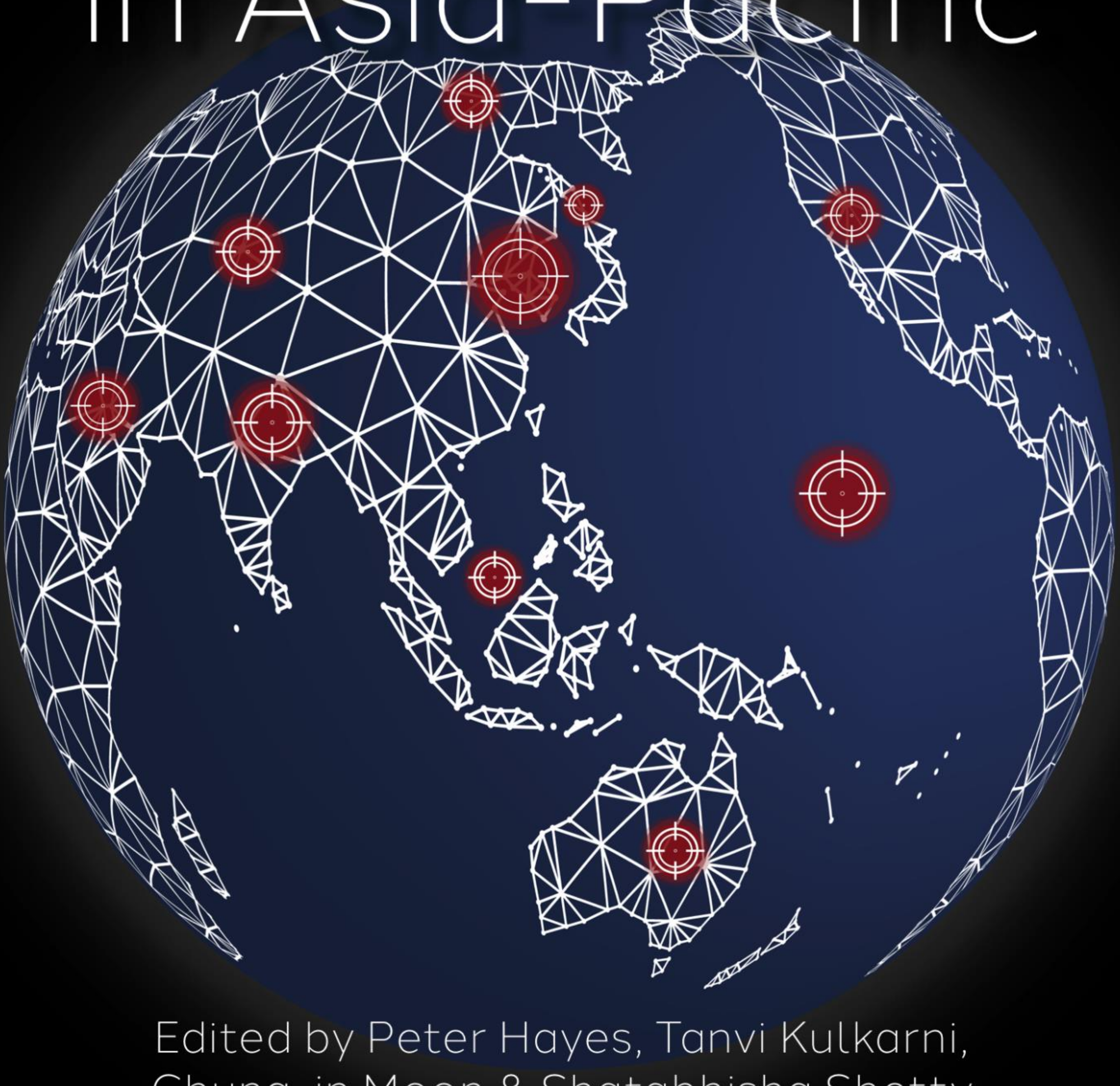
WMD in Asia-Pacific



Edited by Peter Hayes, Tanvi Kulkarni,
Chung-in Moon & Shatabhisha Shetty

WMD in Asia-Pacific

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Peter Hayes, Tanvi Kulkarni,
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Preface

Marty Natalegawa

Since preparation of *WMD in Asia-Pacific* commenced in 2018, the world has plunged into a global pandemic, experienced unprecedented climate change-induced firestorms and floods, and stands on the precipice of nuclear war in Europe due to Russia's invasion of Ukraine.

The world is now more fractured and less capable of addressing such global existential threats than at the end of the Cold War. Two decades of opportunity to build cooperative security at all levels of international human affairs were squandered, and then the world plunged into accelerating conflict over the last decade.

Many old conflicts deepened while new ones emerged out of the failure to address underlying drivers such as poverty, inequality, discrimination, and outright oppression as authoritarian rulers crushed social movements seeking to address these core issues and exploited division to seize and centralize power while confronting adversaries at home and abroad with threat and violent intervention.

At the same time, many militaries grew in size and strength. The world is awash with armament for sale and military technology is also freely available enabling the rapid diffusion of the latest hardware and software to more nations for local production and deployment, including software, missiles, logistics, and in many cases, nuclear, chemical, or biological warfare capabilities known as "weapons of mass destruction" or WMD—the subject of this book in the Asia-Pacific region.

APLN set out to survey the vast array of such capabilities in the Asia-Pacific, including all types of WMD and to provide an authoritative description of these means of destruction in an accessible format that would be freely available to policy makers and decision-makers. Thus, as each chapter was completed, it was posted immediately rather than waiting for the entire book before publication. Now that all nineteen chapters are complete, they are compiled in this book to give scholars, students, journalists and interested readers a benchmark reference. It should be read in conjunction with APLN's previous reference book, *Nuclear Weapons: The State of Play 2015*.[1]

WMD in Asia-Pacific covers all types of WMD—admittedly with a focus on nuclear weapons as the most dangerous of these capacities. It includes all the states possessing such capabilities in the Asia-Pacific region. It provides the necessary historical perspective to understand why WMD is so widespread. And it is multifaceted in that it covers not only the systems themselves, but provides windows into how each party views their particular insecurities that drove them acquire and deploy WMD.

Fortunately, the book does not dwell only on the bad news about WMD in each conflict in the region and at the global level affecting the region. It also provides some waypoints on how to navigate out of the security dilemmas involving WMD in each conflict, and also some novel suggestions for new approaches to controlling WMD in the Asia-Pacific region.

Adoption of urgent risk reduction measures, resumption of arm control dialogues and agreements, and progress on nuclear disarmament in each WMD-laden conflict are now extremely urgent--and also essential to reduce tension so that states can respond cooperatively to humanity's other interlinked existential threats, climate change and pandemics.

APLN would like to thank the primary donor to the *WMD in Asia-Pacific* book project, the Asia Research Fund in Seoul. We also acknowledge the contribution to this book by APLN partners Nautilus Institute and the Research Center for Nuclear Weapons Abolition at Nagasaki University, and also the work of independent peer reviewers for each chapter of the book and too many to list here. You know who you are, thank you.

Marty Natalegawa,
Chair, APLN
March 2022

[1] Free download: https://cnnd.crawford.anu.edu.au/publication/cnnd/5328/nuclear-weapons-state-play-2015.

1. Surveying the WMD Landscape in Asia-Pacific

Peter Hayes and Shatabhisha Shetty

Introduction

We begin the first section of this chapter by introducing the term “Weapon of Mass Destruction” (WMD) and how it is used in the phrase “WMD landscape”—both of which are widely used but are also conceptually problematic. Next, the chapter summarizes a set of seven nuclear force traits that come with the possession and deployment of nuclear weapons, and that force possessor states to make tradeoffs that characterize their nuclear force posture. These include: making possession of nuclear weapons capacities more or less opaque versus transparent; ensuring that nuclear weapons are always available for use versus are never be used without legitimate direction; maintaining centralized, dictatorial authority to use nuclear weapons versus decentralizing and even pre-delegating authority to use; limiting nuclear weapons to counterforce or military-only targets with minimum civilian casualties versus “counter-value” or population targets, often whole cities; and achieving “minimum” deterrence based on imposition of unacceptable risk to a nuclear aggressor (that they would be hit by at least some nuclear retaliation after making nuclear first-strike) versus insisting that a nuclear aggressor faces “mutual assured destruction” irrespective of the level of destruction wrought on the victim of a nuclear first strike. The section explains how nuclear weapons are used to create threat and the paradoxes that result from attempting to use annihilative WMD threats against other states.

In the chapter’s second section (Surveying the WMD Landscape), we present the summary reports from seventeen authors from the three “cockpits” of war and nuclear war in the Asia-Pacific region. The overview begins with Luo Xi’s description of the triangular nuclear competition between the United States, Russia, and China, and their nuclear force modernization programs. Petr Topychkanov expands the scope to include the modernization programs of India, Pakistan, and North Korea to those of the great powers, and the problem that opacity creates for strategic

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instability. Nick Hansen presents the missile delivery systems of each nuclear-armed state in the region, and he examines the bewildering diversity of missiles deployed or under development by these states. Peter Hayes delineates the nuclear command, control, and communications (NC3) systems employed by each nuclear-armed state in the region, without which nuclear weapons could not be used and worse, serve as "force multipliers," and any one of which could lead to loss of control of nuclear weapons and nuclear war. Namrata Goswami shows how states are moving vertically into space for many different WMD-related operations and to compete with each other in this domain in ways that could trigger war and nuclear war. John Carlson takes the horizontal direction and shows how states obtain latent nuclear weapons capabilities in the region and the need to put sensitive nuclear fuel cycle facilities and materials under multinational control. Allan Behm finds that nuclear extended deterrence is based on an inherently incredible bluff and is therefore an irremediably flawed basis for a national security strategy that increases the risk of nuclear war. Jonathan Forman and Alexander Kelle review the history of chemical weapons use in the region in wartime and for deterrence and the problem presented by modern chemical industry and innovation for maintaining the modern non-use norm for chemical weapons. Richard Pilch and Miles Pomper examine how the coronavirus pandemic may enable the re-emergence of banned bio-weapons and the motivation that some nuclear-armed and non-nuclear states may have to obtain chemical weapons in lieu of using or obtaining nuclear weapons.

From these WMD-weapons capacities, we turn to where they might be used in three locations in the WMD-landscape, viz, South Asia, Northeast Asia, and the Taiwan Straits. Rakesh Sood traces the evolution of the Indian-Pakistan conflict embedded in an inherently triangular nuclear threat system with China. Perhaps in no other nuclear-prone conflict is the weight of colonial history so directly linked to the adoption of nuclear forces. As Sood explains, the 1947 partition of Pakistan from India leading to multiple clashes, wars, and now state-sponsored, cross-border terrorism makes it critical that minimal crisis management communication and dialogues commence to reduce the risk of nuclear war in the Indian-Pakistan conflict. In the second zone of possible nuclear war, the Taiwan Straits, Robert Ayson argues that it is urgent to reverse the current spiral of political and military confrontation between the United States and China that recognizes both of vital interests in the Straits and that therefore they must find ways to reduce the risk of war and nuclear escalation such as no-go zones and other confidence building measures. Shifting from East to Northeast Asia, Lee Sang-Hyun contends that the key risk of nuclear war now resides in the asymmetric nature of the DPRK's conventional, cyber, and nuclear forces compared with the United States and the ROK and that the only way forward is to engage the DPRK and enable it to become a "normal" state via a peace process.

The search for ways to exit from or eliminate altogether the WMD-landscape is tackled first by Dmitry Stefanovich who notes that Cold War era treaties have mostly unraveled and in any case, did not ameliorate the threats of war in the Asia-Pacific region, making it imperative to identify ways to concretely reduce by measures such as limited deployment zones for launch platforms, testing activities, warhead storage, modernizing hotlines, and applying international law more stringently to nuclear operations in this region. In the Pakistan-India-China nuclear triangle, Feroz Khan identifies a range of trilateral confidence building measures including linked conflict resolution processes, conventional force restraints, and nuclear restraints on unilateral, bilateral, and trilateral bases across a range of possible political, military-nuclear, conventional-nuclear, and economic spheres. To curb possible nuclear proliferation by Japan and/or the ROK, Moon Chung-in examines and dismisses the various arguments mustered by pro-proliferation policy currents in each country, and he notes that it is urgent to reinforce official reluctance to entertain nuclear armament by increased civil society education and mobilization in each state. Tuya Nyamosor shows how the three nuclear weapons-free zones (NWFZs) that exist in the region emerged, compares their regulatory provisions, and notes the near-term applicability of the NWFZ concept to Northeast Asia. Richard Tanter highlights the rapid ratification of the Treaty on the Prohibition of Nuclear Weapons in the region and the practical and legal obstacles to expanding its jurisdiction to encompass the nuclear weapons and nuclear umbrella states.

The third part of this chapter (Conclusion) returns to the seven key tradeoffs that nuclear armament demands each nuclear-armed state make, listed above; and presents the orientation made by each nuclear state from these combined choices. From this review, we find that while they share many of the dilemmas that nuclear armament poses, each attempts to resolve these dilemmas in their own way. For the most part, they do not think alike about nuclear weapons, are not committed to the same norms of behavior or rules of the road, and lack even a common vocabulary for discussing or managing nuclear risk in this region. Nonetheless, we identify eight ways that the risk of nuclear war and other WMD may be reduced and eventually eliminated. These include minimizing the role of nuclear weapons; controlling the diffusion of disruptive technologies and separating nuclear from non-nuclear forces; slowing and reversing the interlinked nuclear domino effect and the arms racing generated by nuclear modernization programs; creating the peaceful conditions that reduce the risk of war in the first place; undertaking numerous, incremental, and immediate nuclear risk reduction measures in each and every nuclear-armed state; delinking and separating the conflicts in each conflict zone to reverse the potential for cascading conflict up and down the nuclear weapons hierarchy; subordinating nuclear weapons and related deterrence to higher level, existential goals, especially climate change and pandemic response; and expanding the landscape in which nuclear weapons are not allowed into defined zones or are prohibited altogether on a national basis.

The "WMD Landscape"

The Asia-Pacific Leadership Network for Nuclear Non-Proliferation and Disarmament (APLN) informs and energizes public opinion, especially high-level policymakers, to take seriously the very real threats posed by nuclear weapons and to achieve a world in which they are eventually eliminated. To this end, in 2019 APLN convened a group of experts to address critical issues related to nuclear and other weapons of mass destruction (hereafter WMD) in the Asia-Pacific region. The global pandemic that erupted in 2020 disrupted APLN's plan to bring these experts together and instead, led to a virtual workshop spanning four days in December 2020 at which their work was presented.

This chapter introduces their work. But first, we define what is meant in this book by the term "WMD" and present the concept of a "weapons of mass destruction landscape." Next, we offer a summary tour of the key features of WMD infrastructure, force structures, capabilities, envisioned uses, and finally, antidotes, at various locations across the Asia-Pacific WMD landscape. Along the way, we find that all nuclear-armed states make seven critical tradeoffs that shape their nuclear identity and their willingness to control and/or disarm their nuclear forces. We conclude this introduction by drawing eight lessons drawn from this review of the WMD landscape in the Asia-Pacific region, each of which has implications for the prospects for resumption of WMD control and disarmament and possible policy measures that might realize such an agenda.

Weapons of Mass Destruction

In this book, WMD is used broadly to refer to weapons that cause mass casualties that distinguish them from non-WMD weapons. Readers should note that the very concept of WMD is contested,[1] politicized, and is not defined legally at the international level although it appears in arms control treaties.[2] The basic idea was well stated by the 1948 UN Commission for Conventional Armaments as encompassing "atomic explosive weapons, radioactive material weapons, lethal chemical and biological weapons, and any weapons developed in the future which have characteristics comparable in destructive effect to those of the atomic bomb or other weapons mentioned above."[3]

Because of the unique effects associated with nuclear weapons, these are the primary WMD addressed in this book. This focus is not to deny the lethal potential of chemical and biological weapons. Indeed, this book identifies where nuclear, chemical, and biological weapons have featured in Asia-Pacific's WMD landscape and may do so again. But it mentions radiological weapons only fleetingly, and does not cover emerging weaponry *with potential to achieve similar levels of effect to WMD such as swarming drones, cyberattacks on critical infrastructure, etc.*

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[1] Michelle Bentley outlines these contextually driven shifts in "WMD" in "War and/of Words: Constructing WMD in US Foreign Policy," Security Studies, 22, 2013, pp. 22-68 at: https://doi.org/10.1080/09636412.2013.757164 and in her *Weapons of Mass Destruction and US Foreign Policy, The Strategic Use of a Concept*, Routledge, 2014.

