-outruns-strategy/>.

¹⁹ For more on this see R. Rajagopalan, *Second Strike: Arguments about Nuclear War in South Asia*, 2005, pp. 56–57.

²⁰ T. Craig and K. DeYoung, "Pakistan Is Eyeing Sea-Based and Short-Range Nuclear Weapons, Analysts Say", *Washington Post*, 21 September 2014,

NO SHARED SENSE OF RISK

It may be recalled that the Cuban missile crisis brought home to Washington and Moscow the risks of deterrence instability. Thereafter, conscious attempts were made by both to handle the two dimensions of such instability: crisis instability, which could tempt nuclear use due to miscalculation or misperception; and arms-race instability which arose from a desire to stay ahead of the adversary. Risk reduction, including through nuclear arms control, was consequently seen to be in the mutual interest to enable mutually agreed measures to alleviate mutually perceived risks.

Unfortunately though, one can see an absence of a shared sense of risks in Southern Asia. The three States are focused on building capabilities in accordance with their specific versions of nuclear deterrence. In the process, some see merit in manipulation of the idea of risks. This tendency is evident in Pakistan's strategy of nuclear brinkmanship and China's strategy of nuclear ambiguity, as well as Indian management of the recent episode of air strikes on Balakot.

Some argue that Pakistan's strategy of raising the spectre of nuclear escalation, and the "mere *threat of approaching the nuclear threshold* will prevent India from seizing the strategic initiative and military dominance of events, permitting Pakistan to escalate the crisis at will without the fear of meaningful Indian retribution".²¹ This is nuclear brinkmanship as a way of augmenting deterrence.²² The possibility of nuclear exchange is meant to evoke fear not only to deter India, but also to scare international audiences into getting involved in conflict resolution in the region. Some suggest this contributes to a desire not for nuclear stability but "managed instability ... to resist agreement, to underpin uncertainty, and to generate ambiguity".²³ Problematically, such approaches can raise risks of inadvertent escalation or nuclear war as a result of miscalculation, as seen during the 2019 crisis with India's decision to undertake air strikes against deep-set targets beyond Pakistan-administered Kashmir and its announced operational deployment of its navy. Without a shared sense of nuclear risks, more risks then get created.

https://www.washingtonpost.com/world/asia_pacific/pakistan-is-eyeing-sea-based-and-short-range-nuclear-weapons-analysts-say/2014/09/20/1bd9436a-11bb-11e4-8936-26932bcfd6ed_story.html; and A. Biswas, "Pakistan's New Missile Disrupts Stability in South Asia", *National Interest*, 27 March 2015, <http://www.nationalinterest.org/blog/the-buzz/pakistan%E2%80%99s-new-missile-disrupts-nuclear-stability-south-asia-12495>.

²¹ Y. Bodansky, "Pakistan's Nuclear Brinkmanship", Freeman Centre for Strategic Studies, 1995, <http://koausa.org/bodansky/article3.html>.

²² See M. Sethi, "Decoding Pakistan's Nukes", *Defense News*, 11 August 2013; T. Hundley, "Race to the End", *Foreign Policy*, 5 September 2012, <https://foreignpolicy.com/2012/09/05/race-to-the-end/>; S. Gregory, "Pak Toxic Chaos Plan Changes Nuke Debate", *Times of India*, 6 March 2011, <https://timesofindia.indiatimes.com/home/sunday-times/all-that-matters/Pak-toxic-chaos-plan-changes-nuke-debate/articleshow/7637964.cms>.

²³ Ibid.

China meanwhile has traditionally believed in the idea of nuclear opacity as a means of deterrence, and appears to lean towards ambiguity now in the face of developments such as US missile defence and Conventional Global Prompt Strike capabilities. It has declared many of its delivery platforms as dual-use capable; all of its missiles are under the common command of the People's Liberation Army Rocket Force and, in some cases, conventional and nuclear tipped missiles are even co-located at the same base. Regardless of its reasons for doing so, for resource optimization or deliberate strategy to enhance deterrence, the result is greater room for misperceptions that can exacerbate risks of inadvertent escalation. And, while the target for this from the Chinese perspective is the United States, the region also faces the downstream effects of such ambiguity.

EMERGENCE OF NEW TECHNOLOGIES

As the three States have steadily improved their technological capabilities, new inductions have taken place. They include tactical nuclear weapons in Pakistan; deployment of MIRVed missiles by China and their testing from a sea-based platform by Pakistan; operationalization of ballistic missile submarines by China and India; and developments in space-based assets and their exploitation for navigation, communication and intelligence, surveillance, and reconnaissance by the three, with one anti-satellite test each by China and India. Efforts at improving the mobility, ranges, reliability and other performance parameters of missiles have also continued.

Apart from these 'traditional' technological advances that have been part of deterrence-building, other technologies are beginning to make their presence felt. Many of these, such as HGVs, autonomous systems for nuclear delivery, and C3 systems using AI, will impact nuclear deterrence in ways that are not even completely understood yet.²⁴

An offence–defence spiral looks inevitable as States respond to nuclear modernization with non-strategic defensive and offensive technologies. This is already leading all nuclear-weapons possessors to adopt hedging strategies that fuel misperceptions. An action–reaction dynamic between States and between strategic and non-strategic technologies is evident today. Each is trying to create uncertainty to enhance its deterrence; but in moments of crisis, this could increase pressure, panic and lead to undesirable actions. This would particularly increase the unease of a State with small nuclear forces and could tempt them towards nuclear pre-emption. Chances of stumbling into nuclear war, therefore, are significantly heightened in the presence of such technologies.

²⁴ See J. Borrie's contribution to this volume.

HURDLES TO NUCLEAR CONFIDENCE-BUILDING

The above section has identified some of the unique regional features that, by themselves and when juxtaposed with emerging global developments, create new risks or aggravate existing ones. Meanwhile, the global mood on risk reduction and arms control is one of despair at the loss of many arms control instruments between the United States and the Russian Federation. While these were bilateral mechanisms, they served as models or templates for others. Can Southern Asia somehow buck the trend and arrive at risk reduction measures? The task will obviously not be easy given that a nuclear chain of four States is involved, where each has a different sense of threat perceptions and sits at a different perch of nuclear capability. Also, there is the lack of uniformity in the desire for moving towards risk reduction owing to different risk thresholds. The following subsections describe the nature of the political relationship between the adversarial nuclear dyads that gets in the way of building confidence.

INDIA–PAKISTAN: THE TRUST PROBLEM

India and Pakistan are not exactly new to the concept of confidence-building. They have concluded several such documents in the last seven decades. The first notable one in this regard was the Shimla agreement in 1972, which established the “commitment to peaceful coexistence, respect for each other’s territorial integrity and sovereignty and non- interference”. Both sides also agreed to “refrain from [the] threat or use of force”, to respect the Line of Control, and not to “unilaterally alter the situation”.²⁵ While overall peace prevailed thereafter, border skirmishes continued and intensified in the late 1980s.

Some nuclear-specific arrangements have also been concluded during periods of relative calm between the sides. For instance, in 1988, the two States signed the Agreement on Non-Attack on Nuclear Facilities. This agreement has since stood in good stead and every year on 1 January both sides exchange a list of their civilian nuclear installations. In 1999, mere months after the overt demonstration of their respective nuclear capabilities, both agreed on some specific nuclear confidence-building measures as part of the Lahore Memorandum of Understanding. Among other provisions, these included agreements to exchange information on nuclear doctrines and security concepts; provide advance notification of ballistic missile flight tests; provide prompt notification of nuclear accidents or unauthorized or unexplained incidents; engage in bilateral consultations on security, disarmament and non-proliferation; and establish communication hotlines to avert crisis situations. The memorandum, however, fell victim to Pakistan’s clandestine occupation of Indian

²⁵ Shimla Agreement, 2 July 1972, <https://mea.gov.in/in-focus-article.htm?19005/Simla+Agreement+July+2+1972>.

territory in Kargil in May 1999.²⁶ Trust dissipated and it was not until 2004 that an agreement on pre-notification on ballistic missile tests was signed. This was followed in 2007 by an agreement on sharing information on accidents in nuclear weapons. This was initially signed for a period of five years but has since received two more five-year extensions in 2012 and 2017.

Despite the presence of such agreements, however, the political relationship between India and Pakistan is marred by low trust and confidence. From the Indian perspective, repeated terrorist activity, with links to elements in the Pakistani State, remains the biggest hurdle to stabilizing the relationship. Pakistan, on the other hand, prioritizes the unsettled issue of Kashmir and the perceived threat from conventional force disparity with India. There remains a huge chasm in the understanding of both sides on the issues that afflict the relationship, including the role of nuclear weapons in their security strategies. The relationship, therefore, exists as a difficult puzzle for nuclear risk reduction since there is no willingness to agree on how grave, or not, the risks are.

INDIA–CHINA: THE APPROACH PROBLEM

The political relationship between India and China is not as harshly framed as that between India and Pakistan. Despite contentious territorial issues, there are several levels of regular political engagement. On the nuclear issue, the two sides have a similar approach to the role of nuclear weapons and deterrence. Therefore, there is a doctrinal consonance that arguably establishes a level of strategic stability. Even during crisis, as in the 2017 stand-off at Doklam that lasted over two months, neither side mentioned nuclear weapons, in contrast to periods of tension between India and Pakistan.

Despite this, however, the chances of the two States undertaking bilateral nuclear risk reduction is low for several reasons. First, China's perception of nuclear risks in general, and those with India in particular, is low. Second, China's focus of its nuclear deterrence is on US capabilities and it is unlikely to accept measures that could in any way constrain its ability to address its threat perceptions there. This is evident in China's overall stance on nuclear arms control and disarmament; a spokesperson of China's Foreign Ministry expressed Premier Xi Jinping's view that his State "will not participate in any negotiations for a trilateral nuclear disarmament agreement".²⁷ Third, China considers India an 'illegitimate' nuclear State and hence refuses to engage in any strategic negotiations that could appear as if it was conferring legitimacy to India's nuclear status.

²⁶ See P.R. Lavoy (ed), *Asymmetric Warfare in South Asia: The Causes and Consequences of the Kargil Conflict*, 2009.

²⁷ W. Riqiang, "Trilateral Arms Control Initiative: A Chinese Perspective", *Bulletin of the Atomic Scientists*, 4 September 2019, <https://thebulletin.org/2019/09/trilateral-arms-control-initiative-a-chinese-perspective>.

»» SUGGESTIONS FOR NUCLEAR RISK MANAGEMENT AND REDUCTION

It is not easy to think of how to get the nuclear chain in Southern Asia started on nuclear risk reduction. Improvement in political relations across the dyads would obviously help. A general feeling of trust would percolate into nuclear risk management too. But the paradox of nuclear risk reduction is that it is most needed when the political relations are uncomfortable and most prone to crisis. Perhaps, it is the emergence of a crisis with its terrifying moments that may make States realize the gravity of the situation. But this could turn out to be too risky. Therefore, measures, and incentives to adopt these, have to be found before a crisis erupts. The following paragraphs offer potential steps that may be taken unilaterally, bilaterally or multilaterally.