[2] Specifically, WMD are referred to in three international treaties that do not define the term, viz, the Seabed Treaty that prohibits "nuclear weapons and other weapons of mass destruction" from being placed on the "seabed and the ocean floor, and in the subsoil thereof"; the Outer Space Treaty that bans placement of "nuclear weapons and other weapons of mass destruction" on celestial bodies except Earth; and The Strategic Arms Reduction Treaty applies the ban to include fractions of Earth's orbit. See Z. Kallenborn, *Are Drone Swarms Weapons of Mass Destruction,* Future Warfare Series No. 60, The Counterproliferation Papers, Future Warfare Series No. 60, U.S. Air Force Center for Strategic Deterrence Studies, Air University, Maxwell Air Force Base, Alabama, May 6, 2020, p. 5. The phrase also appears in the preambles to the Latin American nuclear weapons free zone treaty and in the proposed Middle Eastern WMD-free zone, and the biological and chemical weapons convention, but *not* the Treaty on the Nonproliferation of Nuclear Weapons. See S. Carus, *Defining "Weapons of Mass Destruction," Center for the Study of Weapons of Mass Destruction,* Occasional Paper, No. 8, National Defense University Press, Washington, D.C., January 2012, p. 21. It also appears in the Guidelines of the Missile Technology Control Regime agreements, and in the UNSC 2004 1540 resolution related to regulating non-state actors; and UNSC resolution 1540 (2004) that requires all states to "fulfil their obligations in relation to arms control and disarmament and to prevent proliferation in all its aspects of all weapons of mass destruction." Interestingly, resolution 1540 explicitly defines the scope of the resolution to apply to nuclear, chemical, and biological weapons (and defines these weapons) but does not define the term WMD. UNSC Resolution 1540, April 28, 2004, at: https://www.un.org/ga/search/view_doc.asp?symbol=S/RES/1540%20(2004) However, the 1995 UNSC resolution 984 on assurances to NPT-party non-nuclear weapons states is delimited to nuclear weapons only.

[3] Ibid, S. Carus, Defining "Weapons of Mass Destruction," p. 5 and 12.

This choice follows from the physics of nuclear weapons. No non-nuclear WMD match the prompt, vastly destructive power that may be delivered globally and near-instantaneously by nuclear weapons, nor the centrality of the threat of nuclear annihilation to the conduct of international relations since World War II. Arguably, only nuclear weapons pose a clear and present danger to the existence of the human species—especially when use in nuclear war may degrade or even destroy human resilience and capacity to manage the other existential threats that afflict humanity.

A further complication is the intimate relationship between potential use of nuclear weapons and conventional weapons which may accumulate enormous casualties over time in large-scale conflicts. Paroxysms of conventional war likely will be the launch pad for any plausible nuclear war. In many respects, nuclear and conventional weapons are joined at the hip and, as will be evident in the chapters on regional flashpoints in this book, cannot be separated.

The "WMD Landscape"

Policymakers and analysts often refer to the "WMD landscape" as if the contours and features of this "threat landscape" can be surveilled and mapped like any geo-spatial terrain.[4] For example, for Paul Bernstein and his colleagues at the US Center for the Study of WMD, the term refers to "The complex and dynamic nuclear landscape … along at least four axes: regional nuclear proliferation, nuclear terrorism, great power nuclear relations, and the security implications of increased interest in nuclear energy."[5] For the US defense Intelligence Agency, it covers: "1. Increasing numbers or capabilities of weapons in existing programs. 2. Enduring security threats to weapons and material. 3. Countries developing new delivery systems with increased capabilities. 4. Countries developing nuclear weapons with smaller yields, improved precision, and increased range for military or coercive use on the battlefield. 5. Countries developing new nuclear weapons

[4] For example: "Biological weapons occupy an interesting role within the WMD landscape as contagious pathogens can be used to create a large strategic outbreak, non-contagious pathogens can target operational forces or populations, and toxins are effective for assassinations." Patrick Terrell, "North Korean Collapse: Weapons of Mass Destruction Use and Proliferation Challenges," The North Korea Instability Project, June 2017, p. 8, at: https://www.38north.org/wp-content/uploads/pdf/NKIP-Terrell-WMD-Use-and-Proliferation-Challenges-062217.pdf

[5] P. Bernstein et al, "The Future Nuclear Landscape," CSWMD Occasional Paper 5, April 1, 2007, p. 1, at: https://inss.ndu.edu/Media/News/Article/693747/the-future-nuclear-landscape/

without conducting large-scale nuclear tests."[6] For John Krzyzaniak writing in *The Bulletin of the Atomic Scientists*, it describes a risk ledger—in 2020, for example, "new nuclear risks emerged, old risks reappeared, and, although no risks really went away, there were some positive signs."[7] For Vipin Narang, it means simply "the strategic environment."[8]

Given that this widely used phrase has no conventional meaning, what exactly are the features of "WMD" that constitute such a landscape and signify a possessor's WMD capacity and intentions that together make up threat?

Typically—at least in the West—WMD in the form of nuclear force structures are described with reference to those that ensure its survivability, its ability to strike an adversary and overcome defenses, and its targeting range.[9] Metrics are assembled such as numbers of warheads, missile "throw-weight" and explosive power, numbers and diversity of naval, aerial, land-based delivery platforms that constitute monads, dyads, or triads, and range of various delivery system. Often such portrayals are simplistic, speculative, and sometimes downright deceitful. Such portraits may be supplemented with an attributed declaratory and operational doctrine, a strategic-cultural profile, and an account of the supporting nuclear-industrial infrastructure.[10]

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[6] US Defense Intelligence Agency, *Global Nuclear Landscape 2018*, February 2018, at: https://dod.defense.gov/portals/1/features/2018/0218_NPR/img/Global_Nuclear_Landscape_2018_Final.pdf

[7] John Krzyzaniak, "The 2020 nuclear landscape, in the shadow of a pandemic," Bulletin of the Atomic Scientists, December 29 2020, at: https://thebulletin.org/2020/12/the-2020-nuclear-landscape-in-the-shadow-of-a-pandemic/

[8] A. Rej, "Vipin Narang on the global nuclear landscape: hype and reality," *The Diplomat*, April 13, 2020, at: https://polisci.mit.edu/news/2020/vipin-narang-global-nuclear-landscape-hype-and-reality

[9] David Arcenaux and Kyungwon Suh describe these typical parameters as specified by Albert Wohlstetter; and then develop metrics that describe the delivery platforms that contribute to these three critical attributes, and the diversification of these platforms that enhance the putative deterrence capacity of a state (they identify seven, viz: "submarine-launched missiles, strategic land-mobile missiles, rapid fueling technologies, nuclear-tipped cruise missiles, multiple independently targetable reentry vehicles, deliverable strategic nuclear weapons, and tactical nuclear weapons." In "Nuclear Platform Diversification: A New Dataset," unpublished paper, May 18, 2021 via email. See video seminar, David Arcenaux, "Nuclear Platform Diversification: A New Dataset," Managing the Atom, Harvard University, May 5, 2021, at: https://harvard.zoom.us/rec/play/tRBavuokQb5IaqQvzMHH-2upXaWBvZI2P8hq7gOGtHvIVzWmXTwzMJzCkxOGanX8gxIZuE_mdUVSze-r.dKBHZuvtjR0Nd0XE?startTime=1620237212000&_x_zm_rtaid=AhPK9IEnSaqu0cQ1pIfstQ.1621357119985.a8a436189e56e22a2c8dc5a384487180&_x_zm_rhtaid=35

[10] K. Kartchner et al, Strategic Culture and Weapons of Mass Destruction, Culturally Based Insights into Comparative National Security Policymaking, Springer-Link, 2009, at: https://link.springer.com/book/10.1057/9780230618305

Unfortunately, this type of depiction reduces the true complexity of a nuclear force to a few common attributes that in reality amount to one nuclear-armed state's threat perception projected onto another. Worst case assumptions predominate, and adversarial intention is rarely addressed, let alone interrogated while the rationality and legitimacy of one's own force structure are rarely examined. Some analysts attempt to overcome the limits of parochial analysis by investigating the determinants of nuclear force structure and the variation within the diversity thereof by quantitative and statistical analysis of "domestic constraints, bureaucratic politics, conventional threats, nuclear rivalries, and nuclear alliances."[11] But most often, detailed accounts proceed by stand-alone or comparative, qualitative case studies grounded in history, and structured by assumptions and hypothetical arguments that attempt to derive general lessons for strategic practitioners and policymakers.[12] These too exhibit bias, especially in the selection of cases.[13] And, much of the literature is focused on Euro-Atlantic security affairs and systematically ignores the historical experience of WMD in Asia-Pacific. Yet, many of the nuclear "near-misses" during the Cold War and most of the post-Cold War near-misses occurred in the latter region, not the Atlantic-European security sphere.

In this chapter—drawing on the subsequent chapters—we use a broad conceptual framework shown in Table 1 to capture the choices made by all nuclear-armed states, whether on purpose or by default. These include making possession of nuclear weapons capacities more or less opaque versus transparent; ensuring that nuclear weapons are always available for use versus are never used without legitimate direction; maintaining centralized, dictatorial authority to use nuclear weapons versus decentralizing and even pre-delegating authority to use; limiting nuclear weapons to counterforce or military-only targets with minimum civilian casualties versus "counter-value" or population targets, often whole cities; and achieving "minimum" deterrence based on imposition of unacceptable risk to a nuclear aggressor (that they would be hit by at least some nuclear retaliation after making nuclear first-strike) versus insisting that a nuclear aggressor faces "mutual assured destruction" irrespective of the level of destruction wrought on the victim of a

[11] E. Gartzke, J. Kaplow, R.N. Mehta, "The Determinants of Nuclear Force Structure," Journal of Conflict Resolution, 58:3, 2014, p. 486, at: https://journals.sagepub.com/doi/abs/10.1177/0022002713509054

[12] Bennett and Smoke present a summary account of this approach in A. George, A. Bennett, *Case Studies and Theory Development in the Social Sciences*, MIT Press, Cambridge, MA, 2005. .

[13] See the penetrating critique in C. Achen and D. Snidal, "Rational Deterrence Theory and Comparative Case Studies," *World Politics,* 41:2, January 1989, pp. 143-169.

nuclear first strike. These abstract choices are revisited at the end of this Introduction in the context of the Asia-Pacific region as represented in subsequent chapters.

Table 1: Nuclear Force Posture Tradeoffs

Transparency	**Opacity**
Certainty	**Uncertainty**
NC3 Negative Bias-Never Use by Mistake	**NC3 Positive Bias-Always Available for Use**
Dictatorial Decision-Making	**Group Decision-Making**
Counterforce Targeting	**Countervalue Targeting**
Maximum Deterrent	**Minimum Deterrent**
Interdependent Nuclear Security	**Autarchic Nuclear Security**

*Table 1 Note: NC3 stands for nuclear command, control, and communications.

How these nuclear postures generate nuclear fear in the minds of their adversaries, and how nuclear threat is perceived and experienced, varies greatly across each region. Each nuclear-armed state reveals different declaratory rhetoric, deployments, and force disposition such as alerts or forward-deployments to send signals about intention to nuclear adversaries who perceive them as "early warning." For such "messaging" to work, nuclear-armed states need some kind of shared vocabulary.

One such language is that of the nuclear forces that speak for themselves. Nuclear forces are embodied in physical locations such as factories that make fissile material for warheads—or the warheads themselves--scattered across the landscape. These sites may be identified and observed from afar—although satellites in space may be as close as one can get to some sites. Among the most threat-laden fixtures are silos, airfields, and ports, and related mobile delivery platforms such as submarines or bombers that may be tracked by various technical apparatus. There are also nuclear warhead testing sites, and missile testing ranges which may be observed close up or, depending on available national technical means, from great distance. These physical structures are the terrain contours and architecture of the force structure that constitute the visible WMD landscape. However, it may also contain "blank spots" that are kept hidden, or they only exist so briefly that only states that are pre-positioned and equipped can map some critical elements of WMD (such as launch exhaust trails on satellite infrared sensors, missile trajectories on radar and telemetry from re-entry vehicles).

When the object of analysis itself is difficult to discern in a given locale, then standard qualitative and quantitative accounts of nuclear forces based on attributed indicators are essentially speculative because they are based on interpretation which is notoriously subject to bias, cultural assumptions, or political bias, and being held secret, not subject to well-informed cross examination. At best, these accounts provide only indirect indication of the intention that may be embodied in these physical artifacts. Minimal disclosure and concealment of physical forces are standard practice of nuclear-armed states in this region. Even the United States practices a "neither-confirm-nor-deny" policy when it comes to nuclear weapons. A haze of ambiguity hangs over and obscures the WMD landscape. Clarity based on transparency is rare and often provided by mistake rather than on purpose.

Yet all nuclear-armed states—even the most opaque—need to provide *some* information about their capacity to adversaries, if only to keep them guessing or to remind them that deterrence is operative, even if the adversary has no immediate intention to attack. Otherwise, ignorance is bliss for an adversary and nuclear weapons have no utility. Thus, nuclear weaponeers must carefully calibrate what to reveal or to deny in order send messages about their capacity and intention to adversaries if they are to affect the perceptions and shape the behavior of adversaries and allies, not to mention domestic audiences. Indeed, to maintain a constant dark cloud of nuclear threat over a WMD landscape requires impressing adversaries that WMD threats are a clear and present danger, and not a figment of someone's disturbed imagination. Nuclear-armed states go to extraordinary lengths to maintain this perceived threat, for example, by staging nuclear war "exercises," mating warheads to missiles or loading them onto bombers at times of high tension, increasing alert levels at missiles and airfields, moving missiles around and dispersing bombers, or putting submarines to sea, to name but a few. In short, nuclear-armed states try hard to impress the other of their ability to bounce their rubble and to reduce them to a smoking, radiating ruin in a nuclear war if they don't change their tune or back off.

Unfortunately, the most important aspect of observable nuclear force deployment is not the revealed capacity per se, but what it says about intention because the latter is what makes the revealed capacity a threat. Intention is not a directly observable feature of the WMD landscape because it inheres in intangibles such as nuclear threat rhetoric, operational doctrine in manuals, organizational structures, analog and digital control systems, the personae of nuclear commanders manifested in their decision-making style, and the decision-making process itself that first constitutes their agency and then enacts their intentions in the form of orders translated into actions that ultimately—should nuclear war erupt due to loss of control of the weapons, accident, or purposeful strikes—become visible as nuclear detonations in the observed landscape of targets likely observed by only a few survivors or possibly no-one at all and therefore, devoid of meaning.

Thus, while it is possible to glimpse the nuclear forces and supporting physical infrastructure, there is no way to divine intention with any surety or clarity because the meaning of nuclear threats is always ambiguous, uncertain, and inherently irrational. Often, decision-makers do not articulate their intentions even as they act let alone that of their adversaries. Even with the benefit of hindsight, it is almost impossible to confidently specify intentionality due to the notoriously poor historical veracity of memoirs and the biases and failures of memory on the part of decision-makers.

A survey of the WMD weapons landscape in the Asia-Pacific region encounters a further methodological obstacle in that "Asia-Pacific" is an Orientalist construct that defines the region with reference to what it is not—that is, not Europe or the United States. "Asia-Pacific" is not a unit of geo-political behavior in itself, nor a shared identity for anyone who comes from or acts in this geographical area. As will become evident in this book, although the dilemmas encountered when nuclear weapons are introduced into a conflict are universal, the specific forms of WMD in each part of "Asia-Pacific" are locale and conflict-specific and must be analyzed separately at each site of potential use at the global, regional-multilateral, and bilateral levels. As we shall see in subsequent chapters, the dynamics of generating threats using WMD—especially from nuclear weapons--in this region are distinctive and do not follow any playbook from the Cold War or other regions.

Chemical weapons have a long history and were used in modern war until banned by the Chemical Weapons Treaty in 1997—and since then, by outliers such as Syria. Biological weapons also have a long history of development with only isolated deployment in the modern era since they were banned in 1975. And other than two actual nuclear attacks in 1945, nuclear weapons have not been used since then. Only the threat of nuclear use has been deployed, widely, to structure international relations by forcing leaders to take the risk of nuclear war and self-damage into account in their decisions. Thus, to date, it is primarily the prospect of resumed WMD use that is the specter that defines the WMD landscape, not widespread use itself.

Yet, it is worth repeating. The worst kind of WMD use, nuclear war, has been fought only once, at Hiroshima and Nagasaki in August 1945, and then only against a non-nuclear state. Since then, no-one has ever exchanged nuclear weapons fire in a war, only nuclear threats. The next use of nuclear weapons would transform the landscape in which people live in radical ways, stopping time, annihilating nature, incinerating whole cities in a flash, eliminating all meaning invested by humans. Until nuclear next-use, all this war-making is imaginary—until it's not. Ironically, even the envisioning of nuclear war has no common basis because the interpretation of the nuclear bombing of Hiroshima and Nagasaki, and of the many near-misses since then, diverge across the states party to these conflicts--the claims of *hibakusha* (survivors of nuclear bombing) to define the past as the basis of future nuclear horror notwithstanding. It is incumbent upon us, therefore, to envision these horrific futures anew as precisely as possible to first understand, and second avoid them, which is the reason for taking this excursion across the WMD landscape.