Initiation of strategic dialogues (bilaterally or multilaterally) to better understand each other's threat perceptions and nuclear doctrines could be one such step. States may find this relatively easy to do since it would involve no commitment or constraining of capability and would simply entail an exchange of views. This could go some distance towards reducing misperceptions that are generated due to non-engagement and as States hedge against the presumed capabilities of their adversaries. Related to this, the creation or better utilization of political and military hotlines or some pre-designated channels for crisis management is an important idea at the operational level.²⁸ Such arrangements would significantly address the problem of inadvertent escalation, particularly when one faces a strategy of brinkmanship or ambiguity that could spiral out of control. Trustworthy channels would then come in handy to reduce tensions. But would States relying on brinkmanship or ambiguity be willing to do so?

Another possible measure could be formalizing of low alert levels, as the arsenals of China, India and Pakistan are already in such a state. This would be a difficult but meaningful step. An agreement (or even joint or unilateral coordinated statements) that formalizes this would be a useful step towards crisis stability, especially once new technologies such as hypersonics can compress response timelines. In this matter, China's approach would be key since, in response to US developments, it could be

²⁸ Military hotlines exist between India and Pakistan but these have never been gainfully employed in crisis situations owing to the low trust levels. In a recent media report after the five-day visit of a high-ranking Army official to China, India's Army Chief General Manoj Mukund Naravane said that the proposal for a hotline between India's DGMO and China's chief of Western Theatre Command "has been accepted and procedural aspects have been ironed out". S. Karanbir Gurung, "New India-China Military Hotline to Become Operational Between DGMO and Western Theatre Command", *Economic Times*, 11 January 2020, <https://economictimes.indiatimes.com/news/defence/new-india-china-military-hotline-to-become-operational-between-dgmo-and-western-theatre-command/articleshow/73204552.cms?from=mdr>.

compelled to alter its own force posture.²⁹ In fact, a Chinese official called upon the United States and the Russian Federation to remove their nuclear arsenals from high readiness as a way of reducing unnecessary risks.³⁰

Another risk reduction measure could be the sharing of best practices on nuclear safety and security (for example, through collaboration between nuclear Centres of Excellence, joint ventures on manufacture of radiation portals, detection equipment, etc.). This would not only create a habit of engagement and dialogue but also foster a common security and safety culture for the region. The ensuing confidence could help in risk reduction.

At a bilateral level, two other measures can be identified for India and China to take without necessarily feeling compelled to involve others. Firstly, given similarities in their approach towards nuclear weapons and deterrence, it may be possible for the leaders of both States to make a statement of the kind made by Presidents Reagan and Gorbachev renouncing nuclear war. This would require China to give up its fundamental objection to engaging with India, but this could be enabled through effective outreach by New Delhi, personal chemistry of the leaders of the two States, or with the growth of India's nuclear capability. Such a political statement could impact the salience attached to nuclear weapons and have a calming influence in this age of nuclear cacophony.

Another achievable step between India and China could be the formalization of a bilateral no-first-use treaty. Currently, only China and India have such a publicly declared doctrine. This is dismissed by others as a declaratory posture. Yet a no first use policy has the potential to lessen inter-State tensions, increase mutual confidence and thus reinforce a cycle of positives. In fact, the policy makes even more sense when one faces an adversary with a small nuclear arsenal that is likely to be extremely sensitive to the survival of their ability to cause unacceptable damage, as it can provide some assurance that their capability would not be interfered with. Both India and China at different times have proposed a multilateral no-first-use treaty. Until this gains more global traction, it could be useful to turn at least their unilateral declarations into a bilateral statement.

²⁹ See G. Kulacki, *China's Military Calls for Putting Its Nuclear Forces on Alert*, Union of Concerned Scientists, January 2016, <https://www.ucsusa.org/sites/default/files/attach/2016/02/China-Hair-Trigger-full-report.pdf>; T. Yoshihara and J. Bianchi, "Chinese Nuclear Weapons Strategy—Leaning Towards a More Proactive Posture? Part II: External Drivers of Potential Change—Technical-Military Developments and Perceptions of Credibility", *China Brief*, vol. 19, no. 13, 2019, <https://jamestown.org/program/chinese-nuclear-weapons-strategy-leaning-towards-a-more-proactive-posture-part-ii-external-drivers-of-potential-change-technical-military-developments-and-perceptions-of-credibility/>.

³⁰ F. Cong, "Maintaining Global Strategic Stability, Reducing Risks of Nuclear Conflicts", Ministry of Foreign Affairs of the People's Republic of China, 16 October 2019, https://www.fmprc.gov.cn/mfa_eng/wjbxw/t1708326.shtml.

At a multilateral level, there might be a lesson to learn from the Nuclear Security Summits process that facilitated the highest amount of political attention to that subject over eight years and led to some credible steps being taken by States to reduce the risks of nuclear security. A round of similar high-level meetings in the form of Nuclear Risk Reduction Summits could be a good platform for States to engage in relevant dialogues and showcase their commitment to the task.

Lastly but most importantly, it needs to be said that all of the above actions could be doable only if there is sufficient education on nuclear risks. Individual or joint studies/movies on effects of deterrence breakdown can help to build constituencies that support nuclear risk reduction and push political leaders into actions. During the decades of the Cold War, regular drills, nuclear alarms and exercises kept the population reminiscent of the dangers. This phenomenon has never been experienced in Southern Asia. Therefore, education of the general public, as well as of influential leaders, on nuclear risks would be a meaningful step towards their mitigation. This could lead to a readiness to invest in negotiations and decision-making by a national leadership and put pressure on implementation of agreements even if change of governments occur.

CONCLUSION

Given the unique nature of nuclear weapons and the horrors that their use can unleash, nuclear risk reduction deserves urgent attention. This should be a common interest for all States. But the involvement of multiple nuclear actors as part of nuclear chains makes the search for nuclear risk reduction and mitigation quite difficult. In fact, it may not be best approached through strictly regional approaches. This is not to dismiss the possibility of success of regional risk reduction in cases where they can be meaningfully constructed, but the complexity of the nuclear chain in Southern Asia appears to lend itself better to a more inclusive multilateral setting. This chapter suggests a 'mop where you can' approach that recommends seizing openings between any of the four actors that comprise the Southern Asian nuclear chain. Every step taken towards nuclear risk reduction would be helpful, since the risk of not taking any would be quite risky indeed.

RECOMMENDATIONS TO REDUCE NUCLEAR RISK IN SOUTHERN ASIA



Engage in high-level dialogues, including of strategic issues

- Explore jointly topics like threat perceptions and nuclear doctrines
- Establish Nuclear Risk Reduction Summits



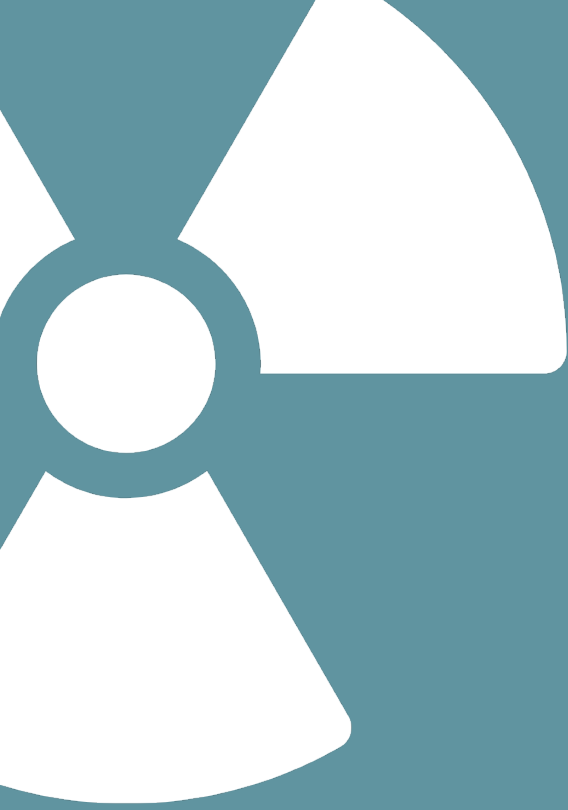
Expand information-sharing and transparency mechanisms

- Create or better utilize political and military hotlines
- Establish habits of engagement, starting with sharing of best practices on nuclear safety and security



Formalize or multilateralize existing stances

- Agreement on low-alert level of arsenals
- China–India exploration of possibility of Reagan–Gorbachev-like statement
- China–India exploration of bilateral instrument based on commonality of no first use policy



CHAPTER 8

UNDERSTANDING RISKS OF NUCLEAR USE IN THE MIDDLE EAST

Hassan Elbahtimy

SUMMARY

- The Middle East has a unique nuclear use risk profile with one undeclared possessor State and a complex web of formal and informal defence alliances between States within the region and great powers outside it.
- The nuclear policy of opacity frames understanding of the risks of Israeli nuclear use and potentially lengthens any nuclear escalatory dynamic.
- The recent growth of military footprints of external powers and the evolving complex web of alliances in the Middle East increases risk by driving potential military entanglement with nuclear-armed extra-regional powers—as suggested in the recent Syrian civil war.
- To reduce risks of nuclear use, States inside and outside the region can consider maintaining nuclear-free alliances/commitments, expand ‘de-confliction line’-like mechanisms to de-escalate conflict, and explore cooperative approaches to downplay the role of nuclear weapons while pushing for general confidence- and security-building in the region.

» INTRODUCTION

This chapter seeks to explore how a nuclear risk reduction framework relates to the Middle East. In doing so, it fleshes out and examines the dynamics of possible nuclear use by regional and extra-regional States. In assessing each, the chapter identifies the key actors, political interests, physical capabilities and the potential for escalatory spirals. Collectively, this aims at producing a contextually rich overview of the nuclear risk profile of the region through attention to both regional and extra-regional dynamics.

In applying this framework to the Middle East, the study acknowledges that the term 'Middle East' evolved as a social construct and is not based on clear geographical boundaries.¹ Therefore in defining the region, the chapter follows the same approach followed by the 1990 United Nations study that explored measures to facilitate the establishment of a nuclear-weapon-free zone in the Middle East.² That definition of the region includes Israel and the Islamic Republic of Iran in addition to the members of the League of Arab States.

In understanding nuclear risks emanating from within and from without the region, it is important to highlight some general characteristics of the nuclear landscape in the Middle East. The region has only one nuclear possessor State. This means that while nuclear dynamics can play a role in regional security dynamics, unlike Southern Asia, the region does not have nuclear-armed rivals bordering one another. This setup renders some of the traditional nuclear strategy concepts, such as nuclear balance or strategic stability, much less relevant to the realities of regional nuclear politics. The nuclear landscape is also different in another aspect. While States in the region have built multiple alliances with nuclear actors from outside the region, to date there has not been a formal or explicit nuclear guarantee extended to the region. This marks the Middle East as distinct from other regions, like Europe or East Asia, whose nuclear politics are partly shaped by nuclear umbrellas through formal structures and force deployments.³ The combination of these two factors colours nuclear dynamics in the region with a different shade.

¹ K. Culcasi, "Constructing and Naturalizing the Middle East", *Geographical Review*, vol. 100, no. 4, 2010, <https://www.jstor.org/stable/25741178>; R. Khalidi, "The 'Middle East' as a Framework of Analysis: Re-mapping a Region in the Era of Globalization", *Comparative Studies of South Asia, Africa and the Middle East*, vol. 18, no. 1, 1998, <https://doi.org/10.1215/1089201X-18-1-74>.

² General Assembly, *Establishment of a Nuclear-Weapon-Free Zone in the Region of the Middle East*, UN document A/45/435, 10 October 1990. This was also the basis on which regional invitations were issued to the 2019 Conference on the Establishment of a Middle East Zone Free of Nuclear Weapons and Other Weapons of Mass Destruction.

³ For example, the US nuclear umbrella covers the 27 other NATO member States mainly in Europe as well as Japan and South Korea in Asia and Australia.

The chapter is divided into two sections. It starts by looking into indigenous nuclear risks by examining Israeli nuclear policy and how it sits within the strategic context of the region. It does so through examining Israel's nuclear arsenal as well as the ideas animating its doctrine and potential for escalation. The second part investigates the role of nuclear-armed extra-regional States in shaping the risk profile of the region. It does so by examining the military footprint of external nuclear powers in the region and their alliances. Here, it points to some enduring patterns as well as new evolving trends in regional security that carry implications for nuclear risks in the region. The chapter ends with reflections on how risk reduction can be approached in the region.

» RISK OF INDIGENOUS NUCLEAR USE

Israel is the only nuclear possessor state in the region. There are several features that make its nuclear status unique and remarkable. Israel holds a policy referred to as nuclear opacity (or 'Amimut' in Hebrew). Under that policy, Israel neither declares itself to be a nuclear-armed State nor does it actively deny possession of nuclear weapons. Israel has also resisted pressure to join the NPT. Whatever Israel's declaratory policy is, its possession of nuclear weapons is widely known even if that possession is not publicly acknowledged.⁴ This set-up is key to understanding how the only nuclear-armed State in the region approaches the question of nuclear use but also how that status is perceived regionally.

THE OPAQUE ARSENAL

While Israel's nuclear status is in no doubt, relatively little is known on its nuclear arsenal. Israel has maintained the capacity to build nuclear weapons for many decades through a closed fuel cycle.⁵ Its reactor in Dimona is capable of producing plutonium; Israel is also suspected of having an enrichment capacity. Data about the operational history of its key nuclear facilities and its fissile material production and holdings are patchy and remain unconfirmed. Knowledge of Israel's capacity is largely derived from assessments based on partial information, leaks, intelligence reports and defector testimony. These make for a considerable margin of uncertainty and a limited ability to track over time.⁶

In terms of Israeli warheads, research institutes that track nuclear weapons holdings provide heavily caveated estimates of the size of the Israeli arsenal. One survey of world nuclear arsenals estimates that Israel has between 80–90 nuclear weapons.⁷ In terms of delivery platforms, Israel is assessed to have delivery capability across at least three platforms. This includes air-dropped gravity bombs, domestically produced land-based ballistic missiles, and through the sea via Dolphin class submarines.⁸

There are broadly two postures frequently associated with the status of Israel's nuclear arsenal.⁹ The first is the 'nuclear option'. Here, all the components of a functioning nuclear device are available but are unassembled. When needed, and in a relatively

⁴ H.M. Kristensen and R.S. Norris, "Israeli Nuclear Weapons, 2014", *Bulletin of the Atomic Scientists*, vol. 70, no. 6, 2014, <https://doi.org/10.1177%2F0096340214555409>.

⁵ A. Cohen, *Israel and the Bomb*, 1998.

⁶ A. Glaser and M. Miller, "Estimating Plutonium Production at Israel's Dimona Reactor", 2011, <https://www.princeton.edu/~aglaser/PU056-Glaser-Miller-2011.pdf>.

⁷ Stockholm International Peace Research Institute, *SIPRI Yearbook 2019: Armaments, Disarmament, and International Security*, 2019.

⁸ *Nuclear Programmes in the Middle East: in the Shadow of Iran*, International Institute for Strategic Studies, 2008.

⁹ S. Feldman, *Israeli Nuclear Deterrence: A Strategy for the 1980s*, 1982.

short time, a device could be assembled and ready for deployment. The second is the 'bomb in the basement'. This indicates that the devices are assembled but not operationally deployed. When needed, they would be rolled out of the metaphorical basement and deployed. Both postures refer to a capability that is only ready to launch after a specific lead-time. That lead-time is longer in the former (nuclear option) than the latter (bomb in the basement). In either case, being a short step from full functionality fits with the frequent statement by officials that Israel will not be the first to introduce nuclear weapons to the region.¹⁰

NUCLEAR DOCTRINE UNDER OPACITY

Analysis of Israel's nuclear profile suggests a strong commitment to building a nuclear capability, but to what end? What role do Israeli strategists and decision makers envision for its nuclear arsenal? As with assessments of the status of Israel's nuclear arsenal, the policy of opacity permeates any assessment of official doctrine. By virtue of its Amimut, Israel does not openly admit to nuclear possession. By extension, this means that a government-sanctioned nuclear doctrine that would both indicate conditions of use and communicate them does not exist.¹¹ Despite this, following the coded debate among Israeli analysts can suggest at least two doctrinal use scenarios.

THE SAMSON OPTION

The first considers nuclear weapons as the ultimate national insurance policy. Under this view, Israeli nuclear weapons are the supreme protector and guarantee for the survival of State. In the case that Israel's existence is put under threat through an overwhelming conventional attack, nuclear weapons can be used to secure the survival of the State against any possible aggressor.¹² This scenario is often referred to as the 'Samson Option', reflecting the biblical account of Samson collapsing the temple on his enemies, but also on himself. The scenario reflects the apocalyptic conditions that would trigger use but also the consequences. In practical terms, this would involve a threat of Israeli nuclear use in a conflict where the State is overwhelmed militarily, and its survival is at stake.

How likely, in the current security landscape, is the realization of the triggers for a 'Samson Option'? The starting point of analysis should be recognition of the radical changes in the security environment that have taken place since early thinking about nuclear options started in Israel. An overwhelming conventional Arab attack is no

¹⁰ O. Israeli, "Israel's Nuclear Amimut Policy and its Consequences", *Israel Affairs*, vol. 21, no. 4, 2015, <https://doi.org/10.1080/13537121.2015.1076185>. The term 'introduction' here is left ambiguous but is understood to mean making Israeli possession of nuclear weapons public or visible.

¹¹ A. Cohen and B. Frankel, "Opaque Nuclear Proliferation", *The Journal of Strategic Studies*, vol. 13, no. 3, 1990, <https://doi.org/10.1080/01402399008437417>.

¹² U. Bar-Joseph, "The Hidden Debate: The Formation of Nuclear Doctrines in the Middle East", *Journal of Strategic Studies*, vol. 5, no. 2, 1982, <https://doi.org/10.1080/01402398208437109>.

longer a credible security risk. First, Israel maintains a military edge vis-à-vis its bordering States.¹³ Second, Israel signed peace agreements with Egypt (which has the largest Arab military force) in 1979 and then with Jordan in 1994. While Israeli borders with Lebanon remain tense, the threat from across that border is asymmetric and non-existential. The border with the Syrian Arab Republic has been effectively pacified since 1973 and with the civil war ravaging its military and resources, the balance of power weighs heavily towards Israel.

When it comes to the Islamic Republic of Iran, the lack of a common border limits the ability of the latter to mount an overwhelming conventional attack of the style that had worried an earlier generation of Israeli leaders. Instead, the dominant security narratives in Israel emphasize threats from non-State actors, as well as from proxy and asymmetric warfare. This drove the authors of the 2018 Strategic Survey to note that despite the turbulent region, “Israel is strong and stable and enjoys quiet borders”.¹⁴ Despite that change in the security environment, an element of ‘existential’ security might be at play that confers value to Israel’s nuclear arsenal as an ultimate guarantor even if the conditions underpinning a ‘Samson Option’ appear far-fetched in the current security environment.

A TOOL FOR DETERRENCE IN A NUCLEARIZED MIDDLE EAST

The second rationale ascribes value to nuclear weapons as a tool for deterrence in a nuclearized Middle East. Under this view, Israeli nuclear weapons are a safeguard against falling behind a regional adversary in the nuclear field.¹⁵ This is frequently captured in the mantra repeated in different variations that Israel is not going to be the first to introduce nuclear weapons to the region but it is also not going to be the second. While Israel was the first regional State to embark on a nuclear weapons programme, the possibility of another State crossing that threshold gives value and utility to Israel’s nuclear status.¹⁶ In this view, nuclear weapons would be announced and revealed to establish an open deterrence relationship with a regional nuclear adversary. The primary aim here would be to establish mutual nuclear deterrence.

How can such a risk be assessed? Several States historically considered nuclear weapons in the region, but none went as far as Israel. Current concerns focus on a

¹³ *The Military Balance*, International Institute for Strategic Studies, 2019.

¹⁴ A. Yadlin, *Israel’s Strategic Environment: Elements, Challenges, and Policy Recommendations*, The Institute for National Security Studies, 2018, p. 131.

¹⁵ E. Eiran and M.B. Malin, “The Sum of all Fears: Israel’s Perception of a Nuclear-Armed Iran”, *The Washington Quarterly*, vol. 36, no. 3, 2013, <https://www.tandfonline.com/doi/abs/10.1080/0163660X.2013.825551>.

¹⁶ This is assumed in various analyses including: Y. Evron, *An Israel-Iran Balance of Nuclear Deterrence: Seeds of Instability*, Memorandum No. 94, Institute for National Security Studies, 2008, <https://www.jstor.org/stable/pdf/resrep08946.6.pdf>; and L. René Beres, “Nuclear Deterrence and Nuclear Conflict”, *Jerusalem Post*, 16 January 2018, <https://www.jpost.com/Opinion/Nuclear-deterrence-and-nuclear-conflict-The-case-of-Israel-536933>.

possible Iranian 'break out' capability that could allow it a nuclear option in the future. In fact, Israel has been one of the key States openly hostile to the Islamic Republic of Iran's nuclear activities, and engaged in several sabotage operations to undermine Iranian nuclear progress. The Joint Comprehensive Plan of Action established verified time-limited controls over Iranian nuclear capabilities, but with its disintegration the future of the Islamic Republic of Iran's nuclear programme is held in doubt. It is the fear of a nuclear Iran that presents the most serious challenge to the long-standing opacity policy in favour for an open declared nuclear policy.¹⁷

¹⁷ D. Kraft, "How demise of Iranian Nuclear Deal Rekindles Israel's Dilemma", *Christian Science Monitor*, January 2020, <https://www.csmonitor.com/World/Middle-East/2020/0113/How-demise-of-Iranian-nuclear-deal-rekindles-Israel-s-dilemma>.