Surveying the WMD Landscape

With these qualifications in mind, we will traverse the WMD terrain guided by twenty authors who are deeply imbued with knowledge of each state and conflict involving WMD, with Asia-Pacific defined loosely as stretching from South Asia to Northeast Asia. We proceed in three stages—by first mapping the lowlands and badlands of conflict zones, then examining how and where conflicts may erupt into paroxysms of violence due to the presence or use of WMD, and finally, mapping some of the pathways whereby the landscape may be left behind, rid of WMD threats either partly or forever, to be replaced by a "post-WMD" or "WMD-free" landscape, the interim version of which is known as a WMD- or nuclear weapons-free zone.

Thus, the first section establishes baseline knowledge about what is known or may be inferred about the status of WMD in the Asia-Pacific region at various locales and trends in WMD proliferation and deployment in regional conflicts. The second section focuses on where wars involving WMD might begin in three locations—South Asia, the Taiwan Straits, and Korea—while examining how asymmetric force structures and future proliferation may increase the risk of the next-use of WMD, especially nuclear weapons, in each conflict. The third section examines how the risk of wars involving WMD in the region might be reduced or even eliminated altogether.

Great Power Nuclear Triangle—the Rise of China

The book commences by describing the baseline status of and trends in vertical and horizontal proliferation of WMD across the entire region. Writing from the China corner of the great power strategic triangle with the United States and Russia, Luo Xi observes that this relationship has become intrinsically trilateral rather than primarily bilateral as it was during the Cold War. She notes that many of the road rules and signposts designed to keep the United States and Russia (formerly the Soviet Union or FSU) from colliding have been abandoned, and that all three of nuclear great powers are modernizing their nuclear forces and introducing "post-ballistic" missile technologies that create new risks superimposed on many of the old. She emphasizes that the nuclear game at the global level is now more complex because each player sizes their nuclear force not only against the other great powers who field triadic nuclear forces with global reach, but against a range of middle and small powers, and even against non-state actors.

Importantly, she argues that "unrestrained nuclear competition between the United States and Russia may complicate future bilateral arms control negotiation and potentially effect China's cognition of its own nuclear retaliatory capabilities." That is, China is not a passive actor on the receiving end of nuclear threat, if it ever was. In the past, China relied on its ability to absorb a nuclear first strike but then retaliate to inflict enough damage to not only deter such a strike, but also armor it against any attempt to use nuclear threats against it as was attempted by the United States during the Korean War and aftermath in the Taiwan Straits and the 1969 Soviet-China clash at the Amur River.

Today, however, China may respond directly to possible US deployment of previously prohibited ground-based intermediate-range missiles in the western Pacific. It may increase the survivability of its nuclear forces by deploying multiple warheads on missiles and experiment with hypersonic boost-glide vehicles that reduce warhead delivery time and early warning to even less than that associated with ballistic missiles. In fact, some claim that China has already done so, in advance of Russia and the United States.[14] Finally—and this development became public after the writing

[14] M. Yeo *et al*, "Hypersonic and directed-energy weapons: Who has them, and who's winning the race in the Asia-Pacific?," *Defense News*, March 15, 2021, at: https://www.defensenews.com/global/asia-pacific/2021/03/15/hypersonic-and-directed-energy-weapons-who-has-them-and-whos-winning-the-race-in-the-asia-pacific/

of this chapter, China may be expanding its ground-based missile force substantially with three new missile fields with up to two hundred silos under construction.[15]

Luo concludes that the three great nuclear powers should undertake urgent nuclear risk reduction measures in the context of the P5 group, that is, the five permanent members of the UN Security Council (all of which are nuclear-armed). But she notes also that China may be more likely to participate in arms control than arms reduction talks because the former are not only inherently more comprehensive in nature than the latter—requiring, for example, that emerging technologies and nuclear-conventional entanglement be addressed—but may also require the participation of other powers with relatively smaller arsenals such as those deployed by the United Kingdom, France, and India. Also, a comprehensive and inclusive nuclear arms reduction dialogue would necessarily encompass how best to resolve regional conflicts in Europe, the Middle East, South Asia, and Northeast Asia so that they are no longer potential regional theaters of nuclear war, with the potential to escalate to global nuclear war between the three nuclear great powers. She suggests that a multilateral dialogue should aim to persuades nuclear-armed states to switch from "launch under warning" to "launch under attack" with a related operational policy whereby nuclear weapons are kept undeployed at central depots on low alert levels, concurrent with declaration of a common "No First Use" policy.

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[15] J. Warrick, "China is building more than 100 new missile silos in its western desert, analysts say," Washington Post, June 30, 2021, at: https://www.washingtonpost.com/national-security/china-nuclear-missile-silos/2021/06/30/0fa8debc-d9c2-11eb-bb9e-70fda8c37057_story.html
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James Cameron examines the differing interpretations of this construction in "China's Silos: New Intelligence, Old Problems," *War on the Rocks*, August 12, 2021, at: https://warontherocks.com/2021/08/beijings-silos-new-intelligence-old-problems/?utm_source=AM+Nukes+Roundup&utm_campaign=c0a7b157d9-EMAIL_CAMPAIGN_2018_07_25_12_19_COPY_01&utm_medium=email&utm_term=0_547ee518ec-c0a7b157d9-391728633
See also H. Kristensen, M. Korda, "China's nuclear missile silo expansion: From minimum deterrence to medium deterrence," *The Bulletin of the Atomic Scientists*, September 1, 2021, at: https://thebulletin.org/2021/09/chinas-nuclear-missile-silo-expansion-from-minimum-deterrence-to-medium-deterrence/

Modernization of Nuclear Forces

Next, Petr Topychkanov assesses the modernization of nuclear force postures, especially the decision to stop de-emphasizing nuclear weapons by expanding the roles attributed to nuclear weapons in rhetoric, operational doctrines, war plans, and deployments. He observes that this trend is part of a broader shift to geostrategic competition and distrust, and resurgence of the concept of limited nuclear warfighting both within the global nuclear triangle of nuclear great powers, but also at the regional level in South Asia and Northeast Asia.

Thus, as soon as the United States withdrew from the US-Russian Intermediate Nuclear Forces (INF) treaty, it tested an extended-range ground-launched cruise missile, with clear intent to deploy it against China (which was not party to the INF treaty and has concentrated its nuclear-armed missile development in this intermediate range capable of attacking US west Pacific allies as well as US territory such as Guam).

Russia too, he notes, is developing and testing new nuclear weapons such as the Burevestnik nuclear-powered long-range cruise missile, the Poseidon nuclear-powered underwater drone, the Kinzhal air-launched supersonic missile, the Sarmat silo-based heavy ballistic missile, and the Avangard hypersonic glide vehicle while rapidly restocking and modernizing most of its existing strategic rocket force.

For its part, according to Topychkanov, China maintains that the "sole purpose" role of nuclear attack is to employ nuclear weapons only in response to a nuclear strike, rather than keeping open the option to use them in a conventional war, as is explicitly kept open by the United States, Russia, and Pakistan. However, China remains opaque as to how many nuclear weapons it deploys leaving open the possibility that it is expanding its arsenal significantly. At the same time, its apparent intent to deploy nuclear ballistic missile submarines along with nuclear warheads, presumably outside China's territorial waters, suggests a major shift in the previously conservative control system in China's nuclear arsenal to include possible pre-delegation of use of nuclear weapons to deployed submariners.

Topychkanov explains that India has earned a place at the great power table but is also trapped in counterforce dilemmas in its relationship with Pakistan. It has obligated itself to observe "no first use" against China and Pakistan, but Pakistan has not reciprocated and relies heavily on the threat of early nuclear use to deter an Indian conventional war against it, especially over Kashmir. At the same time, India lacks nuclear forces able to survive a Chinese nuclear counterforce attack.

Finally, he concludes that the DPRK presents a particularly problematic case due to its nuclear opacity. The DPRK has not made available an official nuclear doctrine that shapes its posture and sets external expectations as to what to expect of its nuclear forces either routinely or in a crisis. This opacity reduces its adversaries to a guessing game as to what the DPRK's nuclear forces are for in a crisis—compellence, deterrence, or some other purpose such as domestic mobilization around a unified "nuclear weapons identity."

Topychakanov concludes that increasing the transparency of nuclear forces is the most important overarching imperative that bears on every nuclear-armed state in the region, and it is central to regaining "strategic stability" in international relations, that is, stable mutual deterrence that ostensibly is the reason to have nuclear weapons in the first place.

Nuclear-Capable Missiles in Asia-Pacific

A nuclear weapon is often reduced to a nuclear explosive device that is "weaponized" into a deliverable warhead. But a warhead without a delivery system can only blow up its possessor; and all delivery systems also require launch platforms and associated NC3 infrastructure. A nuclear weapon therefore consists of the combination of NC3, launch platform, delivery system, and warhead. This is a more expansive but also more logical definition of a nuclear weapons than the narrower, conventional definition as a nuclear explosive device that releases energy from a controlled fission or fusion reaction.[16]

Nick Hansen describes the incredible array of missile delivery systems deployed or under development by the six nuclear weapons states in the Asia-Pacific region, including those that employ fixed or mobile land-based launch platforms, submarines, and aircraft-launched missiles. Nuclear weapons states also have non-missile delivery systems for gravity nuclear-bombs, torpedoes, and tactical nuclear weapons for ground-use, but they rely on ballistic missiles for the

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[16] For example, a nuclear weapon is defined as: "*Complete major assembly (i.e., implosion, gun, or thermonuclear) in its intended ultimate configuration, or in a disassembled configuration for a temporary period of time, which, upon completion of the prescribed arming, fusing, and firing sequence, is capable of producing the intended nuclear reaction and release of energy," Glossary, US Department of Defense, Nuclear Matters Handbook (2020 revised), at:* https://www.acq.osd.mil/ncbdp/nm//NMHB2020rev/glossary.html

most part due to their combined speed of delivery and geographical reach to overwhelm any possible defense against nuclear attack, although cruise missile-delivered nuclear weapons are part of the picture for lesser nuclear wars using aircraft-launched nuclear weapons.

In each nuclear-missile endowed state, Hansen traces the evolution of their missile arsenal into a breathtaking diversity of missile systems. Although there are many possible drivers in each nuclear-armed state that explain this bewildering diversity, including domestic determinants such as service rivalry, political-bureaucratic interest and pork barrel politics, the cumulative momentum built up by decades of scientific and technical missile (and space rocket) R&D and testing, engineering cultures, and design philosophies that affect accuracy and reliability performance, the military-industrial base and availability of critical materials such as those needed for liquid versus solid propellants and hardware such electronics needed for guidance systems, access to testing sites to miniaturize warheads deployable on missiles or to test the missiles themselves over instrumented test ranges, doctrinal dogma such as the necessity of the three-legged nuclear triad and related counter-value (low accuracy, big warheads to kill cities) versus counterforce (high accuracy, small warheads needed to kill military targets) requirements, the major factor undoubtedly is geo-strategic, that is, the nature and number of adversaries, their location relative to a given nuclear-armed, missile-endowed state, and the target set and challenge presented by the target states' nuclear and conventional forces including their vulnerable NC3 nodes, the wily exploitation of the adversaries worst fears whatever the true capability of one's own proliferating missile types, and the competitive dynamic between nuclear missile armed adversaries that leads to competitive, matching development and deployments irrespective of the military logic of system acquisition and possible use.

Thus, there are many historical trajectories for each nuclear-armed states missile proliferation with varying combinations of unilateral and competitive acquisition of missile capabilities stretching over many decades, as is the case with US-FSU/Russian or US-Chinese missile acquisition, but also radically different pathways taken by breakout states like the DPRK that skip some phases altogether to leapfrog into long-range missile status, whereas, others like Pakistan remain focused on intermediate and short-range missiles. In short, Hansen argues, the strategic context matters when it comes to understanding the profusion of missiles in Asia-Pacific.

Hansen observes that arms control and disarmament treaties and agreements that controlled the vertical (by nuclear-armed states) and horizontal (by non-nuclear armed states) proliferation of missiles has largely collapsed, and the remaining controls are unravelling quickly. As more states acquire missiles, including new missile types such as hypersonic delivery systems launched from missiles the area covered by their missile range begins to overlap, creating a new layer of complexity and potential risk to nuclear crisis and possible escalation. It is urgent, therefore, to control not only nuclear weapons, but also missiles, to reduce and eventually eliminate the risk of nuclear war—a topic addressed in later chapters of this book.

NC3 "Force Multipliers"

Peter Hayes notes that nuclear or missile test sites, nuclear fuel cycle or warhead production factories, and nuclear delivery sites and platforms such as silos, ports, or airfields, are all visible either at least fleetingly or all the time. But when it comes to nuclear command, control, and communications (NC3), these systems are much harder to identify and to characterize. Nuclear command posts may be identified above or below ground where supreme political and military commanders likely would assemble to deliberate and then fire their nuclear weapons —if they were not "decapitated" first in a nuclear preemptive strike by their adversary. Some of the larger early warning systems such as radars or satellite ground stations can be observed, as can the large antennas that transmit orders over very low frequency radio signals to submarines with nuclear-armed missiles.

But for the most part, NC3 is nowhere to be seen on the WMD landscape. Yet, without nuclear command-and-control and their supporting information sensors and communications infrastructure, nuclear weapons could not be used. Moreover, high performance NC3 multiplies the lethality of the weapons themselves by increasing their speed and precision. Ironically, these systems themselves are also the most important targets to be hit early in a nuclear war, even more so than nuclear weapons themselves.

What matters when it comes to NC3, Hayes argues, is not how one or another NC3 system stands alone but how adversarial NC3 systems interact to create risks which may originate in potential misreading of early warning information ("false positives" that advise leaders that their state is under nuclear attack when it isn't), technological failure (which could lead to accidental detonation), or organizational pathology (whereby an individual or a unit acts in a way that leads to nuclear escalation contrary to the intention or orders of the supreme nuclear command).

Why does NC3 matter? Since the Cold War began, a serious incident between nuclear weapons states with the potential to escalate to nuclear war has occurred on average once every three years. In each of these, NC3 was integral to the near-miss. In 2022, the beat goes on.

The three great power nuclear-armed states —the United States, Russia, and China —now have global or near-global reach. Each has satellite and ground-based communication and observation—especially radar—sensors that match their long-range nuclear-weapon delivery platforms and systems. Their NC3 systems combine Cold War analog legacy systems with ultra-modern digital systems, often shared with conventional forces. In all three cases, these global NC3 systems are complex, rely on high technology, and likely will fail badly under the real stress of nuclear attack, making it difficult to control nuclear war or to terminate it once one breaks out.

At the other end of the spectrum are small nuclear-armed states like the DPRK. Pyongyang has likely built an NC3 system that is dedicated solely to nuclear forces to preserve Kim Jong Un's sole control of nuclear weapons. Thus, Kim Jong Un likely relies on a relatively simple NC3 system with political commissars who manage the warheads, and the military who deploy missiles ready to be mated with warheads.

Northeast Asia is not the only location with multiple NC3 systems in play in the Asia-Pacific region. Given that India has an advanced scientific and engineering infrastructure and a globally competitive IT sector, one can safely infer that India's current NC3 relies heavily on cable, especially fiber-optic cable, microwave links, and radio links including non-dedicated satellite links between nuclear warhead sites that are sufficient to support dispersed missile launcher sites and fighter-bomber units on various airfields. However, how effective such communications are to support India's mobile nuclear weapons remains an open question.

Like India, Pakistan's physical NC3 infrastructure of command centers, communication nodes, networks, and early warning systems are not robust, especially those related to its deployment of tactical nuclear weapons near the contested Kashmiri border in times of war.

Hayes notes that all nuclear-armed state in the Asia-Pacific region confront five shared NC3 dilemmas. These are: (1) the contribution of NC3 to the risk of nuclear war due to its inherent vulnerability and the incentive to strike NC3 systems first or lose one's own NC3 system, (2) NC3 modernization and disruptive technology, (3) nuclear decision-making and commander accountability under international law pertaining to NC3, (4) complexity and the global NC3 system, and (5) the pandemic-nuclear nexus and NC3.

Hayes points out that there is no consensus as to what procedures should be implemented in all NC3 systems to ensure a minimum of accountability in the form of checks and balances to block manifestly illegal and insane strike orders from being implemented. It is for this reason that the Treaty on the Prohibition of Nuclear Weapons includes NC3 systems in its scope, although it has yet to develop a practical set of recommendations that would allow NC3 systems to align with the core values of this treaty. He proposes a Global NC3 Code of Conduct that might serve as an interim step to more stringent controls on NC3 systems.

Emerging Asia-Pacific Space Powers Capabilities

Namrata Goswami extends the WMD landscape from Earth into space. Long dominated by the United States and Russia, but with China catapulting past Russia in the last decade and India also entering into the space domain, the strategic landscape now includes not only the atmospheric exit, brief transit through space, and atmospheric re-entry of warheads during tests, or, as would occur in a nuclear war, hurtling towards targets, but also near-permanent constellations of geostationary or orbiting military intelligence and communication satellites that are integral to collecting intelligence on targets and communication of nuclear strike orders.