» ESCALATION, MISCALCULATION AND ACCIDENTS UNDER OPACITY

Escalation, miscalculation and accidents can all provide pathways for nuclear use. But even here opacity is an important factor in understanding the risk landscape. It can be argued that Israel's opacity policy places an extra layer that lengthens the pathway for possible nuclear use in an escalatory dynamic. A change in declaratory policy to an overt posture can be used as a signalling tool and therefore extends the escalatory ladder. Yet while Israel's nuclear opacity or ambiguity may dampen escalation potential, it could have the contrary effect on miscalculation or accidental use. The lack of transparency domestically can lead to lower levels of accountability creating an environment more prone to accidents. Lack of a declared or open deterrence policy also gets in the way of clear signalling to an adversary and opens the door for possible miscommunication.

The region's history of conflict and war provides some interesting historical insights about the potential and propensity for nuclear escalation in situations of active combat. Two examples here are worth mentioning. The first was during the 1973 Arab–Israeli War. The early phases of war saw a successful surprise attack by an Egyptian–Syrian military coalition that rolled back Israel's control over Sinai and the Golan. The fast collapse of Israeli defences in Sinai and the Golan led to real anxiety in Israel. Israeli policymakers feared that the Arab armies would be encouraged to take their advances deeper into Israel. Within this context, some Israeli voices, most notably Moshe Dayan, then Israel's Minister of Defence, suggested that it might be time for Israel to consider using its nuclear weapons to hold back the advancing Arab armies.¹⁸ Had that proposal been followed, it would have reversed Israel's opacity policy.

However, despite the dire military situation Israeli leaders found themselves in, Israeli Prime Minister Golda Meir showed no interest in bringing nuclear weapons out of the basement and using them either as a deterrent or as a tool to blackmail the United States to provide military assistance for Israel.¹⁹ The Israeli focus instead was on continuing to fight that war conventionally rather than move the conflict to a nuclear domain. A nuclear escalation remained a theoretical proposal that was not seriously entertained or acted on despite the seriousness of the conflict.

Another test of opacity took place during the Israeli–Iraqi conflict close to the 1991 Gulf War. Iraqi leader Saddam Hussein in 1990 had made a threat to “burn half of

¹⁸ O. Israeli, “Israel's Nuclear Amimut Policy and its Consequences”, *Israel Affairs*, vol. 21, no. 4, 2015, <https://doi.org/10.1080/13537121.2015.1076185>.

¹⁹ E. Colby et al., *The Israeli “Nuclear Alert” of 1973: Deterrence and Signalling in Crisis*, CNA, 2013; A. Cohen, “When Israel Stepped Back from the Brink”, *New York Times*, 3 October 2013, <https://www.nytimes.com/2013/10/04/opinion/when-israel-stepped-back-from-the-brink.html>.

Israel", implying the use of chemical weapons.²⁰ Israeli response remained outside the realm of nuclear and instead threatened Iraq with a harsh response using "the same merchandise".²¹ The threat of a chemical attack took a bigger dimension in the run up of the 1991 Gulf War when Saddam fired ballistic missiles towards Israel (and also Saudi Arabia), further triggering fears that they would carry a chemical payload.²² Yet despite the spectre of possible chemical warfare, Israel did not break its opacity policy and kept the conflict within the conventional domain.

The key takeaway is that the history of conflict in the Middle East contains several instances where a nuclear escalation seemed possible, but the policy of opacity prevailed. To this date, Israel has only fought conventional wars.

HOW ENDURING IS THE OPACITY POLICY?

If opacity is a key paradigm to understanding Israeli nuclear policy and has a key impact on our understanding of doctrinal, escalatory and other forms of nuclear risks, it is important to consider how solid and enduring that policy is and some of the arguments put against it. The starting point of this assessment is that this policy appears rather stable and resilient in the current circumstances and its supporters were able to defend it against some calls for an open declared nuclear doctrine or temptations for a nuclear escalation in different conflict situations.

It is perhaps easy to see why that policy has endured. First, it seems to have worked reasonably well for Israel. Second, it managed to accommodate US reactions to Israel's acquisition of nuclear weapons. The United States has worked to contain nuclear tensions in the region and promote the NPT. Opacity allows Israel to avoid openly antagonizing US policy, therefore preserving its relationship with the United States. This is arguably one of the most influential reasons behind opacity. Finally, in keeping its nuclear capabilities in the shadow, Israel has tempered reactions by other regional States to its nuclear status.

That said, the policy of opacity has also been under pressure on several grounds. The most pressing has been speculation about a change in the Islamic Republic of Iran's nuclear status with questions about that re-emerging with the disintegration of the Joint Comprehensive Plan of Action and Iranian threats to withdraw from the NPT.²³

²⁰ H. Brands and D. Palkki, "Saddam, Israel, and the Bomb: Nuclear Alarmism Justified?", *International Security*, vol. 36, no. 1, 2011, <https://www.jstor.org/stable/41289691>. The threat was accentuated through the frequent use of chemical warfare in the Iraq-Iran war.

²¹ A. Levran, *Israeli Strategy after Desert Storm: Lessons of the Second Gulf War*, Routledge, 2014.

²² Z. Maoz, "The Mixed Blessing of Israel's Nuclear Policy", *International Security*, vol. 28, no. 2, 2003, <https://doi.org/10.1080/13537121.2015.1076185>.

²³ K.L. Afrasiabi and N. Entessar, "Iran's Impending Exit from the NPT: A New Nuclear Crisis", *Bulletin of the Atomic Scientists*, 28 January 2020, <https://thebulletin.org/2020/01/irans-impending-exit-from-the-npt-a-new-nuclear-crisis/>.

This fuels arguments that the answer for such an eventuality can be a move to an explicit nuclear doctrine and an establishment of an open deterrence relationship.²⁴ But so long as the Islamic Republic of Iran remains non-nuclear, this argument seems to lack a compelling edge. The other challenge to that policy comes from Israeli liberals who oppose nuclear opacity on democratic grounds. For example, Avner Cohen argues that the lack of public discussion over nuclear policy and the high degrees of governmental secrecy, including a very active censor, is corrosive of liberal and democratic values.²⁵ Yet, these arguments have not managed to mount a serious challenge to the dominance of Israeli opacity/ambiguity.

²⁴ L. René Beres, "Israel Must Reevaluate Its Policy of Nuclear Ambiguity", BESA Center Perspectives Paper No. 1,023, 2 December 2018, <https://besacenter.org/perspectives-papers/israel-nuclear-ambiguity/>; D. Kraft, "How demise of Iranian Nuclear Deal Rekindles Israel's Dilemma", *Christian Science Monitor*, January 2020, <https://www.csmonitor.com/World/Middle-East/2020/0113/How-demise-of-Iranian-nuclear-deal-rekindles-Israel-s-dilemma>.

²⁵ A. Cohen, *The Worst-Kept Secret: Israel's Bargain with the Bomb*, 2010.

RISK IN A HEAVILY 'PENETRATED' REGION

In 1984, Middle East scholar Professor Carl Brown famously described the region as uniquely 'penetrated'.²⁶ This has come to be used frequently by regional specialists to refer to a mode of interaction characterized by the significant influence of foreign powers in regional affairs. This influence is sometimes resisted locally and in other times invites other external balancing influences. These dynamics reflect both investment by key international actors in regional affairs but also complex alliance dynamics that can lead to entanglement and, subsequently among nuclear allies, higher risk of nuclear escalation.

That frequently used 'penetration' paradigm is qualified when it comes to regional nuclear relations with the outside powers. The region appears rather shielded from nuclear dynamics prevalent in other regions. None of the external nuclear-armed States deploys nuclear weapons in the region. While nuclear targeting lists are classified, it is assumed that the absence of externally placed weapons might have reduced the nuclear targeting footprint of the region. Furthermore, practices common in other regions like extended deterrence or military alliances with a nuclear dimension do not exist in the region. Defence and security arrangements exist between regional actors and external powers (nuclear-armed) but these have no explicit stipulations for nuclear protection or for nuclear deployments.

Considering this set-up, it can be posited that the risk of nuclear use by external powers derives from two key factors. The first is through alliance entanglement where an ally threatens to use nuclear weapons in defence of a regional ally despite that not being part of a formal security commitment or arrangement. The second is direct military conflict in the region involving external nuclear States. The widespread presence of foreign military forces, bases and installations in the region and the participation of those States in active military operations might lead to direct clashes escalating to a nuclear level.

NUCLEAR POSTURING AND ENTANGLEMENT OF EXTERNAL POWERS

During the Cold War, conflicts in the Middle East frequently drew in the United States and the Soviet Union, exacerbating nuclear tensions. For example during the Suez Crisis of 1956, the Soviet Union issued a thinly veiled nuclear ultimatum to the invading British, French and Israeli forces to withdraw from Egyptian territory and warned of a

²⁶ C.L. Brown, *International Politics and the Middle East: Old Rules, Dangerous Game*, 1984, pp. 3-5, 16-18.

'third world war'.²⁷ In 1973, the United States staged a Defcon 3 nuclear alert in response to tensions with the Soviet Union over the 1973 Arab–Israeli war.²⁸ Some of this legacy shows dynamics of entanglements in action where great powers found themselves resorting to nuclear threats and signalling on the back of regional wars. But with the end of Cold War, a new regional security landscape emerged in the Middle East involving different actors and carrying different risks.

The United States remains a key player in the region despite its strategic re-positioning with a pivot to Asia and the decreasing appetite for military involvement in the Middle East after the 2003 Iraqi invasion. It remains the most influential external actor in the region with a significant military footprint and access to regional waterways, infrastructure, as well as a web of political alliances that supports its regional posture.²⁹ The point of gravity for US regional involvement is clearly to the East and particularly in support of the Arab Gulf States where it is tied to a series of formal and informal security commitments that currently play into tensions between the Islamic Republic of Iran and Arab Gulf States.³⁰ Additionally, the United States also has a long-standing tradition of supporting Israel.

The United Kingdom and France both have security relations, including through significant arms deals with regional actors and both recently played a role in an air campaign to oust Gadhafi in Libya.³¹ Yet, their ability to independently project power in the region is far less pronounced than the United States. The Russian Federation on the other hand has, since the start of its decisive air campaign in Syria in 2015, introduced itself as an important regional player and the key patron for the Assad regime. It is also important to note the special relationship between Saudi Arabia and Pakistan that might have implications on the latter's ability to provide nuclear protection to the former. It is widely understood that Saudi Arabia made significant financial contributions to the Pakistani nuclear weapons programme, leading to speculation that this could be in return for some form of future nuclear protection.³² Since the end of the Cold War, these nuclear powers have refrained from bringing their nuclear status to bear in a regional security dynamics. Yet the above overview

²⁷ R.K. Betts, *Nuclear Blackmail and Nuclear Balance*, Brookings Institution Press, 2010, pp. 62–63.