Thus, just like US Space Command and Strategic Command that provide space-based support for nuclear forces along with a vast array of ground-based stations and terminals, Chinese People's Liberation Army (PLA) now has its own Space Force (PLASSF) which, unlike the US space force, fuses China's military and civilian space sectors. China's strategic goal, writes Goswami, is to displace the United States as the premier space power, and to secure itself from US military attack on ground or in space. Like the United States and Russia, China now has its own geospatial positioning system based on satellites endowing it with an independent ability to guide missiles to targets such as aircraft carriers—provided it can find and track them with other intelligence means.

Although it lags behind China, India too invests heavily in space launch capacity, has sent missions to the Moon and Mars, and also like China, used a missile to destroy a low-earth-orbit satellite. Pakistan has advanced missiles able to provide space launch rocket services but lags far behind

India in satellite and space activities. But to compete with India and to support long-distance, offshore (especially submarine) operations, Pakistan will likely seek China's assistance to develop space-based capacities just as it did with its nuclear weapons program. Japan is responding to China's expansion into space by developing its own space launch and satellite programs. The DPRK is the weakest entrant into the space race, but its long-range missiles give it the capacity to boost payloads into space that might eventually equip it with independent satellites.

Goswami envisions that war involving these space-based assets could erupt from many different angles given the number of conflict dyads that exist in the Asia-Pacific region. "Because conflict systems are linked," she avers, "we can expect horizontal proliferation specifically where competition is pre-existing in dyads. Japan's counterspace capabilities will encourage development of counter-space capability by North Korea. North Korea, already incentivized to create an ASAT to deter the United States, will accelerate to keep pace with any South Korean counterspace developments. Pakistan, seeking parity and deterrence with India, and contesting leadership in the Islamic world has incentives to develop ASAT capability." Any of these states could jam, dazzle or laze the others satellites. From there, all bets are off.

Beyond the cislunar space between Earth and the Moon, the great powers are developing the capacity to project power to Mars and asteroids, based on stepwise lunar settlement and beyond. The appetite of great powers to proliferate vertically the reach of their weapons of mass destruction has no apparent limit.

Nuclear Fuel Cycles and Horizontal Proliferation

John Carlson brings us back to Earth by examining horizontal proliferation arising from the construction and operation of nuclear fuel cycles spread across the region. The region already is a nuclear-armed crowd, containing three of the five NPT-designated nuclear weapons states (NWS)—the United States, Russia, and China—and three non-NPT nuclear-armed states—India, Pakistan, and the DPRK—the only NPT non-NWS to have left the NPT (in 2003) and armed itself with nuclear weapons. Each developed a fuel cycle to provide it with fissile material, although India, Pakistan and the DPRK depended on outside suppliers and technical support along the way.

The safeguards system implemented by the International Atomic Energy Agency in Vienna rests on non-nuclear weapons states providing access and transparency to inspectors to ensure that any diversion of significant quantities (sufficient to make a nuclear warhead from enriched uranium or plutonium) is identified quickly enough to allow the international community to respond before a weapon is produced and tested. In cases such as Japan, this conversion or latency period may be so short as be almost zero, requiring very high levels of monitoring and access. In others, the period may be months or years, in which case IAEA's safeguards provides confidence to other states that non-nuclear neighbors intend to stay that way.

Yet, intention may be disguised by secrecy. In such instances, Carlson states: "Where a state develops enrichment or reprocessing capabilities in secret this is a clear sign of proliferation intent." Also, intention may evolve over time: "The situation is not so clear," he avers, "where a state develops such capabilities openly, under IAEA safeguards. The state may be deliberately establishing a nuclear weapon option—in this case motivation still precedes capability, but the state's intention is not obvious. On the other hand, the state at that time may be genuinely committed against acquiring nuclear weapons is not obvious." That is, "what is unthinkable today might be considered a necessity tomorrow. In such a case capability could influence motivation."

For this reason, acquisition of enrichment or plutonium production and processing capability always generates a demand for information to be provided by nominally innocent parties to states concerned about the risk this latency poses to their own security. If a non-nuclear state also acquires dual-use technologies that are useful to weaponize fissile material, other states may hold that there is *prima facie* evidence that nuclear weapons proliferation is now underway and demand more intrusive access to determine what is going on. Suspicions are doubled and tripled when other weapons-specific testing or development and testing of warhead delivery systems are identified or observed—as occurred most notoriously in this region with the DPRK's nuclear breakout in the last three decades.

If such activity is undertaken by a state in an insecure geo-strategic context, international concern may lead to counter-proliferation threats and deployments of conventional and/or nuclear forces that in turn accelerate the proliferation activity that are the cause for concern in the first place—and even lead other states to entertain acquiring their own nuclear forces, as Japan and the ROK have done at different times.

Carlson envisions that the only way to reverse these cycles of suspicion and mutual threat making is to shift legitimate but sensitive fuel cycle activities from national to multinational control. This management approach is applicable not only to non-nuclear states with latent nuclear weapons capabilities via their fuel cycle activities, but also to nuclear possessor states that are disarming nuclear weapons but retain large stocks of fissile material and the capacity to move it quickly from civilian to military use. Until then, nuclear fuel cycles criss-cross the strategic landscape with constant risk of nuclear armament in areas previously devoid of nuclear threat.

Double Bluff and Extended Nuclear Deterrence in a Pandemic World

Allan Behm dissects the logic and underlying assumptions of “nuclear extended deterrence”—the distinctly American practice of projecting nuclear threat from home-based and forward-deployed nuclear weapons. Of course, there is no doubt that the United States is capable of using nuclear weapons in the region against adversaries such as China, Russia, or the DPRK. The critical question if whether it ever would do so on behalf of an ally, that is, are such threats against another nuclear-armed state ever credible, and from the view point of a nuclear-umbrella state, are the putative gains of marginal deterrence so gained worth the countervailing threats that may be made by the potential adversary, including risk-taking to force the United States to back off. While the United States and a potential nuclear adversary trade threats, Behm suggests that the state to which a nuclear umbrella is extended is left in a precarious position in which its existential security depends on an incredible threat working against a highly motivated adversary that amounts to a nuclear bluff.

In sum, “Extended nuclear deterrence theory has gradually morphed into a kind of deterrence theology —a belief system founded on a codified set of indemonstrable doctrines. The validity of the system rests on five implausible and ultimately unprovable propositions: that the guarantee is absolute and unconditional, that nuclear exchange escalation can and will be controlled, that the guarantor will accept the fact and consequences of a nuclear attack on behalf of the client state to which deterrence is extended, that the decision maker will make rational choices based on the logic of the guarantee, and that any possible aggressor will make its decisions based on the same strategic mindset as the guarantor. But each of these propositions is unsupportable.”

It follows, argues Behm, “Since none of these propositions is necessarily true, the validity of extended nuclear deterrence is ultimately dependent on irrationality—the irrationality of the guarantor decision maker accepting unimaginable consequences on behalf of a third party. The fact that the dynamics of war, which are instinctive and visceral, can be considered and analyzed rationally does not render them rational. And the obverse is true: while it may be comforting, it is irrational for the client state to regard extended nuclear deterrence as an ultimate guarantee of national security."

Possessors of nuclear weapons always cast a shadow over other states, even if they do not intend to do so. But according to Behm, the introduction of nuclear extended deterrence in contested areas of the strategic landscape in Asia Pacific adds a volatility to conflicts rather than creating stability.

Chemical Weapons History, Science, and Future Prospect

As if the prospect of nuclear war arising from nuclear extended deterrence is not enough, the specter of chemical weapons remains present in this region. Jonathan Forman and Alexander Kelle revisit some of the darkest episodes of past wars to remind us of the experimentation and use of chemical weapons by Japanese imperial forces in China, the chemical armament of the great powers, US forward deployment of chemical weapons in Japan and its pursuit of "chemical extended deterrence" against DPRK chemical weapons in the Cold War, the stockpiling of home-grown chemical weapons by the ROK, and the removal and destruction of these stockpiles under the rubric of the 1997 Chemical Weapons Convention. (Here, as Forman and Kellerman explain, "chemical weapons" refers to chemicals with toxic properties used to harm humans and animals, which excludes incendiary chemicals, explosive chemicals, and herbicides). Echoing this dark history, Japan and China conduct a joint, cooperative removal and destruction of residual Japanese chemical weapons from China that continues to this day, even during the pandemic.

As with nuclear fuel cycle facilities and fissile material, many chemicals are dual-use, that is, widely used in innocent commercial activity but also usable as weapons. Moreover, the development of other types of chemicals (such nanomedicines that target specific cells or tissues) expands the range of possible chemical attacks compared with the indiscriminate nature of chemical gases or weapons used in the past. The Organization for the Prohibition of Chemical Weapons that supports the Chemical Weapons Convention designates laboratories at the member state level including China, ROK, Russia, Singapore, and the United States to detect chemicals that may be weaponized and to support verification while states such as Japan and Malaysia have counter-chemical weapons laboratories.

Forman and Kelle observe that the general trend is that less states possess chemical weapons today, thereby reducing the chances that they would be used in war. Although there is no publicly available hard evidence, the DPRK is widely assumed to be the only state in the region with a deployable chemical weapons arsenal for use in artillery and rocket shells. A credible threat of non-state actors weaponizing commercially available chemicals also exists in the region since the Japanese cult Aum Shinrikyo used sarin gas in the Matsumoto and Tokyo subways in 1994 and 1995 respectively.

Biological Weapons and Nuclear Deterrence in the Pandemic Era

Completing the dismal picture of WMD in the region, Richard Pilch and Miles Pomper examine the potential re-emergence of already banned biological weapons due to the pandemic on the one hand, and the possible incentive to obtain chemical weapons on the part of already nuclear-armed states face in posing a credible threat of use of nuclear weapons on the one hand, or the difficulty that some non-nuclear states face in obtaining their own nuclear weapons in the first place.

Biological weapons have an odious history in the region starting with Japan's biological weapons program in China involving experimentation on prisoners of war that killed more than 10,000 prisoners of war and others and use in attacks that killed upwards of 200,000 people, mostly civilians. During the Cold War the United States developed biological weapons, but in 1971 it unilaterally banned its own use. The Soviet biological weapons Cold War program was aimed at the United States and China, and it continued development of such weapons even after joining the Biological Weapons Convention that came into force in 1975. Although the DPRK possesses the materials and skills to make biological weapons, there is no evidence that it seeks or has such at the moment, and none of the other nuclear powers in the region such as India or Pakistan are thought to have offensive biological weapons.

Due to the potency of bioweapons, some nuclear-armed states such as the United States and India have reserved the right to use nuclear weapons in response to bio-attacks on their forces, thereby raising the possibility of a mistaken attribution of a natural outbreak or natural pandemic that leads a state to use nuclear weapons. This risk is particularly salient to the Korean conflict where the DPRK has long held that it was attacked by US bioweapons in the Korean War, albeit falsely. Thus, the DPRK may be inclined to view a natural outbreak as originating from the United States or the ROK as part of their effort to destabilize or remove the regime. In short, how biological events that might be attacks are attributed is a critical issue that bears on the risk of war and nuclear war, and there is no clear common understanding between nuclear possessor states on this issue.

The raw materials and technology for biological weapons are dual-capable and spread across the entire region. The primary bulwark against misuse of these building blocks or actual deployment is early detection. Thus, Pilch and Pomper argue that states should create a pro-active network of detection, using many of the same tools that are essential to monitoring and then responding to spillover of pathogens from natural reservoirs that lead to pandemics such as coronavirus SARS-CoV-2 or better known as COVID-19.

The pandemic reminds us that bioweapons also present a unique non-state actor attack vector whereby an already infected individual sets out to spread contagious disease with potentially devastating health and psychological impact on targeted populations. Such an individual may be motived by ideology or state-sponsored and would present great difficulty in attribution and response.

India-Pakistan Nuclear Confrontation

In Section 1 we saw that WMD range from the molecular to extra-terrestrial and that the capabilities to make and deliver such weapons are scattered across the Asia-Pacific region. Of the three types of WMD, the threat is heavily weighted on the nuclear end of the scale in East Asia and South Asia, dominated by six of the world's nine nuclear-armed states and three of its nuclear umbrella states.

In this section, we examine how these weapons might be used where vital interests of states collide in Northeast Asia, East Asia-Taiwan, and South Asia.

Rakesh Sood traces the evolution of the Indian-Pakistan conflict embedded in an inherently triangular nuclear threat system with China. Perhaps in no other nuclear-prone conflict is the weight of colonial history so directly linked to the adoption of nuclear forces. As Sood explains, the Indo-Pakistani conflict is rooted in the very creation of these two states and the 1947 partition of Pakistan from India and their claims to both govern Kashmir and Jammu leading to multiple clashes, wars, and now state-sponsored, cross-border terrorism.

India's nuclear arsenal was adopted to project nuclear threat against China *and* Pakistan and to countervail their nuclear threats to India, whereas Pakistan's nuclear arsenal is aimed only at India to offset India's conventional and nuclear forces. India's two-front nuclear challenge combined with its No First Use doctrine requires it to rely on conventional military and non-military means to respond to Pakistan's incursions, enabling Pakistan in turn to assert its prerogative of nuclear first-use and to forward-deploy its tactical nuclear weapons to emphasize this choice.

Sood examines seven instances of conflict between India and Pakistan, five of which came after 1998 by which time both were nuclear-armed and nuclear threat began to play an explicit role. If these instances prove anything, it was that nuclear threats by India could not stop Pakistani-supported terrorist attacks or conventional conflict with it, and that risk-taking including that presented by tactical nuclear weapons deployed in conflict zones by Pakistan worked to activate third parties to intervene to prevent further escalation, short of the nuclear threshold. In effect, Pakistan relies on risk-taking to induce third parties to intervene with India on its behalf at the height of crises—a strategy that has worked on multiple occasions. Sood finds that the United States was key in recent instances of such "climb down" diplomacy, with Saudi Arabia and the United Arab Emirates also playing a role. China too was involved, but India is not likely to accept this role in the future. "In short," he concludes, "external actors may not be able to provide off-ramps in the future as readily as in the past."

Given these realities and Pakistan's likely continued use of terrorist attacks on Indian targets to initiate conflict with India and the improbability that the international community will prevail on Pakistan to change this strategy, the risk of inadvertent nuclear escalation will continue no matter how much India tries to block Pakistan. It is critical, therefore, that minimal crisis management communication lines are kept open and, in the future, bilateral and trilateral dialogues begin on shared understandings on a range of nuclear-related risks at the earliest possible time.

Taiwan Straits

If Pakistan and India have developed a tripwire for escalation to nuclear war in their contest over disputed territory, Robert Ayson argues that the People's Republic of China (hereafter China) and the United States have set up the conditions that could spiral to nuclear war in the Taiwan Straits due to the intersection of political friction between China and Taiwan (over which China claims sovereignty, recognized implicitly by most states) with US-China strategic competition.

Ayson argues that although it is not easy to start a nuclear war in the Taiwan Straits, the risk is real and derives from the asymmetry of forces in the conventional military balance between

China and the United States on the one hand, and the propensity of the Taiwanese leadership to seek independence on the other.

Historically, the United States' ability to muster massive conventional naval and aerial force in the Western Pacific buttressed by its willingness to arm Taiwan to defend itself provided overwhelming superiority to China's mainland-based forces. But over the decades, the balance has tilted to the point that China can now pose a lethal missile threat to US aircraft carriers and regional airbases such as Guam, Okinawa, and Kunsan as well as Taiwan itself while mounting a cross-strait invasion force. Not since the 1958 Quemoy Matsu crisis has the United States had to entertain the risk of nuclear escalation over the Taiwan Straits as it must do today.

The "balance of resolve" between the United States and China, suggests Ayson, is based on their perception of each other's ability to dominate as they escalate to ever greater conventional and then nuclear force, and their resolve that the benefit of victory is worth paying the price of such escalation. There remains little doubt that the United States ultimately has superior nuclear forces with which to punish China's nuclear and conventional forces. The issue is how to avoid approaching the nuclear threshold of China or the United States and which state is more or less deterred by nuclear threat at lower levels of violence than all-out nuclear war. Escalation by either side using cyberwarfare, nuclear or conventionally-armed dual use missiles, and other steps could lead to a "murky twilight zone" between rapid escalation and crossing the nuclear threshold.

At stake for China is the political legitimacy of its leadership if it does not assert sovereign control over Taiwan should it declare independence. For the United States, its reputation as a great power patron to its allies at a global level is on the line, in what is the first great test of declining US hegemonic power against China rising from centuries of humiliation at the hands of the West.

Given that there is no way to easily reduce the stakes in the Taiwan Straits conflict, Ayson suggests that the antagonists reduce ambiguity by creating no-go zones whether in cyberspace or physical space, reinstating tacit understandings about the status of Taiwan, and signaling that attacks on command-and-control systems are off limits, all of which are necessary to their mutual recognition of the "urgency of enhanced communication, cooperation and restraint."