²⁸ B.M. Blechman and D.M. Hart, "The Political Utility of Nuclear Weapons: The 1973 Middle East Crisis", *International Security*, vol. 7, no. 1, 1982, <https://www.jstor.org/stable/2538692>.

²⁹ M. Zenko, *US Military Policy in the Middle East: An Appraisal*, Chatham House, 2018, <https://www.chathamhouse.org/publication/us-military-policy-middle-east-appraisal>.

³⁰ T. Gibbons-Neff, "How U.S. Troops Are Preparing for the Worst in the Middle East", *New York Times*, 6 January 2020, <https://www.nytimes.com/2020/01/06/world/middleeast/troops-iran-iraq.html>.

³¹ J.W. Davidson, "France, Britain and the Intervention in Libya: An Integrated Analysis", *Cambridge Review of International Affairs*, vol. 26, no. 2, 2013, <https://doi.org/10.1080/09557571.2013.784573>.

³² M. Fitzpatrick, "Saudi Arabia, Pakistan and the Nuclear Rumour Mill", *Survival*, vol. 57, no. 4, 2015, <https://doi.org/10.1080/00396338.2015.1068562>; N.L. Miller and T.A. Volpe, "Abstinence or Tolerance: Managing Nuclear Ambitions in Saudi Arabia", *The Washington Quarterly*, vol. 41, no. 2, 2018, <https://doi.org/10.1080/0163660X.2018.1484224>.

demonstrates how key nuclear powers are engaged in a web of security alliances in the region that provide the basis, at least theoretically, for nuclear entanglement.

GROWING MILITARY FOOTPRINT AND THE CHALLENGES OF DE-CONFLICTION

In addition to this web of alliances, the past few decades saw a significant expansion in the number of foreign military installations and bases in the region. An assessment by the Washington-based Middle East Institute estimates that the Middle East has the 'highest concentration' of international military installations in the world with at least 41 such facilities in the region.³³ This has created an overcrowded military space that poses additional risks, particularly when forces are engaged in active combat in the same military theatre (as in the case of the Syrian civil war and the campaigns against the Islamic State in Iraq and the Levant).

These bases or facilities belong to a number of nuclear actors including the United States, the United Kingdom, France, the Russian Federation and also China. The United States by far contributes the highest number of such facilities. For example, the number of US military bases and installations in the region has increased from two following Operation Desert Storm (Gulf War 1990/1991) to 29 known installations in 2018.³⁴ Both the United Kingdom and France have gained a foothold in the region and, in doing so, reversed earlier military withdrawals that accompanied the process of de-colonization in the last century. Now the United Kingdom operates a permanent naval facility in Bahrain, the HMS Jufair, in addition to access to facilities in Oman and Qatar.³⁵ France operates military bases in the United Arab Emirates (since 2009) and in Djibouti and has deployments in Iraq and Lebanon as part of the United Nations Interim Force in Lebanon.³⁶ The Russian government now maintains an influential military presence in Syria through two bases (naval base in Tartous and air base in Hmeimim) and has bolstered its force projection in the region by sealing access

³³ *Foreign Military Presence in the Middle East*, Middle East Institute, 5 April 2018, <https://www.youtube.com/watch?v=psUa6cFeIR0>.

³⁴ *Ibid.*

³⁵ L. Brooke-Holland, *UK Forces in the Middle East Region*, Briefing Paper Number 08794, UK Parliament, 14 January 2020, <https://researchbriefings.parliament.uk/ResearchBriefing/Summary/CBP-8794#fullreport>.

³⁶ M. Lafont Rapnouil, "Alone in The Desert? How France Can Lead Europe in the Middle East", Policy Brief, *European Council on Foreign Relations*, April 2018; https://www.ecfr.eu/publications/summary/alone_in_the_desert_how_france_can_lead_europe_in_the_middle_east; Service d'Information du Gouvernement (SIG), "French Military Forces Deployed in Operations Abroad", 2014, <https://www.gouvernement.fr/en/french-military-forces-deployed-in-operations-abroad>.

agreements with several States.³⁷ Even China, which has so far played a minor role in regional alliances, established its first overseas military base in Djibouti in 2017.³⁸

In 2020, there are three on-going active military conflicts in the region, in Libya, Syria and Yemen. Of these, the Syrian war perhaps provides the most relevant example demonstrating how a combination of regional alliances and military deployments can lead to increased risk of escalation. While the spark for the conflict was the Syrian uprising in 2011, it evolved in a way that drew in a variety of regional and international actors and engulfed them in a dense web of political and military interactions with an ever-present potential for escalation. The Assad forces were supported by the Islamic Republic of Iran, Hezbollah and Iraqi militias, and then later through a decisive 2015 intervention by Russian airpower. Meanwhile anti-Assad forces were supported by Turkey (NATO member), Saudi Arabia and Qatar with the United States, the United Kingdom, and France lending political support and light military assistance to the rebels.

Significantly, the rise of the Islamic State in Iraq and the Levant and the international campaign led by the United States to defeat the organization led to a crowded military theatre that included Russian and US forces in active combat but with different priorities, targets and operating through different networks of local alliances. The risk of accidents or miscalculation leading to a mutual confrontation was acknowledged by officials from both nuclear-armed States.³⁹ So despite the souring of relations between Washington and Moscow, both governments agreed a new measure that aimed to reduce the risk of fighting between their forces or allies on the ground or in the air. The result was a 'de-conflicting' hotline where US and Russian military leaders communicate their intended military operations to avoid unintended clashes.

Information available in the public domain helps to explain how this risk reduction measure operated. The demand for such a hotline took a serious turn with the start of the Russian Federation's air campaign in support of Assad in 2015. The hotline was established in 2016 and connected the forward headquarters of the US Central Command (in Al-Udeid in Qatar) with their Russian counterparts in Syria. The frequency of its use reflects the scale of potential clashes. According to US Maj. Gen. David S. Nahom, the line was used '15 to 20 times' a day.⁴⁰ Some of these calls were

³⁷ "Well Protected Military Bases to Remain in Syria—Kremlin Spokesman", RT, 21 March 2016, <https://www.rt.com/news/336445-syria-russian-military-bases/>; R. Thornton, "Countering Prompt Global Strike: The Russian Military Presence in Syria and the Eastern Mediterranean and Its Strategic Deterrence Role", *The Journal of Slavic Military Studies*, vol. 32, no. 1, <https://doi.org/10.1080/13518046.2019.1552655>.

³⁸ D. Sun, *China's Soft Military Presence in the Middle East*, King Faisal Center for Research and Islamic Studies, 2018.

³⁹ G. Taylor, "U.S. Military uses Russian 'Deconfliction' Line 20 Times a Day to Separate Jets over Syria", *The Washington Times*, 5 October 2017, <https://www.washingtontimes.com/news/2017/oct/5/us-russia-use-military-deconfliction-phone-20-time/>.

⁴⁰ Ibid.

scheduled while others were triggered in quick response to military action and the situation on the ground. The line helped, in at least one incident, to avert escalation when Syrian and Russian air force targeted the Syrian Democratic Forces who are backed and trained by the United States.⁴¹ Despite the value of such a measure as reflected by the frequency of its use, it ultimately fell victim to the ups and downs of relations between the United States and the Russian Federation. It was terminated in 2017 as the Russian Federation protested US punitive military strikes against its ally Assad following allegations of renewed use of chemical weapons in Syria.⁴²

⁴¹ A.S. Weiss and N. Ng, *Collision Avoidance: Lessons from US and Russian Operations in Syria*, Carnegie Endowment for International Peace, March 2019, https://carnegieendowment.org/files/Weiss_Ng_U.S.-Russia_Syria-final1.pdf.

⁴² J. Gambrell, "AP Explains: What is the US/Russia 'Deconfliction Line'?", Associated Press, 7 April 2017. <https://apnews.com/9147aa068855466386cf19ddab5bc827>.

CONCLUSION

This chapter has examined key aspects of the nuclear risk profile of the Middle East. In doing so, the analysis captures a region caught between some enduring patterns and evolving trends. Israel's nuclear opacity means the regional nuclear politics operate on multiple levels between public and secret. Israel's current security environment is a far cry from the early fears of an overwhelming conventional attack that, in part, animated the drive for the bomb in the early days. Under these conditions, the Israeli bomb might appear redundant but that can easily change if fears of a nuclear the Islamic Republic of Iran materialize and the need for open deterrence is established. More broadly, the region's relationships with the nuclear powers have been in flux. The region is, perhaps borrowing Brown's description, more 'penetrated' than ever before and the proliferation of military bases and the shuffling in military alliances is a clear indicator of a risk profile that can potentially turn nuclear.

Efforts to address regional risk reduction related to Israel's nuclear capabilities will inevitably be tied to the unique nature of nuclear discourse in the region and face two key challenges. On the Israeli side, the entrenched policy of nuclear opacity would forestall any direct discussion of nuclear risks. On the side of the Arab States and the Islamic Republic of Iran, the issue will be intrinsically tied to their contestation of the legitimacy of Israel's nuclear arsenal. Like Israel, they too do not openly acknowledge the Israeli arsenal and their fear of legitimizing or rewarding Israeli possession is entrenched. The combined effect of these two factors presents formidable obstacles to any risk reduction exercise conducted under the nuclear banner.

The Arms Control and Regional Security Working Group that emerged from the Arab-Israeli Madrid Peace Process in the 1990s tried but failed to build a common concept for regional security. Arab States wanted to use the process to rid Israel of nuclear weapons while Israel saw the process as a way to manage, rather than alter, the status quo and rejected any formal denuclearization commitments. Different views about the ultimate destination hindered adoption of any interim measures. If anything, the experience highlights the challenges in regional consensus-building over the nuclear state of play. Yet while a frontal approach on nuclear risks can be challenging, a backdoor approach to risk reduction might prove more fruitful. This can instead focus on general confidence- and security-building measures as well as cooperative methods that ultimately could side-line and downplay the role of nuclear weapons while building trust and common expectations of regional security risks.

When it comes to external actors, the trend of an expanding foreign military footprint in the region as well as the growing entanglement with regional actors will likely complicate security calculations and their conduct of military operations in the region. So far, the region has not witnessed any nuclear deployments or the extension of nuclear umbrellas to States within it. Risk reduction efforts involving external powers

should aim at resisting any temptation to reverse this state of affairs or introduce a nuclear component to their regional security relations. The growing number of foreign bases and installations and direct foreign involvement in regional wars highlight the value of establishing clear communication lines, including at the operational level, to avoid unintended clashes and contain them when they occur. The US–Russian de-confliction line can provide an example to methods that can be developed to ensure that any crowded battlefield in the region remains free of nuclear conflict.

RECOMMENDATIONS TO REDUCE NUCLEAR RISK IN THE MIDDLE EAST



Maintain nuclear-weapons-free nature of foreign military presence

- No deployment of nuclear weapons in the region
- Prevent extension of nuclear umbrellas



Engage in a backdoor approach to risk reduction

- Commit to general confidence- and security-building measures
- Explore cooperative approaches to downplay the role of nuclear weapons



Establish communication channels to prevent escalatory dynamics

CHAPTER 9

TAKING FORWARD NUCLEAR RISK REDUCTION

Wilfred Wan



THE STATE OF AFFAIRS

The risk of nuclear weapon use will exist so long as nuclear weapons exist. Experts believe that there remain around 14,000 nuclear weapons in the world, with 3,500 deployed and many of those in a state of high operational alert.¹ The pace of reductions in the global stockpile since the end of the Cold War has stalled in recent years; arms control and disarmament structures are in a precarious state. While the probability side of the risk equation remains difficult to ascertain in a precise and meaningful manner, the risk of use across all scenarios cannot be discounted, for a number of reasons.²

Indeed, nuclear weapons remain central to the security strategies of nuclear-armed and nuclear-allied States. In some instances, these weapons have taken on increased prominence as nuclear-armed States consider in their doctrines the role of those weapons in deterring a wider range of security threats. Relatedly, nuclear weapon modernization programmes may increase the safety, security, and reliability of those weapons but, by virtue of enhancing their effectiveness and flexibility, may also render them more usable in escalatory scenarios. Meanwhile, assessment of unauthorized and accidental risk remains difficult; the opacity of nuclear weapons programmes is striking even within national structures and raises basic questions regarding the extent of independence in management and oversight.

¹ SIPRI Yearbook 2019: Armaments, Disarmament, and International Security.

² As risk exists as a function of probability and consequence. See J. Borrie, T. Caughley and W. Wan (eds), *Understanding Nuclear Weapon Risks*, UNIDIR, 2017, <https://www.unidir.org/files/publications/pdfs/understanding-nuclear-weapon-risks-en-676.pdf>.

»» COMMONALITIES IN RISK PROFILES

Concerns about the risk environment extend well beyond the status of nuclear weapons themselves. The contributions in this volume examine both risk and risk reduction across a set of cross-cutting domains and geopolitical regions. In varying degrees each author explores the possibility that the different risk-of-use pathways identified in the framework chapter may in fact come to fruition. As they sketch the risk profiles of their areas of study, several common strands in sources of risk and underlying conditions in which risks are heightened emerge.

GEOPOLITICAL COMPETITION

Fundamentally, there exists significant fluidity at the geopolitical level. Following the long period of relative bipolar stability during the Cold War, and the short-lived moment of unipolarity during which some suggested marked the end of great power competition, the current state of affairs is characterized by shifting power dynamics, evolving strategic concepts, and expanded theatres of competition. In many ways the existing order is an inadequate fit for this encompassing “competitive multilateralism”.³ Such dynamics challenge the capacity of the system to mobilize collective action, as with international actors engaged in conflict prevention and management.⁴ They have turned domains for cooperation into competitive spaces—as in geo-economic forums and development initiatives.⁵

Certainly the nuclear sphere is not immune to these dynamics. For Borrie, the current period of transition has driven an unpredictability that challenges strategic relations among States, including their understandings of nuclear deterrence. He highlights the different strategic concerns of the United States, the Russian Federation, and China in particular. Panda posits that it is precisely the ‘great power competition’ among those three States that underwrite their mutual mistrust. This mistrust has a cascading effect, driving risk.

Fallout from shifting power dynamics has manifested quite plainly in the uncertain future of the bilateral New START, which is set to expire in 2021. The United States for instance has labelled China’s involvement in negotiations in any follow-up as “imperative to global security”, also pointing to Beijing’s secrecy around its stockpiles

³ B. Jones, J. Feltman and W. Moreland, “Competitive Multilateralism: Adapting Institutions to Meet the New Geopolitical Environment”, Brookings Institution, September 2019, https://www.brookings.edu/wp-content/uploads/2019/09/FP_20190920_competitive_multilateralism_FINAL.pdf.

⁴ S. von Einsiedel et al., *Civil War Trends and the Changing Nature of Armed Conflict*, UN University Centre for Policy Researcher Occasional Paper 10, March 2017, <https://cpr.unu.edu/civil-war-trends-and-the-changing-nature-of-armed-conflict.html>.

⁵ G. Csurgai, “The Increasing Importance of Geoeconomics in Power Rivalries in the Twenty-First Century”, *Geopolitics*, vol. 23, no. 1, 2018, <https://doi.org/10.1080/14650045.2017.1359547>.

as a “serious threat to strategic stability”.⁶ For its part, China has underlined the “order-of-magnitude difference” in its nuclear forces compared to those of the United States and the Russian Federation.⁷ As arms control and disarmament agreements “often reflect hegemonic interests in maintaining both stability and status”, the lack of stability, the fluidity of status, and the overall indeterminate nature of the strategic balance present obstacles to the maintenance of existing agreements, let alone the development of new ones.⁸

PERMEABILITY OF REGIONS

The impact of global dynamics on regional and local contexts adds another dimension to the risk picture. As highlighted in the introductory chapter, many of the authors in the volume wrestle with the ‘region’ as a construct, underlining its analytical shortcomings in the contemporary landscape. India’s strategic calculus with Pakistan, for instance, is complicated by China’s looming presence in Southern Asia and consequently the wary eye Beijing casts to the United States. For Sethi, this is the ‘chain conundrum’—with developments in the nuclear capabilities, doctrines, and postures from one dyad percolating into others. In the Euro-Atlantic, Kühn observes that Moscow’s subregional acts of conventional intimidation and brinksmanship against NATO member States in the form of “dangerously close military encounters” is partly a manifestation of strategic rivalry between the Russian Federation and the West: these may increase risk of accidental nuclear use, a consequence of the fierce competition across strategic, regional, and subregional levels there.

Across all areas of study, increased complexity stemming from regional permeability to global dynamics is highlighted as a risk source. Ogilvie-White observes that tense strategic relations between the Democratic People’s Republic of Korea, Republic of Korea, and Japan could draw the United States and subsequently China into a conventional conflict that escalates to nuclear use, deliberate or inadvertent by any of the region’s nuclear-armed States. She notes for instance that US–ROK joint military exercises to signal alliance resolve have raised the ire of the DPRK regime. The fact that risk of nuclear use can emerge as a result of extra-regional footholds is perhaps best illustrated in a region with only one nuclear-armed State. Even without nuclear deployment or explicit nuclear protections, Elbahtimy suggests the complex web of alliances in the Middle East increases risk by driving potential military entanglement with nuclear-armed extra-regional powers—as suggested in the recent Syrian civil war.

⁶ E. Farge, “U.S. urges China to join nuclear arms talks with Russia”, 21 January 2020, <https://www.reuters.com/article/us-usa-trump-putin-china/u-s-urges-china-to-join-nuclear-arms-talks-with-russia-idUSKBN1ZK24B>.

⁷ “Foreign Ministry Spokesperson Lu Kang’s Regular Press Conference on May 16, 2009”, 16 May 2019, https://www.fmprc.gov.cn/mfa_eng/xwfw_665399/s2510_665401/t1664099.shtml.

⁸ J. Revill and J. Borrie, “Compliance, Enforcement, and the Future of WMD Arms Control and Disarmament”, manuscript in progress.

The susceptibility of all regions to the spillover effects of global dynamics involving nuclear-armed States engaged in geopolitical competition thus subjects each to nuclear risk.

STRATEGIC MISTRUST

The traditional conceptualization of deterrence stability rests upon a foundation of offsetting capabilities and shared beliefs about mutual vulnerability. Against a fluid geopolitical backdrop however, strategic perspectives among nuclear-armed rivals are more likely to contrast and perhaps clash. This manifests both in greater unpredictability and interrelated competition. Capabilities are being built by States “in accordance with their specific versions of nuclear deterrence” (Sethi), undermining trust further and driving the possibility of misperception, miscalculation, or misunderstanding. Heightened suspicion among States has contributed to the evaporation of arms control, according to several authors, and—in Borrie’s estimate—can even directly increase risk of use by requiring States to account for a wider range of extreme contingencies in their nuclear planning.

Yet strategic mistrust at the global level is not strictly the natural by-product of geopolitical competition. Exacerbating this is a lack of transparency surrounding nuclear weapons programmes. Elbahtimy notes that Israel’s policy of opacity invites the possibility of miscommunication, while Ogilvie-White similarly points to the destabilizing effects of the DPRK’s undeclared posture. She argues that the Kim Jong Un regime purposefully weaponizes fear and uncertainty by raising the spectre of nuclear use; this can become a self-fulfilling prophecy. While these are extreme examples, Kühn similarly points to the Russian Federation’s lack of transparency regarding its tactical nuclear weapons as a contributing factor to risk in the Euro-Atlantic. Overall, mistrust has been built among nuclear-armed States.

THE SECURITY DILEMMA

Geopolitical competition and strategic mistrust, while concerning in their own stead, have also contributed to action–reaction dynamics, adding a final layer to the risk picture. Panda refers to technology-racing dynamics in which the United States, the Russian Federation, and China seek first-mover status to secure strategic advantages against their fellow great power competitors. While also contributing to potential arms races, these developments on their own can contribute to greater unpredictability and risk, as Borrie observes. For Sethi, continued modernization may in fact bring about an arms race in South Asia, one that includes non-strategic defensive and offensive capabilities as well. Through such action–reaction dynamics, increasing asymmetries in capabilities may expand the scope of risk.

Technological development hardly represents the only pathway to the security dilemma, as authors point to any number of activities as potentially driving insecurity and escalation in the current tense environment. Ogilvie-White links Pyongyang's nuclear and missile tests to US–ROK regular joint military exercises. Sethi cites Indian surgical strikes in 2016 and 2019 as responses to a number of attacks by non-State armed groups allegedly linked to Pakistan. In the absence of shared understandings and risk perceptions, the possibility of entanglement of nuclear and non-nuclear capabilities prolongs risk, as Kühn argues, and may exacerbate the possibility of nuclear use.

RISK REDUCTION RECOMMENDATIONS

As the above indicates, there are many challenges to taking forward nuclear risk reduction. Geopolitical rivals will not easily develop trust and confidence, nor will they come to agreement overnight on strategic concepts and security dilemmas. Difficult relations will continue to reverberate across regional and local contexts. Ultimately, risk reduction efforts must move forward in the very environment that has seen risk trend in the wrong direction. Even the necessity of engagement with nuclear-armed States outside the purview of the NPT can increase risk by other means, by serving to legitimize their nuclear status and undermine non-proliferation norms, as Ogilvie-White notes. Indeed, the sources of nuclear risk are complex and multi-faceted.