DPRK Asymmetric Nuclear, Cyber, Bio, Chemical Forces

As with the India-Pakistan and Taiwan Straits conflicts, the risk of nuclear war in Korea is rooted in a division of a nation combined with unresolved historical conflicts. Lee Sang-hyun suggests that the DPRK's "asymmetric" military capabilities enable it to overcome the inferiority of its conventional military force by exploiting weaknesses of countervailing US-ROK and UNC allied forces. Accordingly to Lee, the core of its asymmetric forces are its nuclear weapons, missiles, cyberwarfare forces, ad chemical and possibly biological weapons. Given the DPRK's asymmetric force advantages and the small geographical area in which war would be fought, the ROK has invoked US nuclear extended deterrence to offset its vulnerability to these asymmetric threats.

The DPRK is estimated to have between twenty to sixty nuclear weapons as of early 2021. It has demonstrated short and intermediate missile delivery systems and possibly the ability to fire a long-range missile that would hit the US mainland.

Since the collapse of the Kim-Trump summit in Hanoi in 2019, the DPRK tested a host of short-range, solid-fueled missiles that may be capable of delivering nuclear warheads. It also displayed new, huge long-range missiles that have yet to be tested, perhaps signaling an intent eventually to develop multiple re-entry vehicle payloads—although it has yet to test even a single re-entry vehicle on a long-range missile. It has also fired missiles from underwater signaling an intent to deploy nuclear weapons at sea in the future.

Lee suggests that DPRK cyberattacks rather than nuclear attacks against US-ROK forces are cheaper and more likely to succeed. Cyberattacks can be launched early and with some level of ambiguity in the runup to a conflict, so they are not only cheaper and faster to use than conventional or nuclear weapons, they are also more adaptable to signaling resolve and to inflicting damage on the vulnerabilities of US and ROK highly informatized weapons systems, and also against critical infrastructure such as banks, public utilities, and even nuclear reactors, all of which are vulnerable to cyberattack.

The DPRK may also have chemical and biological weapons, but Lee notes there is little hard information available whereas its nuclear and cyber weapons are already well demonstrated. Lee suggests that the DPRK might use nuclear weapons to make China intervene in a conventional offensive against the DPRK that occurs either inadvertently or on purpose across the Demilitarized Zone. It might "asymmetrically escalate" by delegating use authority to commanders in an obvious way to impress on adversaries its appetite to take risk as a way to force some accommodation of its demands—not unlike Pakistani deployment of tactical nuclear weapons to forestall Indian conventional attack in a crisis. Such asymmetric use necessitates the DPRK keeping enough nuclear weapons in reserve to be able to stop escalation to all-out ad/or nuclear war if engaged in dangerous provocation or offensive but limited conventional operations against the ROK.

Standard confidence building measures are unlikely to work with the DPRK, concludes Lee, in part due to the nature of the DPRK's polity, but also because the wellsprings of trust have been poisoned for so many decades by all parties to the Korean conflict. As the standoff is likely to continue and even deepen for the foreseeable future, in addition to acquiring offsetting capabilities to the DPRK's asymmetric forces, Lee concludes that it is prudent to press the DPRK to become "a normal state in Northeast Asia via a peace process on the Korean Peninsula in the long run."

Risk Reduction Measures

In section 3, authors scan the horizon for possible ways to reduce the risk that WMD—especially nuclear weapons—use might be used and related non-proliferation and disarmament strategies in Asia-Pacific.

Dmitry Stefanovich observes that the most important Cold War era arms control and incident prevention agreements were bilateral between the United States or one of its allies and the former Soviet Union. These treaties codified lessons learned from nuclear crises such as to the need to keep lines of communication open, and they led to the jointly developed concept of "strategic stability," that is, nuclear commanders should always act in ways that reduce the adversary's incentive to attempt a disarming nuclear first-strike. He notes that none of these treaties were aimed primarily at the Asia-Pacific region. In any case, legacy arms control agreements that created common security and increased transparency that extended to this region have mostly unraveled with the United States and Russian emphasizing instead reliance on military and nuclear capabilities and increased ambiguity. Perhaps most worrisome is that the new generation of leadership in each great power has not lived through the horrors of World War II, the Cold War, and many of the "local" wars in which millions perished. Few if any have ever seen a nuclear explosion first-hand.

Stefanovich suggests that rather than proposing improbable strategic arms treaties or abstract, high-level "risk reduction" architecture at the level of P5 (the five permanent and nuclear-armed members of the UN Security Council), it is more useful to identify ways to concretely reduce risk in each of the specific nuclear-prone bilateral and multilateral “deterrence equations” in which nuclear threat is present. He suggests that risk reduction measures be focused on five common interests of all nuclear-armed states. These are (a) setting limits on the number and patrol areas of ballistic missile-firing submarines to reduce fear of leadership-decapitation or force-disarming strikes using submarine-launched missiles fired from a short distance offshore below early warning radars and arriving in only a few minutes; (b) decoupling nuclear weapons from aircraft staging bases so that non-strategic nuclear weapons are more transparent and less easily deployed without being noticed; (c) establishing a regional, multilateral long-range missile and space launch rocket notification regime drawing on networked, national early warning radars that would enable states to monitor and verify compliance with the regime and departures therefrom; (d) establishing hardened, modernized, and harmonized multilateral hotlines between the capitals of the region for transmission of missile launches and for crisis communications to depoliticizing incidents that will assuredly occur by design or by accident; and (e) reinforcing the now customary nuclear use taboo by more stringent application of the Law of Armed Conflict to nuclear operations of all kinds.

Trilateral Confidence Building Measures in South Asia

Taking up the Pakistan-India-China nuclear triangle outlined by Rakesh Sood in section 2, Feroz Khan identifies trilateral confidence building measures to reduce this risk. As Khan puts it: “At the trijunction of three nuclear-armed countries, the potential of major regional military crises—either between India and Pakistan or India and China—is increasing, and it could escalate to a major conventional war and nuclear catastrophe.”

To find such measures is not easy given the long trail of failed past agreements and bilateral peace-making initiatives between India and Pakistan on the one hand, and China and India on the other. Khan recognizes that shifts in the strategic landscape itself—in particular, in the geoeconomics of trade, investment, and financing of infrastructure between China and India—contain clues as to what might work instead of repeating past failures.

He notes that China’s primary strategic concerns lie to its east and north, and the negative trends on these fronts evokes its growing military and nuclear force capabilities that create anxiety for India which responds with its own upgrade of nuclear forces thereby driving Pakistani threat perceptions. As noted by Sood and affirmed by Khan, India’s no-first-use posture with respect to

China drives it to pose a conventional military response to Pakistani provocations or attacks, under Pakistan's nuclear threshold. Pakistan in turn attempts to drive down this threshold by forward-deploying tactical nuclear weapons and making its own use doctrine ambiguous.

Faced with this escalation interlinkage, Khan proposes that China, India, and Pakistan undertake a trialogue or trilateral dialogue noting that it is critical to overcome media hype and domestic political fearmongering that has driven past crises. More concretely, he suggests that the previously bilateral strategic restraint regime (SRR) between India and Pakistan in 1998 that comprises of linked conflict resolution processes, conventional force restraints, and nuclear restraints be transformed into a trilateral SRR by adding China and capitalizing on the agreement to undertake regional conflict resolution by (a) conducting two separate sets of bilateral conflict resolution; (b) promoting economic interdependency and shared prosperity; (3) restraining conventional forces with deployment limits and low force zones; (4) restraining nuclear threat by doctrinal assurance and non-alerting status; and (5) establishing a modernized nuclear hotlines at level of head of state while also expanding the scope of the existing India-Pakistan non-attack agreement to include non-attack on nuclear command, control, and communication (NC3) including cyberspace.

In short, according to Khan the way forward is to transform the region from the existential security-centric relationship into one that is more of an economic-centric relationship. Whether this is possible in a post-pandemic period is unclear, but the vision is clear.

Nuclear Proliferation by ROK and Japan?

Moon Chung-in examines the prospects that Japan and/or the ROK might seek independent nuclear forces due to the resurgence of pro-nuclear weapons policy currents in both countries driven in part by the threat posed by the DPRK's nuclear breakout in a falling domino-like effect. If this were to occur, the conditions for "mutual probable destruction" would be proliferated in Northeast Asia and any chance of restoring a modicum of "strategic stability" would be lost irrevocably.

In the ROK, Moon finds that there is a teleological school that promotes 'nuclear sovereignty' based on the logic of 'nuclear for nuclear' and seeks nuclear armament regardless of American stance. It competes with an instrumentalist school who push for a conditional, independent nuclear armament based on enhancing the credibility of US nuclear extended deterrence by either redeploying US tactical nuclear weapons (withdrawn in 1991) or by engaging in a NATO-style nuclear weapons-sharing agreement on a bilateral or trilateral (NEATO) arrangement. The instrumentalist school has the upper hand in the public debates, but both advocate that the ROK shift from nuclear latency to nuclear armament—posing a challenge to American nuclear hegemony in the region, dooming any denuclearization deal with the DPRK, and raising the threat of Japanese proliferation that would assuredly follow from the ROK nuclear armament.

In fact, likewise driven by the DPRK's nuclear armament and related missile testing, Japanese conservatives have reactivated old Japanese debates about an independent nuclear force with a view primarily to using Japan's nuclear weapons latency as a political weapon in relations with an ever-more assertive China. Unlike the ROK, Japan's public opinion polls show the majority of the population to be opposed to Japan's nuclear armament to the deeply rooted nuclear taboo originating in the Hiroshima-Nagasaki traumas, and Japan is also constrained by its adoption in 1967 of its three non-nuclear principles of not possessing, producing, or introducing nuclear weapons. But as with the instrumentalist school in the ROK, the pro-nuclear weapons policy current in Japan enables Japan to try to be a tail wagging the superpower dog, that is, to push the United States to raise the credibility of its nuclear extended deterrence commitments to Japan in spite of US disinclination to do so under multiple US presidents since the turn of the century.

Both the ROK and Japanese governments have resisted being drawn into this loose talk of nuclear weapons proliferation and observe stringent monitoring and verification of their nuclear materials facilities and stocks of fissile material. Thus, while these two states could break out very quickly and have the necessary missile delivery technology also available, neither is likely to do so short of a major alliance rupture or an actual war in the region that shreds American credibility. Both are committed to increasing conventional forces to deter their respective adversaries, and while these pro-nuclear policy currents have some cross-border connections with each other as well as with similar voices in the United States that support the idea of allied proliferation, civil society groups in the ROK and Japan are forming countervailing coalitions opposed to nuclear armament while also addressing the risk of counterforce dilemmas arising from conventional forces that may evoke more, not less nuclear threat from the DPRK and even China.

As the South Korean survey data shows, supporters of nuclear armament can change their view after being exposed to data related to costs and constraints of going nuclear. Thus, there should be national and international efforts to educate citizens on the danger of nuclear weapons by disseminating timely and objective information. Moon notes further that ROK pro-nuclear sentiment declines when political and military tension falls in the peninsula, suggesting that the most constructive way to avoid further nuclear dominos falling in Northeast Asia may be to make peace in Korea as fast as possible.

Nuclear Weapons-Free Zones

Regional nuclear weapons-free zones (NWFZs) are one of the oldest risk reduction measures that endure in spite of great power transitions and regional turbulence. NWFZs provide security not only to the non-nuclear weapons states party to a NWFZ treaty, but also to the nuclear weapons states in the region. Three such zones exist in the region, viz: the South Pacific, Central Asia, and Southeast Asia NWFZs, plus the Mongolian NWFZ recognized as such by the P5 if not under international law.

Tuya Nyamosor examines how each of these NWFZs were created. Although all follow the standard UN treaty NWFZ format, they are also tailored to local circumstances. The South Pacific Zone not only responded to French nuclear testing in the Southwest Pacific, but banned all nuclear testing—peaceful or otherwise. It also gave Indonesia confidence that Australia would not arm itself with nuclear weapons. The Southeast Asian NWFZ extended its jurisdiction to transit of national waters and to the 200 nautical mile Exclusive Economic Zone, putting pressure on the nuclear weapons states who have so far refused to sign and ratify the treaty. The Central Asian NWFZ is the first zone in which nuclear weapons had been deployed (in Kazakhstan) and removed at the end of the Cold War, has two bordering nuclear-armed states, and encounters volatile conflicts in all directions. As a former nuclear test site is located in the region, it has strong environmental rehabilitation provisions as well as banning nuclear tests. Finally, Mongolia has pushed hard to get political recognition of its unilateral nuclear weapons-free status and promotes learning from and coordination with other NWFZs.

In spite of these achievements, these NWFZs have limited utility. Recognized in the NPT itself as a valuable way to reduce the threat of nuclear war, NWFZs are only an interim step on the long road to nuclear disarmament. Indeed, the guarantees provided by nuclear-armed states to the non-nuclear parties of non-attack with nuclear weapons are based ultimately on their ability to revert to nuclear threat should a non-nuclear state break out, or should a nuclear weapons state threaten to or actually use nuclear weapons against a non-nuclear weapon state party to the treaty. And, to date none of the treaties have been ratified fully by nuclear-armed states, giving them legal enforcement resting on domestic, not the force of international law.

Nonetheless, drawing on these and other precedents (especially from Latin America), Northeast Asia has been proposed for the next NWFZ in the region, partly to enable the denuclearization of the Korean peninsula, but also to contain the proliferation impulses in the ROK and Japan.

Prospects for the Treaty on the Prohibition of Nuclear Weapons

Given the failure of the nuclear-armed states to resolve their conflicts with each other or non-nuclear states, and given the increasing dependence on nuclear threat as a basis of international relations, many civil society organizations and many states have concluded that it is time to revolt against the hegemonic role of nuclear weapons and to simply ban them outright. This sentiment, motivated in large part by revulsion at the humanitarian impacts that a nuclear war would have on human populations as well as putting Earth's biosphere at risk, led to the campaign for the Treaty on the Prohibition of Nuclear Weapons (TPNW) signed into existence in New York in 2019 and ratified to come into force on January 22, 2021. The TPNW covers the entire gamut of nuclear weapons activity, not just the fissile material or delivery system. This includes all the supporting infrastructure that makes nuclear weapons usable and nuclear war possible, including that hosted by non-nuclear states (often but not always nuclear umbrella states). It also bans threatened use of nuclear weapons. Predictably, the nuclear-armed states in the region have either rejected the treaty altogether or simply ignored it; US nuclear allies have also rejected it; but as of mid-2021, nine ASEAN member states signed and four ratified the treaty, and nine of the Pacific Island states party to the South Pacific NWFZ signed or acceded to the treaty.

Nobuyasu Abe explores how to overcome the gridlock between the TPNW and the NPT. He suggests that the credibility of the NPT must be restored by the NPT Nuclear Weapons States making real nuclear disarmament progress, deceleration of their modernization and competition, and undertaking risk reduction measures alongside regional conflict resolution and new nuclear weapons free zones, strengthening the IAEA safeguards system, blocking the naval propulsion-highly enriched uranium loophole in the NPT, and preventing small reactor deployment. Concurrently the TPNW ratifying states must address the missing elements of their proposed prohibition regime on robust verification for proposed measures, clarify key definitions in the treaty itself and enter into dialogue with NPT states, and hopefully participate in the covid-postponed NPT review conference when it finally takes place. He suggests that a number of countries are well placed to build bridges between NPT and TPNW states such as New Zealand and Indonesia in the Asia-Pacific region. Finally, he argues that it is critical to maintain the historical memory of the horrific consequences of past nuclear bombings to delegitimate and constrain nuclear use.

Richard Tanter also identifies the practical and legal obstacles that block the TPNW from making a credible claim to have banned nuclear weapons on a universal basis. In particular, the monitoring and verification requirements to determine compliance are complex and confront many dual use systems that will be difficult and even impossible to disentangle from systems that support nuclear operations, directly or indirectly. These tasks lie at the core of the TPNWs potential to actually offer a nuclear weapon elimination pathway in contrast to its ability to stigmatize or delegitimate nuclear weapons of mass destruction, important as these tasks may be to reducing the utility of nuclear weapons to possessor states.

Tanter identifies a number of key tasks that must be undertaken to advance the TPNW agenda, including dialogue between regional nuclear umbrella and prohibition states, pushing for clarity on nuclear guarantees from the United States to allies and related risks, and doing everything possible to make one or more nuclear-armed state in this region abandon its nuclear armament and commit to the prohibition of nuclear weapons.

Conclusion

As noted earlier, we observe that WMD, especially nuclear weapons, confront commanders with the same imperatives and confront them with the same dilemmas wherever they are located. Arguably, these shared features of WMD landscape force all possessors of nuclear states to make tradeoffs along the same axes of choice, either purposely or by default. To remind, these tradeoffs include the following:

1. **Transparency versus opacity**: Making possession of nuclear weapons capacities *transparent* so that the weapons speak for themselves (for example, by revealing location of nuclear forces on a regular schedule in a manner that can be monitored and verified by an adversary exemplified by US-Soviet/Russian arms control treaties, or testing of nuclear weapons or

periodic testing of missiles to demonstrate capability undertaken by all nuclear armed states to date[17]) *versus* keeping capacities *opaque* to increase uncertainty and to minimize vulnerability (for example, by withholding all visibility and access, for example, to suspect chemical plants or biological research facilities such as chemical weapons capabilities developed and undeclared by the ROK even in the course of dismantlement, and even using deception to mislead an adversary as to status of nuclear forces or commander propensity to use—as when Richard Nixon and Henry Kissinger "secretly" alerted US nuclear forces from October 13-30 1969 to put pressure on the Soviet Union to pressure Hanoi to end the Vietnam war).[18]

2. **Certainty versus uncertainty:** Declaring intention to use nuclear weapons clearly, openly, and with *certainty* (for example, by having dedicated, nuclear-only forces such as US strategic missiles, openly forward-deploying tactical or theater nuclear weapons, or adopting a "No First Use" policy matched by demonstrable practice of separating warheads from delivery systems) *versus* creating *uncertainty* as intention to use (for example, by making ambiguous, bellicose threats, testing in the midst of a tense military standoff, as occurred in the Donald Trump-Kim Jong Un rhetorical war in 2017).
3. **Positive versus negative control**: Ensuring that nuclear weapons *always available for use* with effective positive controls (for example, maintaining Launch on Warning posture, automated launch systems and hardened communications) *versus* ensuring that they are *never usable without legitimate direction* with effective negative controls (such as two-person rules, separation of warheads from delivery system, Permissive Action Links).
4. **Individual versus group decision-making**: Maintaining *dictatorial decision-making*, centralized control, and authenticated authority to use nuclear weapons (for example, in the United States and the DPRK where one person has absolute authority to order that nuclear weapons are launched) *versus group decision-making*, decentralized control, and even pre-delegated authority to use nuclear weapons (for example, in Russia, India, and China—although the group decision-making may collapse into a single commander under duress).
5. **Counterforce versus counter-value targeting**: Limiting nuclear weapons to *counterforce or military-only targets* with minimized civilian casualties (which only the United States and

[17] With the possible exception of Israel.
[18] See W. Burr, J. Kimball, *Nixon's Nuclear Specter: The Secret Alert of 1969, Madman Diplomacy, and the Vietnam War*, University Press of Kansas, 2015.

Russia have the technical means to do, even in principle, given the need to identify and target precisely military targets that may be moving quickly, although it is a reasonable presumption that US and Russian targeting quickly veers into de facto counter-value targeting based on "military necessity" due to unstoppable escalation once a nuclear war begins) *versus* planning to detonate them on "*counter-value" or population and/or economic recovery targets,* either deliberately or as "collateral damage" from targets hit out of military necessity (as is surely almost inevitable given the short range and imprecise real-time targeting capabilities of China, Pakistan, and the DPRK).

6. **Minimum versus maximum deterrence**: Achieving *"minimum" deterrence* derived from assuring that a first-strike nuclear aggressor is likely to be hit by surviving nuclear forces even after absorbing a first-strike, irrespective of the level of destruction wrought on the target of a nuclear first strike (long China's strategic goal, possibly that of India with respect to China, Pakistan with respect to India, and the DPRK with respect to the United States) *versus* striving for *"maximum" deterrence* based on escalation dominance at every step and ultimate "victory" in a nuclear war (as appears to be the strategic goal of the United States with respect to all its adversaries by creating, testing, displaying key elements of the nuclear triad, Russia with respect to the United States and China by its own emulation of US practices supplemented by extreme delivery system diversification and testing activity, and India with respect to Pakistan).
7. **Autarchic versus interdependent nuclear security**: Striving for autarchic nuclear security based on nuclear threat (evidently China, Russia, DPRK, and India's posture) *versus* interdependent nuclear security created by collaboration with allies and even with adversaries via technology sharing and sales, and by mutual arms control and/or disarmament agreements (as enshrined in US nuclear alliances with Japan and the ROK, and possibly Pakistan and India).

Table 2: Nuclear Force Posture Tradeoffs

Transparency	**Opacity**
US, Russia	DPRK, China, India, Pakistan
Certainty	**Uncertainty**
US, Russia, China, India	DPRK, Pakistan
NC3 Negative Bias-Never Use by Mistake	**NC3 Positive Bias-Always Available for Use**
US, Russia, China, India	DPRK, Pakistan
Dictatorial Decision-Making	**Group Decision-Making**
US, DPRK, Pakistan	Russia, China, India
Counterforce Targeting	**Countervalue Targeting**
US, Russia	China, India, DPRK, Pakistan
Maximum Deterrent	**Minimum Deterrent**
US, Russia	China, India, DPRK, Pakistan
Interdependent Nuclear Security	**Autarchic Nuclear Security**
US	China, India, DPRK, Pakistan

In Table 2, we cluster states with respect to how each state made each tradeoff. Unsurprising, the choices that states make on each of these tradeoffs diverge, in some cases radically. The overall posture of a given state is the result of all seven choices, whether these are made explicitly or *de facto*. There is no *a priori* reason that the choices made by a given state should be consistent. In fact, organizational theory suggests the opposite. Nonetheless, this broad-brush treatment highlights the variation in how nuclear-armed states project nuclear threat, cause fear in the minds of their adversaries, and themselves perceive and experience nuclear threat. Driven by the imperative inherent in arming with nuclear weapons but shaped by unique local internal and external factors, each state reveals its own nuclear threat *modus operandi* which becomes manifest in its revealed intentions, declaratory rhetoric, deployment patterns, and use of forces such as alerts or forward-deployments to send signals about intention as warnings to nuclear adversaries.

Thus, one finds that all nuclear weapon states "speak" with a common vocabulary of the various elements of nuclear threat-making such as bases, missile test ranges, WMD factories, deployment sites and platforms (such as silos, airfields, ports, ships, missiles and aircraft)—but the shared vocabulary may not convey the same meaning to those using it; and it does not extend to many elements that are deliberately not displayed, may be completely invisible such as command posts, communication nodes, organizational structures, or are shared with or indistinguishable with infrastructure that supports conventional forces.

For all these reasons, the stories inscribed in a "WMD landscape" are specific to each nuclear-prone conflict. We find from the investigations reported in this book that there are no simple rulebooks nor overarching principles that determine how nuclear weapons affect international relations in a specific, nuclear-prone conflict. Even norms of behavior in relation to WMD are hard to come by. None are universally accepted by nuclear weapons possessor states, and all are contested in one way or another by one or more nuclear-armed state. Some states declare that they will not be the first to use nuclear weapons; others assert that prerogative and reject No First Use as mere declaratory rhetoric. To date, perhaps the only nuclear norm that might be held to be universal in the region is the view that nuclear weapons must never be used again, the "nuclear taboo." Whether and how long that view will hold is anyone's guess.

Moreover, there are no travel guides on how to exit from this WMD-laden landscape, especially the areas saturated by nuclear threat. How the common dimensions of nuclear threat combine uniquely in each of the nine nuclear forces, and how each nuclear command perceives nuclear threat via its own strategic prism means that not only are the nuclear forces of each nuclear-armed state incommensurate, but also, no two nuclear threat-based relationships are the same—especially when three or more states armed with nuclear weapons are party to the same conflict. Consequently, the terrain and contours that capture how nuclear weapons are embodied in the WMD landscape are convoluted and twisted, sometimes grotesquely, in ways that are specific to each nuclear threat relationship and to each actual conflict in which nuclear threat is employed, the latter also being in flux as geopolitical circumstances shift over time.

That said, we find eight broad themes emerged in the course of this survey that are common across the entire region and demand that policy makers and stakeholders respond in ways that reduce the risk of nuclear war and promote the control and disarmament of WMD, especially nuclear weapons. These include:

1. *Nuclear, chemical, and (to the extent that they still exist and are deployable) biological weapons are inextricably intertwined with conventional forces in international conflicts*. Because one or both nuclear-armed states or their allies in such a conflict fear that they may be overwhelmed by conventional attack, these nuclear possessor states supplement and even

substitute for conventional deterrence with nuclear threat. Perhaps more often than not, possession and reliance on nuclear weapons reveal strategic weakness, not strength, and are a weak straw on which to base a national security strategy. It follows that all states should minimize the role of nuclear weapons and recess those that exist while rectifying conventional force deficits, or use non-military means to ameliorate or resolve conflict over time.

2. *Relatedly, the diffusion of low-yield nuclear weapons, disruptive technologies and ever more lethal conventional weapons accelerates this intermingling and blurring of nuclear and conventional forces that increases the risk of war and thereby, nuclear war.* It is critical, therefore, to interrupt this self-reinforcing cycle of conventional conflict laden with nuclear threat, especially in the Korean peninsula, Taiwan Straits, and in South Asia, noting that the parties to these conflicts range from non-state actors (Taiwan) to small and medium powers (DPRK, Pakistan) to great powers (India, China, the United States and Russia). It follows that states likely should re-structure their conventional forces as they disarm nuclear forces to avoid gaining overwhelming counterforce superiority that otherwise will incentivize an adversary to substitute nuclear force for conventional forces if they forego “equalizing” nuclear weapons. As an interim measure, nuclear-armed states should disentangle their nuclear and conventional command, control, and communications systems and delivery systems. In short, conventional arms control and disarmament are integral to the realization of nuclear disarmament and nuclear non-proliferation.

3. *Once adopted by a state, nuclear weapons beget more nuclear weapons.* First, the real and imagined threats posed to adversaries generates either vertical proliferation whereby a nuclear adversary expands their own nuclear armament to maintain “escalation dominance” so that it cannot be coerced by the other—an imperative that then ratchets across multilateral nuclear conflicts to cause other, less capable nuclear-armed states to respond in kind. Or, it activates a horizontal nuclear domino effect whereby a non-nuclear state perceives increasing nuclear threat and actively seeks and then obtains its own nuclear weapons. The reverse is also the case, with the implication that successful multilateral nuclear arms control and disarmament must commence at the top of the nuclear hierarchy to reduce the pressure on lower ranked, less capable nuclear-armed states to proliferate with nuclear weapons.

   It is critically important therefore that nuclear-armed states put their nuclear modernization programs on hold and re-examine these commitments to reduce cost and risk, and to avoid generating action-reaction arms racing, especially cascading effects across the rank hierarchy of nuclear-armed states that are linked to more than one adversary. Interim measures that facilitate such pauses and buy time include nuclear weapons-free zones, modernized nuclear hotlines, and new rules of the road agreements.

4. *The risk of nuclear war is incrementally and inexorably rising*. This finding follows from the increasing number of nuclear-armed states, the risk that non-state actors may obtain and use WMD, and the all too real possibility that nuclear commanders may lose control of their weapons leading to war and nuclear war at times of high tension and crisis. Conversely, we see that when peace takes hold and tensions fall, the risk falls correspondingly.

5. *Practical and realistic risk reduction measures should be taken in each nuclear conflict relationship that ameliorate the core, nuclear-prone conflicts*. Such measures must create the political and military conditions that allow vertical and horizontal proliferation to be reversed and create the geo-political space to realize "mutually assured interdependence" based on common values and shared interests, especially shared economic prosperity and ecological sustainability. Small steps may prepare the way for bigger steps and ideal but implausible measures should not be allowed to block tangible ones that kick-start a dynamic of arms control and disarmament. Possible measures include submarine-free zones, separating warheads from delivery systems, missile and rocket launch notification, shared early warning, and adoption of a global NC3 code of conduct based on the Law of Armed Conflict.

6. *Nuclear and other WMD operate and are interlinked at global, regional, and national levels*. The three global great powers not only confront each other's nuclear threat, but they are also party to regional conflicts that involve middle and small nuclear-armed states and are susceptible to non-state terrorism. The nuclear forces that great powers deploy against each other also threaten their lesser nuclear adversaries, leading them to offset an increased threat with additional nuclear forces of their own. Due to this cascading effect down the entire global hierarchy of nuclear-armed states, each state has a strong interest in pushing the three global nuclear powers to create new multilateral nuclear arms control and disarmament frameworks that relieve the pressure on lesser states.

7. *Truly existential threats such as global pandemics or global climate change demand immediate reduction of tension between nuclear-armed and nuclear umbrella states*. Even a small nuclear

war could disable the ability of the international community to manage these twin global crises, and there are at least three locations in this region in which nuclear war is all too possible.

Conversely, the steps taken to resolve conventional conflict, reduce nuclear forces, and lower the risk of nuclear war create conditions in which chemical and biological weapons are even less likely to be used than they are already and would also create the political-security conditions that would enable joint efforts to overcome other existential threats.

8. *We are witness to an epochal shift whereby the primary conflict axis is between nuclear weapon and umbrella states to one in which non-nuclear, non-allied states must now be considered.* The nine nuclear weapons and thirty nuclear-umbrella states which rely on nuclear threat now confront the rest of the world—of which eighty-six states have signed the Treaty on the Prohibition of Nuclear Weapons as of the time of writing this paper.[19] By this ratification, the prohibition states in this region are increasing their non-nuclear commitments made already in nuclear weapons-free zones in Central Asia, Southeast Asia, the South Pacific, and Mongolia, and if this trend propagates into a Northeast Asian WMD or nuclear weapons-free zone, then the nuclear-armed and nuclear umbrella states will find themselves under increasing diplomatic pressure to find common agendas with the nuclear prohibition states. For example, as John Carlson points out in this book, nuclear *and* non-nuclear weapon states need to employ multilateral safeguards on all fissile materials stockpiles in a manner that is monitored and verified to internationally agreed standards rather than the currently discriminatory system that exempts weapons fissile material from international inspections.

In his famous study *Landscapes Of Fear* (1979), Li-Fu Yuan explained that people have always lived in fear due to anxieties caused by exposure to threatening natural and artificial environments, in an attempt to impose order and predictability.[20] Yuan did not contemplate nuclear foreboding, but others geographers such Kenneth Hewitt have after describing the horrific fate that befell scores of cities from conventional and nuclear annihilation in World War II.[21] The scale of the killing of whole cities is one reason why nuclear target lists are the most secret aspect of WMD practice by states. In the few instances where targeting has been unveiled, it has been shown to be

[19] Treaty on the Prohibition of Nuclear Weapons, UNODA, https://treaties.unoda.org/t/tpnw

[20] Li-Fu Yuan, *Landscapes of Fear*, University of Minnesota Press, Minneapolis, 1979.

[21] K Hewitt, "Place annihilation: area bombing and the fate of urban places," Annals of the Association of American Geographers, 73:2, June 9983, pp. 257-284.

spectacularly irrational, exemplified by the targeting of tiny Ulan Bator in Mongolia, admittedly then a Soviet satellite state, by a 1-10 megaton thermonuclear weapon by the US Strategic Air Command in 1959;[22] and by the utterly insane planned overkill on Russian targets in the US strategic target list as late as 1991.[23]

Most people targeted directly or as collateral damage by nuclear weapons today are either unaware of living in the shadow of nuclear weapons, or they find themselves unable to do anything about it given the social and political distance separating them from those who are targeting them with nuclear weapons. Nonetheless, civil society in the Asia-Pacific region was the progenitor of the push to create the prohibition treaty, for which the Nobel Peace Prize was awarded in 2019. Civil society will continue to propagate strongly for the treaty in this region. Mayors for Peace, and the champion nuclear survivor cities of Hiroshima and Nagasaki are powerful voices in this push with unassailable moral authority.

The nuclear prohibition states have made explicit the profundity of their commitment to hold the nuclear weapons and nuclear umbrellas states accountable, proactively, and before a nuclear war occurs. Meanwhile, nuclear-armed and nuclear umbrella states have reaffirmed their equal and opposite commitment to retain nuclear weapons, in effect, indefinitely. How long it will take for the first nuclear-armed or nuclear-umbrella state in this region to renounce nuclear threat and commit to nuclear prohibition is anybody's guess. Perhaps it will be the DPRK that overturns the

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[22] Strategic Air Command, "Atomic Weapons Requirement Study for 1950…sm 129-56," June 15, 1956, released under US FOIA request to National Security Archives, at: https://nsarchive2.gwu.edu/nukevault/ebb538-Cold-War-Nuclear-Target-List-Declassified-First-Ever/
Ulan Bator is designated in the urban-industrial target list at: https://nsarchive.gwu.edu/nukevault/ebb538-Cold-War-Nuclear-Target-List-Declassified-First-Ever/documents/1st%20city%20list%20complete.pdf

[23] D. Rosenberg describes the fantastic overkill in US nuclear war plans in "Nuclear War Planning," in M. Howard et al, edited, The Laws of War, Yale University Press, New Haven, 1994, pp. 160-190. See also D. Rosenberg, The Origins of Overkill: Nuclear Weapons and American Strategy, 1945-1960," International Security, 7:4, Spring, 1983, pp. 3-71, at: https://www.jstor.org/stable/2626731 The discovery between 1985-1991 of the full loss-of-control of US nuclear targeting by senior military and political leaders, and the targeting in some cases of hundreds of nuclear weapons on target sets in the US nuclear war plan is recounted by Frank Miller in "PART II: FRANK MILLER'S NARRATIVE" in F.C. Miller and G. Butler, "Masters of the Nuclear Weapons Enterprise," chapter 23, in Butler, George Lee. *Uncommon Cause - Volume II: A Life at Odds with Convention - The Transformative Years*, Outskirts Press, Kindle Edition, October 2015. Miller notes: "At some point, presumably in the 1970s, the war planners at the JSTPS [Joint Strategic Target Planning Staff] (without informing the Joint Staff or OSD, much less the White House staff) had decided to define a "city" in such a manner that had the President ordered a strike that included the cities withhold, all of those cities would nevertheless have been obliterated."

established nuclear disorder by not only denuclearizing itself but by joining the prohibition treaty, forcing the ROK to follow suit. Or perhaps civil society will turn another nuclear umbrella state into a mouse that roared, following in the path of the Philippines anti-nuclear constitution (1986) followed by New Zealand's anti-nuclear legislation (1987). In the long run, therefore, we conclude that bottom-up, nuclear arms control and disarmament will commence in a mutually reinforcing dynamic that will reduce nuclear risk until the weapons are abolished and ultimately eliminated. Until then, we can only hope that our luck holds.