Still, the current state of relations and the unacceptable consequences of any detonation event underline the need for drastic action to reduce the risk of nuclear weapon use. The authors in this volume have provided a series of recommendations to combat the scope and scale of risk sources and conditions, including measures that extend well beyond the nuclear landscape. Tables 9.1 and 9.2 filter these lists through the typology of risk reduction measures identified in the framework paper. Even as authors tailor their recommendations to their particular areas of study, there emerge some common themes.

Figure 9.1: Recommendations to Reduce Risk of Nuclear Weapon Use Across Domains

CATEGORY	MULTIPOLARITY (PANDA)	TECHNOLOGY (BORRIE)
Political– Doctrinal Commitments		<ul style="list-style-type: none">▪ Engage in reciprocal unilateral measures, e.g. acknowledging mutual nuclear vulnerability, committing not to build up nuclear forces
Strategic Considerations	<ul style="list-style-type: none">▪ Preserve arms control (e.g. New START)	<ul style="list-style-type: none">▪ Preserve arms control (e.g. New START)▪ Deployment limits/bans of certain systems▪ Protect nuclear C3 infrastructure
Operational Procedures		<ul style="list-style-type: none">▪ Remove non-strategic nuclear weapons from launchers▪ Adopt notifications system on space activities
Bolstering Engagement and Transparency	<ul style="list-style-type: none">▪ Strategic dialogues and consultations (US–Russia and US–China)▪ Clarify doctrine and modernization plans via P5▪ Encourage multilateral efforts, and seek to engage non-NPT nuclear-armed States	<ul style="list-style-type: none">▪ Joint exploration of implications of technology, with advisory boards and military–military dialogues▪ Include strategic technology in P5 discussions▪ Include wider configuration of States in discussions (e.g. international conference on risk reduction)

Figure 9.2: Recommendations to Reduce Risk of Nuclear Weapon Use Across Regions

CATEGORY	EURO-ATLANTIC (KÜHN)	NORTHEAST ASIA (OGILVIE-WHITE)	SOUTHERN ASIA (SETHI)	MIDDLE EAST (ELBAHTIMY)
Political– Doctrinal Commitments		<ul style="list-style-type: none"> ▪ Unilateral statements by nuclear-armed or nuclear-allied on restraint or non-use 	<ul style="list-style-type: none"> ▪ Formalization of low alert-levels ▪ China–India to explore political agreements 	<ul style="list-style-type: none"> ▪ Maintain nuclear-free alliances/commitments
Strategic Considerations	<ul style="list-style-type: none"> ▪ Extend New START and reinvigorate Open Skies Treaty 	<ul style="list-style-type: none"> ▪ Address conventional–nuclear disconnect in war planning (US) 		
Operational Procedures	<ul style="list-style-type: none"> ▪ Implement Incidents at Sea and Dangerous Military Activities Agreements 	<ul style="list-style-type: none"> ▪ Create regional system of missile testing pre-notifications ▪ Intergovernmental oversight body on missile safety 		<ul style="list-style-type: none"> ▪ Expand “de-confliction line”-like mechanisms to de-escalate
Bolstering Engagement and Transparency	<ul style="list-style-type: none"> ▪ Establish regular doctrinal seminars ▪ Use relevant sites for transparency exercises ▪ Establish subregional risk reduction centres ▪ Improve risk analysis via wider engagement 	<ul style="list-style-type: none"> ▪ Expand agenda of US–DPRK Summits ▪ China–DPRK safety workshops ▪ Convene risk reduction dialogues on diff. levels ▪ Raise awareness with campaigns/networks 	<ul style="list-style-type: none"> ▪ Strategic dialogues, on threat perceptions ▪ Create/utilize political and military hotlines ▪ Share best practices on safety and security ▪ Convene nuclear risk reduction summits 	<ul style="list-style-type: none"> ▪ General confidence- and security-building ▪ Explore cooperative approaches to downplay role of nuclear weapons

Broadly, the authors call upon States to:

1. Increase strategic engagement

The ubiquity of calls for engagement underlines the degree to which trust and confidence among States is absent. Across domains and regions, more ambitious activities to reduce the risk of nuclear weapon use—to revisit doctrines or strategies, to enact behavioural or operational change—are simply not feasible in the current environment. Accordingly, a first step is simply for States to engage in dialogue. They may not easily formulate shared understandings of strategic concepts; however, dialogue can help to prevent misperception, miscalculation, and misunderstanding, and chip away at the mistrust that has accompanied geopolitical competition and shifting power dynamics. The promise of such efforts, as Sethi observes, is that they “involve no commitment or constraining of capability”.

Authors call for dialogue across a litany of forums and encompassing all combinations of actors. Still it is clear that such engagement has the greatest value among the States directly involved in the so-called ‘great power competition’. Strategic dialogues and consultations between the United States and the Russian Federation, and the United States and China—likely more amenable to those parties than a trilateral forum—could

improve contentious bilateral relations, as Panda argues. These processes could help reduce asymmetries in risk perceptions among the parties, inspiring joint efforts to combat those risks in the longer term. Additionally, these States could build upon existing multilateral venues, most notably the P5 process among the five permanent members of the Security Council—these being the five recognized nuclear-weapon States.

Increased strategic engagement can entail a host of substantive issues. For instance, the P5 has under the coordination of China and the United Kingdom taken steps towards exchange on nuclear doctrine. This could become the basis for further discussion and joint exploration, including of modernization plans or of strategic technologies that may affect the nuclear balance, as the authors suggest. While the process itself has largely been closed to date, regular briefings with nuclear-allied and non-nuclear weapon States could expand the circle of exchange and rebuild broader trust. Still, the limitations of the P5 format do draw attention to the need for other configurations of States to be involved in strategic dialogues. Again, this could happen in existing forums—Kühn for instance suggests doctrinal exchange through discussions in the United Nations or the OSCE. Regionally oriented approaches may be appropriate as well: Sethi calls on bilateral and multilateral exchange in Southern Asia on nuclear doctrine and threat perceptions more broadly; Ogilvie-White recommends convening a regional risk reduction dialogue in East Asia, as well as continuing the Trump–Kim Summit series and expanding its agenda. Regardless of venue however, strategic engagement is critical to reducing the risk of nuclear weapon use across all scenarios.

2. Preserve, formalize, and develop policies of restraint

Given geopolitical competition and instability, States should preserve extant agreements that contribute to trust and confidence at a strategic level. It is striking that several authors highlight as of utmost importance the United States and the Russian Federation extending New START prior to its 2021 expiration—regardless of whether the United States is successful in its efforts to involve China in a potential follow-up. The treaty has symbolic value as the last vestige of nuclear arms control, while practically it offers the States with the largest nuclear stockpiles “a baseline of quantitative parity” (Panda) in terms of deployed nuclear missile launchers, and provides through its verification system “an important mechanism for clarification and engagement” (Borrie). Its extension would preserve one of few areas in which trust (driven by data) still exists among the parties.

A second step for States then is to enact policies of restraint to undercut the action–reaction dynamics that can drive technology racing, arms racing, and even nuclear escalation. This could be done by preserving extant agreements such as New START; Kuhn also cites the value in the trans-Atlantic Open Skies Treaty, whose multi-party

verification and transparency mechanism underwrites broader strategic predictability in the Euro-Atlantic. Beyond these, authors prescribe a variety of means through which States can achieve this goal, including by formalizing existing practices as well as developing new policies pertaining to areas of particular concern. In recognizing the difficult path ahead, they discuss measures that can be taken unilaterally or exist at low degrees of formality.

Preserving or embedding restraint where it exists appears as a feasible step forward in nuclear risk reduction. For instance, Sethi observes that India, Pakistan, and China could formalize the existing low-level alert statuses of their respective arsenals. While a multilateral agreement would be difficult to achieve in this context, such reaffirmations of policies of restraint have normative value. This logic explains the push for all five NPT-nuclear weapon States to sign their protocol to the Treaty on the Southeast Asia Nuclear Weapon-Free Zone (the Bangkok Treaty). And while a Middle East zone free of weapons of mass destruction remains a contentious subject, Elbahtimy argues that regional States would do well at least to keep their alliance relations with extra-regional nuclear-armed powers free from explicit nuclear guarantees or protections.

Maintaining a gap between nuclear weapons and all other types of weapons is a recurring theme. One means to achieving this is through the development of normative frameworks around new capabilities. Measures to this end would likely be more symbolic than verifiable, as with proposals to declare nuclear C3 'off-limits' from offensive cyber operations. Borrie's piece focuses precisely on addressing such entanglement possibilities. Drawing on the example of the Presidential Nuclear Initiatives, he lists several unilateral commitments that could be reciprocated, including limits (or bans) on deployment of nuclear hypersonic systems and non-strategic delivery systems, and on the development of nuclear-armed cruise missiles. These would not be easy achievements, though the possibility of misunderstanding and misjudgment linked to these capabilities could link to concerns of nuclear-armed States. Indeed, decoupling nuclear from non-nuclear capabilities in general can provide a means of preventing escalatory dynamics. Coming from another angle, Ogilvie-White suggests that joint risk planning by nuclear and conventional commands could have the same effect. She calls for a widespread approach to limit "provocative language and behaviour of all kinds", including perhaps the most demonstrative policy of restraint: doctrinal change.

3. Enhance use of notifications, signals, and crisis communication channels

Absent stronger strategic engagement and policies of restraint (and even with them), there exists a need for a greater level of clarity as to State behaviours at an operational level. This greater transparency and communication can serve critical functions, lessening the possibility for misperception, miscalculation, or misunderstanding.

Accordingly, a third step for States is to strengthen their crisis avoidance and management techniques.⁹ This can be done with the enhanced use of notifications, signals, and crisis communication channels. Yet transparency is not a panacea. Excessive data can turn information-exchange into noise, muddling the environment and even sowing chaos for decision makers. And as discussed in the framework chapter, States have to weigh their legitimate security concerns in determining their level of openness.

Still, considered measures to enhance information-exchange and communications, with an eye to prevent crisis or manage it where it occurs, can help to restore predictability. In the long term, the Vienna Document of the OSCE stands as a model for confidence- and security-building, as it outlines procedures in notification, consultation, and observation including of large-scale exercises, unusual military activities, and hazardous incidents. In the shorter term, crisis avoidance and management activities could be undertaken ad hoc. Elbahtimy cites the frequently used ‘de-conflicting hotline’ established in 2016 between US and Russian military leaders during the Syrian civil war, in which the two nuclear-armed States shared their intended operations in order to avoid direct conflict or inadvertent escalation. That the hotline fell victim to worsened geopolitical relations underlines the need to maintain “trustworthy channels” (Sethi)—among political and military leaders alike.