Section 1

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2. A Looming Strategic Arms Race in the Asia-Pacific Region: From a Chinese Perspective

Luo Xi

Introduction[1]

Nuclear weapons have become integral to Russia's reclamation of its major power role after the collapse of the former Soviet Union. It began a nuclear modernization program in the late 1990s, which is still ongoing. According to President Vladimir Putin's report in late 2019, modernized equipment now accounts for eighty-two percent of Russia's nuclear triad.[2] Russia's declaratory policy is to develop and deploy nuclear weapons to deter and, if necessary, prevail in a regional war—a strategy known as "escalate to de-escalate."

Russia's strategic modernization program has three elements. First, it is routinely replacing aging warheads and delivery systems with new, more advanced ones. Russia's nuclear triad consists of land-based international ballistic missiles (ICBMs), submarine-launched ballistic missiles (SLBMs), and strategic bombers. The land-based component of the strategic triad includes two versions of the SS-27: Mods 1 and 2. The focus of the current and larger phase of Russia's modernization is the SS-27 Mod 2 ICBM (known in Russia as RS-24 Yars), which is equipped with four multiple independently targetable reentry vehicles (MIRVs). Russia is also developing the heavy multiple-warhead ICBM (SS-X-29), known as Sarmat, which will replace the SS-18 in 2021.3 As for the sea-based component of its nuclear triad, Russia has already announced a plan

[1] This paper was prepared for the Weapons of Mass Destruction (WMD) in the Asia-Pacific Workshop, organized by the Asia-Pacific Leadership Network for Nuclear Non-proliferation and Disarmament (APLN) in December 2020. A version of this paper was published in the *China International Strategy Review* in June 2021 under the title, "Competition between great powers and a looming strategic arms race in the Asia–Pacific."

[2] Russian Federation Defence Ministry, "Supreme commander-in-chief of the Russian Federation Attends Extended Session of the Russian Defence Ministry Board Session." *Press Release*, December 18. 2018, http://eng.mil.ru/en/news_page/country/more.htm?id=12208613@egNews

[3] RIA Novosti, *Russia to Develop New Heavy ICBM by 2020,* December 20, 2010, https://sputniknews.com/russia/20101220161856876/

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to build five and purchase two more new Borei class submarines (Project 955A) to replace the older Delta IV SSBNs (Project 667BDRM) after 2023.[4] Russia has also resumed production of the Tu-160 aircraft in 2019 and is expected to field the first ten Tu-160M2s before 2027.

Second, Russia has begun to modernize its tactical nuclear weapons. As of early 2020, Russia is estimated to have a stockpile of about 4,310 nuclear warheads that are assigned to long-range strategic launchers and shorter-range tactical nuclear forces.[5] Of these, about 1,870 are nonstrategic warheads.

Third, Russia has begun to develop, test, and produce new "exotic" types of nuclear weapons. In March 2018, President Putin listed five new nuclear-capable weapons systems:

1. a nuclear-armed, maneuvering hypersonic glide vehicle (the Avangard), currently carried by a modified SS-19, and soon to be carried by an SS-29
2. a nuclear-powered, nuclear-armed cruise missile of "unlimited" range (the Burevestnik) to penetrate an adversary's missile defense systems
3. an air-launched ballistic missile purportedly intended to target ships (the Kinzhal)
4. an SS-18 follow-on ICBM with modern features to penetrate missile defenses (the Sarmat)
5. a deep-diving, unmanned, nuclear-powered and nuclear-armed underwater delivery vehicle (the Poseidon) that is scheduled for delivery in 2027[6]

In February 2019, President Putin announced an additional nuclear-powered anti-ship hypersonic cruise missile (the Tsirkon) to the Russian nuclear weapons inventory. All these programs illustrate that Russia is determined to continue its reliance on nuclear weapons as a key element of its national security strategy. The new and "exotic" nuclear weapons provide means to augment existing nuclear forces with systems that are not counted under the New Strategic Arms Control Treaty (New START), now extended by the United States and Russia for five years by Presidents Biden and Putin.

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[4] Hans M. Kristensen & Matt Korda, "Russian nuclear forces 2020," *Bulletin of the Atomic Scientists*, 2020, Vol.76, No.2, pp.102-117.
[5] Hans M. Kristensen & Matt Korda, "Russian nuclear forces, 2020," *Bulletin of the Atomic Scientists*, Vol.76, No.2, pp.102-117.
[6] President of Russia, *Presidential Address to Federal Assembly*, March 1, 2018, http://en.kremlin.ru/events/president/news/56957

These dynamics of Russian nuclear arms replacement, modernization, doctrine, and deployment—along with those of the United States—converge to suggest the new nuclear arms race between the United States and Russia will be different from that of the Cold War. In the late 1960s and early 1970s, the Soviet Union and the United States had approximate parity in the number of deliverable weapons in their nuclear arsenals. Their key strategic nuclear objectives were to obtain sufficient capacity to inflict a certain level of assured damage to the other one in a retaliatory strike. Driven by the reality of assured retaliation and near certainty of mutual annihilation in a nuclear war, the two nuclear superpowers had little incentive to pre-emptively strike the other's strategic nuclear forces. During the second half of the Cold War, Soviet leaders became uncertain of being able to indefinitely maintain a posture of guaranteed retaliation and mutual annihilation.[7] Three decades after the Cold War ended, we find the principles which guide the numbers or size of nuclear weapons have changed. On the one hand, the United States re-emphasized nuclear deterrence, boosted its nuclear modernization, and acted skeptically towards arms control measures. Thus, the guiding principles that shape the size and type of US nuclear forces have shifted from preserving strategic stability between the nuclear great powers to countering strategic threats from nuclear adversaries, whether they be small, medium, or great powers. Conversely, Russia's nuclear modernization is still motivated in part by Moscow's strong desire to maintain overall numerical parity with the United States. For the Russian leadership the US ballistic missile defense system constitutes a real future risk to the credibility of Russia's retaliatory capability. Consequently, Russia began to research and develop new nuclear systems to counter deployment of US missile defenses. This unrestrained nuclear competition between the United States and Russia may complicate future bilateral arms control negotiation and potentially affect China's cognition of its own nuclear retaliatory capabilities.[8]

Apart from the major powers, more regional states have undermined efforts to restrain missile-proliferation by acquiring the scientific, technological, and industrial capabilities to produce both ballistic and cruise missiles.[9] The DPRK, India, and Pakistan have declared their possession of nuclear weapons and demonstrated their ability to use ballistic missiles. The DPRK test-fired an

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[7] Brendan R. Green and Austin Long, "The MAD Who Wasn't There: Soviet Reactions to the Late Cold War Nuclear Balance," *Security Studies*, 2017, Vol.26, No.4, pp.606-641.

[8] Charles L. Glaser, C. L., and Steve Fetter. 2016. "Should the United States Reject MAD? Damage Limitation and US Nuclear Strategy toward China," *International Security* 41 (1), pp.49–98.

[9] Nuclear Threat Initiative, "The Delivery Systems Threat," *Nuclear Threat Initiative*, December 30, 2015, http:// www.nti.org/learn/delivery-systems/

inter-continental range ballistic missile, which can reach at least the US West Coast, some 8,000 kilometers distant. India flight-tested a system with a range of 3,500 to 5,000 kilometers. Pakistan also has intermediate-range ballistic missiles able to carry nuclear warheads over 2,750 kilometers.[10] Evidently, states will continue developing or acquiring missiles and related technologies, despite interdiction, international condemnation, sanctions, and asymmetric efforts to limit them.

The "Post-INF" Capabilities and Major Powers' Strategic Interactions

The Intermediate-Range Nuclear Forces Treaty (INF) ended in 2019, but the issue of INF-range missiles remains. Russia's alleged treaty violations and China's increasing conventional and nuclear armed missile capabilities drove the United States to withdraw from the treaty. The former Trump Administration held that if the United States remained bound by the INF treaty limits, then it would be increasingly at a disadvantage with respect to Russia and China. American analysts argued that China has deployed thousands of land-based intermediate-range ballistic and cruise missiles, and ninety-five percent of them would violate the INF if China was party to it—which, of course, it is not.[11] After the US INF withdrawal, Russia decided to suspend its obligations under the INF treaty as a countermeasure. The current Biden Administration remains greatly concerned with Russia and China's potential employment of nuclear and conventional armed intermediate-range ballistic and cruise missiles and may try to seek negotiations on a global treaty to ban them.[12] The termination of the treaty means that the Asia-Pacific has entered into a "post-INF" era in which, as explained below, "post-ballistic" capabilities become a priority in military planning of these states and tripolar great power strategic interactions become more complex.

The "post-ballistic" capabilities arise from emerging technologies such as advanced guidance and stealth technology. Enhanced by these new technologies, a new generation of cruise missiles and

[10]Missile Threat, Missile Defense Project. Lasted updated July 31, 2021, https://missilethreat.csis.org/missile/shaheen-3/

[11] Jacob Stokes, "China's Missile Program and US Withdrawal from the Intermediate-Range Nuclear Forces (INF) Treaty," *US-China Economic and Security Review Commission Staff Research Report*, Feb.4,2019, p.2.

[12] Sharon Squassoni, "How the Biden Administration can Secure Real Gains in Nuclear Arms Control," *Bulletin of the Atomic Scientists*, March 30, 2021, https://thebulletin.org/2021/03/how-the-biden-administration-can-secure-real-gains-in-nuclear-arms-control/

tactical (shorter-range) ballistic missiles gained greater accuracy, reliability, and affordability than the long-range ballistic missiles. Modern cruise missiles can fly at low altitudes, which make them less visible to radars coverage and more difficult to detect and defend against. Shorter-range ballistic missiles, with their accuracy measured in meters, have become effective tools for taking out high-value, well-defended targets inside an adversary's territory.

These attributes, however, leave target nations with very limited ability to counter the new generation of missiles in wartime. Hypersonic vehicles with speeds of Mach 5 and above, for example, can drastically reduce the timelines for attack and response. The further proliferation of hypersonic missiles and the related technologies may cause miscalculation and misperception. Hypersonic weapon systems are divided into hypersonic glide vehicles and hypersonic cruise missiles. The United States, Russia, France, Japan, China, and India are all pursuing these weapons. Russia has already deployed early versions. Furthermore, the growing popularity of dual-capable missiles, when equipped with either conventional or non-conventional warheads, are also destabilizing and could lead to devastating deterrence failures because the payload ambiguity increases uncertainty in a crisis and, thereby, the stakes of not striking first.

Russia has tested and fielded a new ground launched cruise missile system (9M729) that the United States claimed violated the INF treaty since May 2013.[13] Over the last two decades, China has deployed several new models of land-attack and anti-ship conventional cruise missiles, which are viewed by the United States as providing what it calls "Anti-access/Area-denial" (A2/AD) capability. On 3 August 2019, the day after the United States withdrew from the INF Treaty, then US Secretary of Defense Mark Esper revealed that the United States aims to deploy INF-range missiles in the Asia-Pacific to counter China's "A2/AD" capabilities.[14] At the same time, the Pentagon initiated a study to evaluate whether the United States needed new military capabilities to offset any advantage Russia and China might acquire by deploying a ground-launched cruise missile of INF range (between 500 and 5,500 kilometers). The potential US Army and/or Marine Corps options to deploy land-based intermediate-range missiles in this region include the intermediate-range ballistic missile (IRBM) with hypersonic glide vehicle, with a range of 4,000

[13] US Congressional Research Service, Russian Compliance with the Intermediate Range Nuclear Forces (INF) Treaty: Background and Issues for Congress, 8 February 2019.
[14] Robert Kobza, "Another Tool in the Toolbox: Using Intermediate-Range Missiles to Counter A2/AD in the Pacific," *Georgetown Security Studies Review*, 2 December 2019: 11.

km; the Tomahawk ground-launched cruise missile (GLCM), with a range of less than 2,500 km; the Improved Army Tactical Missile System (ATACMS), with a range of less than 700 km; and the Precision Strike Missile (PrSM), with a range of 499 km.[15]

The potential deployment of the previously prohibited ground-based INF-range missiles by the United States in the Asia-Pacific region, especially in the western Pacific, may increase the complexity of trilateral great power strategic interactions. In response, some Chinese scholars have suggested that China should increase the survivability of its nuclear forces by deploying multiple warheads on missiles and experiment with hypersonic boost-glide vehicles.[16] Some analysis outside China even speculated that Beijing might change its longstanding no-first-use (NFU) commitment and the minimum nuclear deterrence posture.[17] Yet to date, China has upheld its NFU commitment to non-nuclear states, in spite of the speculation of some in Washington that it would amend its NFU policy in the near future.

As for Russia, President Putin announced Russia will deploy new missile systems and augment its missile defenses in its eastern regions.[18] Russia also took other countermeasures that enhance Sino-Russian military ties and help China to boost its own missile defensive systems.[19] The Sino-Russian military cooperation between their respective missile defense systems can be traced back to US withdrawal from the Anti-Ballistic Missile Treaty (ABM) in 2002. Driven by the potential development of the aforementioned missiles by the United States, Sino-Russian relations gained a new momentum recently, which was named a "comprehensive strategic partnership" by China[20] and "an allied relationship" by Russia.

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15 Tanya Ogilvie-White, "Post-INF Arms Control in the Asia-Pacific: Political Viability and Implementation Challenges," *The International Institute for Strategic Studies,* 30 June 2020: 3.
16 Tong Zhao, "China in a world with No US-Russia Treaty-Based Arms Control," *Carnegie-Tsinghua Center for Global Policy*, 1 April 2019.
17 Andrey Baklitskiy, "What the End of the INF Treaty Means for China," *Carnegie Moscow Center Commentary*, 2 December 2019, https://carnegie.ru/commentary/80462
18 Stephen Blank, "After the INF: Russia's Propaganda and Real Threats," *Eurasia Daily Monitor*, 6 September 2019, https://Jamestown.org/program/after-the-inf-russias-propaganda-and-real-threats/
19 "Russia is Helping China Build a Missile Defence System, Putin Says," *Guardian*, 4 October 2019.
20 "China and Russia," Ministry of Foreign Affairs of the People's Republic of China, online, https://www.fmprc.gov.cn/mfa_eng/wjb_663304/zzjg_663340/dozys_664276/gjlb_664280/3220_664352/

Will China Join the Trilateral Arms Control Negotiation?

In early 2019, the Trump Administration began to push for a trilateral arms control that would include the United States, Russia, and China. Then-president Trump noted that "Russia and China and us are all making hundreds of billions of dollars worth of weapons which are costly and ridiculous."[21] In April 2020, the US State Department released a report titled, "US Priorities for Next-Generation Arms Control," which outlined US priorities for "next-generation arms control" involving both Moscow and Beijing.[22] The United States tended to cite China's participation as a pre-condition of the extension of the New START. The treaty limits deployed US and Russian strategic nuclear forces. Additionally, it facilitates inspections and exchanges of information on the status and movements of their intercontinental ballistic missiles and heavy bombers.

At the time, US proposals to trilateralize New START appeared disingenuous given that the relatively small Chinese nuclear forces are not equivalent to those of the United States and Russia.[23] Leaving aside the quantitative and qualitative differences of China's nuclear force, its warheads and relevant delivery systems are stored at separated locations, which means the existing counting rules in New START are not suitable to China.[24] Several Chinese spokespersons rejected the Trump administration's calls officially, arguing that the two nuclear superpowers should bear the main responsibility of reducing their arsenals to lower levels.[25] From Beijing's perspective, any request for a trilateral arms control dialogue from the United States is more a litmus test of its campaign of maximum pressure towards China on a range of policy issues and an excuse for its withdrawal from the treaty for non-substantive reasons. China is also worried that verification of

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[21] Sonne P. and J. Hudson, "Trump Orders Staff to Prepare Arms-control Push with Russia and China," *The Washington Post*, April 25, 2019, https://www.washingtonpost.com/world/national-security/trump-orders-staff-to-prepare-arms-control-push-with-russia-and-china/2019/04/25/c7f05e04-6076-11e9-9412-daf3d2e67c6d_story.html

[22] Christopher A. Ford, "US Priorities for Next-Generation Arms Control," *Arms Control and International Security Papers*, Volume 1, Number1, April 06, 2020.