As with strategic engagement, the great promise of crisis avoidance and management activities is that they do not centre on restraint in either capability or behaviour. Rather, they stress caution and prudence, outlining agreed-upon procedures should incidences occur. In some cases—as with the US and Russian Nuclear Risk Reduction Centers established in 1987—they primarily entail information-exchange. As such these activities are especially useful for behaviours that could be seen as provocative. Incidents at Sea and Dangerous Military Activities agreements are Cold War-era examples; Kühn proposes revisiting their implementation. Borrie echoes similar principles in calling on States to adopt notification and test guidelines in space. For Northeast Asia, Ogilvie-White suggests a pre-notification system for nuclear and ballistic missiles testing.¹⁰ Given relatively modest ambitions, these types of procedures present possible areas for progress. In time, crisis avoidance and management principles may be the foundation on which more expansive exchange rests.

⁹ See also L.A. Dunn, *Reversing the Slide: Intensified Great Power Competition and the Breakdown of the Arms Control Endeavour*, UNIDIR, 2019, pp. 7–8, <https://www.unidir.org/files/publications/pdfs/reversing-the-slide-en-755.pdf>.

¹⁰ The 2005 India–Pakistan Agreement on Pre-Notification of Flight Testing of Ballistic Missiles could be a model.

4. Commit to reduce nuclear risks

Addressing the myriad of risk sources and underlying conditions will help to lessen the likelihood of a nuclear detonation event. Yet the complexity of risk profiles across domains and regions underscores the need for a full-spectrum approach to the issue. A fourth step then is simply for States to engage in a concerted effort to reduce the risk of nuclear weapon use. While risk reduction as a topic is not new, as discussed in the framework chapter, multilateral engagement on the topic remains nascent.¹¹ Many have espoused the value of nuclear-armed States reaffirming the Reagan–Gorbachev joint statement that ‘a nuclear war cannot be won and must never be fought’. A mission statement at the highest level could have significant reverberations across the nuclear landscape. The Nuclear Security Summit series stands as a precedent of political attention driving practical action; a risk reduction equivalent could at the very least provide a regular venue for engagement on the issue.

Besides attention, a commitment to risk reduction requires stronger risk awareness and risk analysis. This entails a dedicated application of risk framing to regional and subregional security contexts, and to domestic-level processes. Analysts and policymakers would do well to devote more attention to the scenarios that reflect realities on the ground; Kühn suggests involving a wider range of communities in this process. Increased public education of nuclear risk may have the added effect of altering domestic-level dialogue around nuclear policy, including in terms of doctrine and modernization plans, as posited by both Ogilvie-White and Sethi. Certainly the lack of transparency around nuclear weapons programmes provides an impediment to efforts to engage on risk reduction writ large, and on bilateral or plurilateral efforts on nuclear safety and security. Indeed, a heads-on approach to nuclear risk education may not be appropriate in all circumstances. In the Middle East, for instance, Elbahtimy calls for a backdoor approach that emphasizes the other objectives outlined in this section—including confidence- and security-building—to work around the opacity surrounding Israel’s programme.

REFLECTIONS

In considering the breadth of recommendations offered by the authors in this volume, a few patterns are noticeable. First, each author presents a rather wide range of possible measures, encompassing unilateral, bilateral, and multilateral spaces in addition to regional. This layering reflects the encompassing nature of risk sources. It also underlines the limitations of a strictly region-centric approach to risk reduction. The permeability of the regional unit does not altogether negate the value of efforts

¹¹ Point 5 in the action plan outlined in the final document of the 2010 NPT Review Conference does contain a number of commitments and recommendations that fall under the umbrella of ‘risk reduction’, if not quite using those words in tandem. See the introductory chapter.

at that level; after all, conventional conflict between geographically proximate States escalating into nuclear conflict (between either the principals or allied nuclear-armed States) is a risk scenario highlighted across multiple chapters. And most authors, in sketching out risk profiles, highlight pertinent dynamics at the regional and subregional levels. Still, the complexity of those profiles—and the manner in which regional and global circumstances are intertwined—suggests the need for complementary action across levels.

Second, it is striking that overwhelming attention is focused on the role of nuclear-armed States in taking forward risk reduction. This is certainly understandable. But it also reflects the degree to which authors believe tense relations among those States more than anything else is contributing to the risk of nuclear weapon use. Non-nuclear weapon States can have tremendous normative influence, in enacting policies of restraint, contributing to operational clarity, maintaining the political spotlight on risk reduction and contributing to ideas and new thinking. Still, the primacy of engagement by nuclear-armed States is a theme. Thirdly and relatedly, many of the offered recommendations centre on utilizing existing platforms rather than creating new ones from scratch. Even as authors espouse the need to involve non-NPT nuclear-armed States, they stress the value of continuing the P5 process, reinvigorating bilateral strategic dialogues, and preserving the existing arms control and disarmament architecture. Some discuss the value of a dedicated forum for risk reduction issues. But risk of use ultimately cannot be detached from the broader strategic environment. As such, even as risk reduction efforts continue, engagement on those issues, including in extant security forums, is necessary for addressing risk across all pathways.

A RISK REDUCTION BLUEPRINT

This concluding chapter identifies some common themes in the risk sources and risk reduction recommendations provided in the contributions to this volume. Notably, across their individual contexts and domains, authors echo many of the risk reduction principles and objectives outlined in the framework paper. Increased strategic engagement, for instance, can help to clarify situations in which nuclear-armed States would consider the use of those weapons, reducing doctrinal risk. The development of policies of restraint can raise the threshold for use, preventing escalatory dynamics. Enhanced communication and transparency can have cross-cutting effects across all four pathways.

Still, it might be the final point from the authors—the need for a commitment to reduce risk—that best captures how risk reduction needs to be taken forward. As Borrie highlights in his chapter, Schelling and Halperin defined as the essential feature of arms control “the recognition of common interest, of the possibility of reciprocation and cooperation even between potential enemies”.¹² This is true of risk reduction as well. A common interest to reduce the risk of nuclear weapon use rests upon a foundation of risk awareness, and a shared sense of the pathways in which risk can manifest. While the facts-based discourse around nuclear weapon risk has grown over the past decade, there remains work to be done. The multiplicity of forums and initiatives in which risk reduction has emerged—each with their own larger purpose and objectives—suggests that a cohesive approach to the topic still eludes States. Differing perspectives exist even on basic concepts.

In light of the recommendations above, a blueprint for progress on nuclear risk reduction follows:

In the immediate term,

- States can affirm their commitment to reduce the risk of nuclear weapon use, including in the context of the 2020 NPT Review Conference. Indeed, risk reduction has been accorded particular importance in the current review cycle, through its relationship with nuclear disarmament and in light of past commitments made by States. As mentioned in the introductory chapter, the topic has emerged on the agenda of State-led initiatives such as the US Creating an Environment for Nuclear Disarmament initiative and the Stepping Stones approach. Widespread acknowledgement of the importance of taking forward nuclear risk reduction, whether in the NPT context—through substantive discussions at the Review Conference, a potential outcome

¹² T.C. Schelling and M.H. Halperin, *Strategy and Arms Control*, 1961 (republished 2014), p. 2.

document, or the P5 process—or outside it—through a high-level statement—could draw the type of political attention that many suggest is required.

In the short term (the next 12–18 months),

- States can look to extend the conversation on risk reduction in a forum dedicated to the issue. Risk reduction cannot be confined to the NPT context, due to the nuclear-armed States that exist outside the treaty as well as the myriad risk sources that exist beyond its purview. The fact that the Creating an Environment for Nuclear Disarmament initiative involves India, Pakistan, and Israel is certainly a positive trend in considering nuclear risk and risk reduction; still there is scope for more inclusivity. There has been no shortage of interest in the topic, including in the Disarmament Commission and the Conference on Disarmament. Follow-on action in the form of a high-level political summit, an international conference, or an Open-Ended Working Group could provide a venue in which common understandings of risk reduction can be reached, and priorities outlined.
- States can also move to build strategic trust and confidence at the regional level, by undertaking unilateral commitments, bolstering existing structures, and deepening dialogue. Individual States, for instance, can affirm their commitments to nuclear restraint and non-use. At the bilateral and multilateral levels, the United States and the Russian Federation can make New START extension a priority. Nuclear-armed and nuclear-allied States can engage in stock-taking of crisis avoidance and management tools, revisiting the status of hotlines, notification systems, and Incidents at Sea and Dangerous Military Activities agreements. Globally, States can look to expand engagement on strategic issues, by jointly exploring the implications of technological developments on the nuclear balance or sketching the contours of multilateral arms control agreements. Finally, the P5 can take forward their exchange on nuclear doctrine while considering ways to increase the transparency of the process.

In the medium and longer term (> 18 months),

- States can look to improve the strategic environment by addressing the insecurities that drive their risk perceptions. Actions taken in the immediate and short term hopefully will have fostered the development of a set of shared understandings and priorities in and around nuclear risk reduction; these should inform all activity moving forward. States can look to deepen their bilateral, plurilateral and multilateral commitments to risk reduction-related areas. They can expand upon existing crisis avoidance and management tools to develop more comprehensive and multilateral frameworks that reflect regional and subregional dynamics and address new behaviours of concern. In extending their engagement on strategic issues, they can move to consider the

viability of new agreements that include mutual constraints, potentially involving destabilizing technologies and across the cyber and space domains. And at an individual level, nuclear-armed States can more systematically revisit their doctrines, force postures, and capabilities through the lens of risk reduction.

The widespread support for the notion of reducing to a minimum the possibility of nuclear weapon use by any means provides a critical opening in a difficult environment. This volume takes a first cut at the kind of analysis necessary to foster the development of practical, feasible, and contextually appropriate risk reduction measures. Each author offers a series of useful recommendations for States to consider in their respective regions and domains. Given the complexity of risk profiles, however, as well as the perpetual dynamism of risk, further exploration is required. This concluding chapter has derived broad principles for action and outlined a blueprint for moving forward. To facilitate carefully considered policies with impact, policymakers and scholars alike will have to delve more into the nuances of regional and contextual circumstances. Doing so will not only successfully advance the risk reduction endeavour but will also lay the groundwork for reinvigorating arms control and disarmament efforts—and help to progress towards the ultimate risk reduction measure: the elimination of nuclear weapons.



NUCLEAR RISK REDUCTION

CLOSING PATHWAYS TO USE

Reducing the risk of nuclear weapon use has received renewed attention in a difficult geopolitical environment. This volume brings together a collection of expert viewpoints across a series of cross-cutting domains and geopolitical regions in which nuclear weapons feature. Each piece considers potential risk of use scenarios in those contexts, identifying risk drivers and underlying conditions, and presenting a series of concrete policy recommendations to address individual risk profiles. Part of UNIDIR's ongoing research on nuclear risk reduction and following on from its recent publication "Nuclear Risk Reduction: A Framework for Analysis", this study is intended to feed into the dialogue on taking forward risk reduction—and on the development of practical and feasible baskets of measures that can close pathways to use.

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