[23] According to Kristensen's assessment, Russia and the United States each maintain approximately 4,000 operational nuclear weapons, while China has around 300, cited from Kristensen H. M. and M. Korda, "Status of World Nuclear Forces", *Federation of American Scientists*, April, 2020, https://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/

[24] Leanne Quinn, "China's Stance on Nuclear Arms Control and New START," *Arms Control Now*, 23 August 2019, https://www.armscontrol.org/blog/2019-08-23/chinas-stance-nuclear-arms-control-new-start

[25] Director-General FU Cong's Interview with Kommersant, Ministry of Foreign Affairs of the People's Republic of China, October 16, 2020, https://www.fmprc.gov.cn/mfa_eng/wjbxw/t1824545.shtml

its forces under a trilateral treaty could help to detect and weaken Beijing's limited nuclear retaliatory capabilities, which rely in part on opacity and ambiguity to compensate for its limited nuclear force.

China's negative attitude towards trilateral strategic arms control negotiation doesn't mean that China does not support the international disarmament and non-proliferation process. As a permanent member of the U.N. Security Council and a nuclear-weapon state, China has played constructive roles in other multilateral nuclear-related negotiations. In the 1990s, China actively led negotiations on military-to-military confidence building and risk reduction. It signed the multilateral 1996 Comprehensive Nuclear-Test-Ban Treaty and participated in the international monitoring systems being set up to detect nuclear explosions around the world. China pushed for a treaty preventing an arms race in outer space.[26] China also played a supportive role in negotiations leading to the 2015 multilateral Iran nuclear deal aimed at limiting that country's pathways to developing nuclear weapons. In the non-proliferation of missiles and their technologies, although it has not participated in any of the world's major export control mechanisms except for joining the Nuclear Suppliers Group in 2004, China joined the Hague International Code of Conduct against Ballistic Missile Proliferation (HCOC) and pledged to halt missile exports in 1992, 1994, 1998, and 2000. In August 2002, China promulgated its own missile export control regulations and lists that corresponded closely to the Missile Technology Control Regime (MTCR) guidelines.[27] In 2003, China applied to join in the MTCR but was blocked by the United States.

When the United States shifted its China policy from engagement to containment under the Trump Administration—a posture likely to be maintained under the Biden administration—China became even more sensitive to the United States' trilateral arms control initiative. Nonetheless, China embraces dialogue underpinned by fair, equitable, and concrete principles. China will participate in negotiations when involved in a broader set of negotiating partners such as France and the United Kingdom with similar levels of nuclear forces rather than being singled out. All five officially recognized nuclear weapon states (the so-called "P5") have convened and collaborated

[26] Nancy Gallagher, "China on Arms Control, Nonproliferation, and Strategic Stability," *CISSM Working Paper*, August 2019: 2.
[27] Robert J. Einhorn and Gary Samore, "Ending Russian Assistance to Iran's Nuclear Bomb," *Survival*, Vol. 44, No. 2 2002: 12.

successfully on the Iran negotiations. From Beijing's perspective, the P5 format might be more appealing than the prospect of negotiating alone with only the two nuclear superpowers. The P5 will be a good place for Beijing to negotiate confidence building measures such as the No First Use (NFU) principle. Some Chinese scholars even support the notion that China should enter into nuclear arms control dialogues rather than nuclear arms reduction negotiations because the concept of arms control is more comprehensive than arms reduction.[28]

Reducing the Risks of Dangerous Strategic Arms Races

The rapidly worsening global security environment now exacerbated by the global pandemic has led to several missile control treaties or agreements being abandoned or facing an uncertain future. The ABM Treaty and the Conventional Forces in Europe (CFE) Treaty collapsed. The termination of the INF Treaty highlights that bilateral arms control ultimately would not curb the geographical spread and technological advancement of missiles. The former Trump administration announced its withdrawal from the Open Sky Treaty. The 2010 New START, the only remaining treaty on limiting strategic ballistic missiles and strategic bombers, was going to expire in February 2021 and was saved only at the last moment by its extension by the Biden administration. Under Trump, even nuclear testing was put back on the agenda with unfounded American claims of the resumption of Chinese nuclear testing—which would have contravened the Comprehensive Nuclear Test Ban's "zero-yield" standard.[29] This reinforces just how far the negative trend went in the United States. Although many observers hope the Biden administration will reverse this trend, structural trends at the global level involving the nine nuclear-armed states, and the chaotic state of American domestic politics and nature of its foreign policy, mean that no-one can predict its stance on these issues for longer than a few years.

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[28] Wu 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

[29] US State Department, "Executive Summary of Findings on Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments," *Bureau of Arms Control, Verification and Compliance*, April. 2020, https://www.state.gov/wp-content/uploads/2020/04/Tab-1-EXECUTIVE-SUMMARY-OF-2020-CR-FINDINGS-04.14.2020-003-003.PDF

China opposes arms racing outright due to its cost and potential strategic risks. From the Chinese perspective, the situation could be improved by the following measures. First, states should strengthen and enlarge the existing institutions of missile control. A combination of deteriorating great-power relations, uncertainties about the impact of emerging technologies, and the fact that some "post-INF" missiles are inherently attractive to states, with low political and legal barriers to acquisition and use, has undermined controls on missile proliferation. There is no universal norm, treaty, or agreement which governs the development, testing, production, acquisition, possession, transfer, deployment, or use of missiles. Apart from the bilateral missile control treaties, the relevant mechanisms include unilateral (export controls), coordinated among exporting states as the MTCR, or multilateral but not legally binding and far from universal measures such as the HCOC. Despite its imperfections, the MTCR—the only existing multilateral arrangement covering the transfer of missiles and missile-related equipment, material, and technology relevant to weapons of mass destruction (WMD)—has brought a significant degree of order to containing the spread of ballistic missiles. The HCOC, an offspring of the MTCR and a useful set of voluntary confidence building measures, refers only to one category of missiles.

The existing regulations covering missiles fall far short of those that would avoid a costly and potentially deadly arms competition. For those concerned and responsible states in this region, it is time to act now, or we will find ourselves bested by a destabilizing missile arms race. These existing instruments should give proper priority to cruise missiles and hypersonic missiles and even missile defense. The scope and number of their participants should be enlarged. A regional missile-limitation regime that provides prior notice of missile and satellite launches to enhance transparency and predictability would also offer great strategic benefits to all states in the region.[30]

Second, all states—but especially the great power nuclear armed states—must do everything possible to avoid the risk of war and nuclear war. States that possess nuclear-armed missiles must ensure that no accident or incident ever happens. All the nuclear-armed states should take the famous saying "a nuclear war cannot be won and must never be fought" as a common understanding and restrain their development and employment of any nuclear ballistic or cruise

[30] Kurosaki Akira, "Moving Beyond Deterrence and Missile Defense," *INESAP Briefing Paper,* No.13, November 2004, http://www.inesap.org/sites/default/files/Briefing13_04_0.pdf

missiles. Nuclear-armed states should be divided into three levels according to the quantity or quality of their nuclear weapons. Each level should have different responsibilities.

The first level is Russia and the United States which, as nuclear superpowers, have more than ninety percent of the world's nuclear warheads. The deterioration of great power relationships has increased the possibility of a nuclear arms race. Their negative attitudes toward arms control have become a major barrier to the progress of international non-proliferation. The nuclear superpowers should reduce the role of nuclear weapons in their military doctrines by rejecting preemptive nuclear strikes or declaring that the sole use of nuclear weapons is as "the last resort" to defend their national security.

The second layer includes France, Great Britain, and China, the other three permanent members of the U.N. security council. It is imperative to encourage these states to make more contributions to the international arms control process.

The third layer involves the four *de facto* nuclear states, India, Pakistan, the DPRK, and Israel, who are neither members of the P5 nor parties to the NPT. Their rights to exploit nuclear energy peacefully should be respected. Meanwhile, every effort should be made to limit and reduce the risk of a nuclear war or conflict between India and Pakistan to boost the denuclearization process of the DPRK, while guaranteeing their national security.

Last, but not the least, the new arms control and disarmament dialogue must directly address the new factors that could increase the risk of accidental or inadvertent nuclear conflict, most important, the potential destabilizing effects of new non-nuclear weapon technologies such as ballistic missile defense, anti-satellite weapons, and precision-strike missile technology. The emerging advanced technologies supplement and even enhance nuclear weapons while offering non-nuclear states capabilities with which to offset the projection of conventional and nuclear forces by the great powers. With the widespread applications of emerging technologies, non-nuclear military facilities and platforms may degrade nuclear decision-making and increase the risk of an accidental nuclear war. Thus, Track 2 dialogues on emerging technologies and some non-nuclear weapon systems might develop workable proposals to reduce the resulting risks.

The continued high alert levels of American, Russian, British, and French warheads to support "launch on warning" is another risk that deserves urgent attention. Moreover, Russia and the

United States each possess huge counterforce capabilities, which threatens not only each other but lesser nuclear adversaries with a decapitating and disarming first-strike. In contrast, China, India, and Pakistan reportedly keep their nuclear weapons un-deployed at central storage facilities on low alert levels. Their retaliatory strike capabilities are based on the principle of "launch under attack," not "under warning." Already in 1994, China proposed that the P5 should agree to adopt NFU, which could lay the foundation of developing codes of conduct to decrease the risks.[31] Recognizing the NFU principle could lessen the risk arising from misperception and misunderstanding of the preemptive strike posture on the one hand and sustain the taboo against nuclear employment on the other.

[31] Zhengqiang Pan, "A Study of China's No-First-Use Policy on Nuclear Weapons," *Journal for Peace and Nuclear Disarmament*, 1, No.1, 2018: 115-136.

3. Assessing the Modernization of Nuclear Postures

Petr Topychkanov

Introduction

The increased of salience of nuclear weapons is a visible trend among all nuclear-armed states.[1] The recent doctrinal changes tend to lower the nuclear threshold. In the regions of Europe, East Asia, and South Asia, the concept of limited nuclear war surfaces again after the years of abandonment. Political turmoil between nuclear-armed states and their allies and the introduction of new technologies add significantly to shocking the strategic stability relations of countries possessing nuclear arsenals. This chapter explores the doctrinal changes in nuclear-armed states that might make closer the risk of first nuclear use.

Nuclear doctrines have a dual character. When discussing the nuclear doctrine, or strategy, observers sometimes describe under this both the doctrine and military plans, which are not always the same. As it was noted in a study on Russian nuclear doctrine, "the usual practice is to draw a line between two aspects of military doctrine: the political and military-technical aspects. Until recently, the former aspect was regarded as the more stable one, while the latter, which determines the means, forms, and methods of warfare, as the more dynamic and changeable."[2] This passage, however, is relevant to any nuclear doctrine.

[1] Tytti Eräst and, Tarja Cronberg, "*Opposing Trends: The Renewed Salience*," (SIPRI, Stockholm: April 2019) p. 3-4.
[2] Valentin Larionov, and Andrei Kokoshin, *Prevention of War: Doctrines, Concepts, Prospects*, (Moscow: Progress Publishers, 1991) p. 13.

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Change in Nuclear Doctrines and Force Postures

United States of America

The Trump administration approved the most recent nuclear doctrine of the United States in 2018. In comparison with the previous version of 2010, it made significant changes, mostly in response to growing threats from Russia, China, and the DPRK, specifically to the alleged violations of the Intermediate-Range Nuclear Forces (INF) Treaty by the former. The document mentioned Russia's so-called "escalate-to-de-escalate" concept and offered the US response to it.[3]

The doctrine witnessed the expansion of US flexibility regarding nuclear options, including low-yield ones. The rationale behind this, as explained in the text, is to preserve "credible deterrence against regional aggression."[4] This change explicitly confirms that nuclear employment by the United States is possible in regional conflicts in sub-strategic scenarios.

In support of these changes, the nuclear posture announced the commencement of research and development of conventional ground-launched intermediate-range missiles.[5] In August 2019, less than three weeks after its withdrawal from the INF Treaty, the United States flight tested a modification of the Tomahawk ground-launched cruise missile from the Mark 41 Vertical Launch System.[6] Another flight test of a ground-launched ballistic missile of the intermediate-range happened before the end of 2019. The deployment of a new missile is possible in the near future in the Asian-Pacific region to deter China. Such a deployment was viewed as desirable by former United States Secretary of Defense Mark Esper.[7]

The Russian and Chinese reactions to these developments indicated their concern about the consequences of the lowered nuclear threshold and triggered an arms race.[8] However, the US

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[3] "Nuclear Posture Review," (Office of the Secretary of Defense, Washington: Feb. 2018) p. 8.
[4] "Nuclear Posture Review," (Office of the Secretary of Defense, Washington: Feb. 2018) p. XII.
[5] "Nuclear Posture Review," (Office of the Secretary of Defense, Washington: Feb. 2018) p. 10.
[6] Aaron Mehta, "Watch the Pentagon test its first land-based cruise missile in a post-INF Treaty world" *Defense News*, 19 Aug. 2019, https://www.defensenews.com/pentagon/2019/08/19/pentagon-tests-first-land-based-cruise-missile-in-a-post-inf-treaty-world/
[7] Aaron Mehta, "Is the US about to test a new ballistic missile?" *Defense News*, 13 Nov. 2019, https://www.defensenews.com/space/2019/11/13/is-the-us-about-to-test-a-new-ballistic-missile/
[8] N. Patrushev, "Videt" tsel," [Acquiring target] *Rossiyskaya Gazeta,* 11 Nov. 2019, https://rg.ru/2019/11/11/patrushev-ssha-stremiatsia-izbavitsia-ot-mezhdunarodno-pravovyh-ramok.html; Ministry of Foreign Affairs of the People's Republic of China, *"Foreign Ministry Spokesperson Geng Shuang's*

nuclear posture states that these measures are defensive—reactive to the growing threats from Russia, China, and the DPRK—and make nuclear employment less probable.

The unique character of the US nuclear posture is not only about a commitment to allies to use nuclear weapons to protect them from nuclear and non-nuclear threats, but also about an extensive list of threats being deterred by the nuclear capabilities of the United States. The United States is only one of the nuclear-armed states that pretend to have effective deterrence against cyber threats.[9] Addressing the volatile security environment, the nuclear posture of the United States does not accept the concepts of no first use and sole purpose of nuclear weapons. It retains ambiguity regarding the concrete scenarios within which this country will use nuclear weapons.[10]

These changes in the US nuclear posture are accompanied by US reservations regarding further bilateral limitations. The US president repeatedly indicated the desire to proceed with a trilateral nuclear arms control agreement with China and Russia.[11] Given China's refusal to this format until all three countries have similar nuclear arsenals,[12] the risk of a nuclear arms control and disarmament dead-end is highly possible.

Russia

During the 1970s and 1980s, the Soviet Union, the predecessor of the Russian Federation, was a proponent of a no first use pledge.[13] In its first post-Soviet military doctrinal document, "Basic provisions of the military doctrine of the Russian Federation," approved in 1993, a negative security assurance with two exceptions replaced this pledge. First, Russia reserved the right to strike first under an armed attack by a non-nuclear weapon state being in alliance with a nuclear weapon state. The second case was a joint aggressive action by a non-nuclear weapon state and an

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Regular Press Conference on August 26, 2019," 26 Aug. 2019, https://www.fmprc.gov.cn/mfa_eng/xwfw_665399/s2510_665401/t1692042.shtml

[9] "Nuclear Posture Review," (Office of the Secretary of Defense, Washington: Feb. 2018) p. 38.

[10] "Nuclear Posture Review," (Office of the Secretary of Defense, Washington: Feb. 2018) p. VII, 22.

[11] TASS, *"US seeks major arms control deal with Russia and China, Trump says,"* 4 Nov. 2019, https://tass.com/world/1086822

[12] Ministry of Foreign Affairs of the People's Republic of China, *"Foreign Ministry Spokesperson Geng Shuang's Regular Press Conference on November 5, 2019,"* 5 Nov. 2019, https://www.fmprc.gov.cn/mfa_eng/xwfw_665399/s2510_665401/2511_665403/t1713475.shtml

[13] R.L. Garthoff, "Continuity and Change in Soviet Military Doctrine," ed. B. Parrot, *The Dynamics of Soviet Defense Policy* (The Wilson Center Press: Washington, 1990), p. 159.

allied nuclear weapon state.[14] In both cases, there was an explicit reference to NATO as an alliance of non-nuclear weapon states and nuclear-weapon states.

In the version of 2000, the military doctrine of Russia mentioned for the first time the concrete circumstances under which the country would use nuclear weapons. With some changes, these conditions remained the same in subsequent versions. In the most recent version of 2014, Russia reserves "the right to use nuclear weapons in response to the use of nuclear and other types of weapons of mass destruction against it and/or its allies, as well as in the event of aggression against the Russian Federation with the use of conventional weapons when the very existence of the state is in jeopardy."[15] The document mirrors the US posture in terms of protecting allies and responding to an extensive list of threats with the nuclear deterrent, except for cyber.

In the Western scientific and expert literature, it has become commonplace to argue that the Russian nuclear doctrine is pre-emptive. The focus of the debate on the Russian pre-emption is on the concept of escalate-to-deescalate; in other words, plans for a limited nuclear strike to stop conventional aggression. Russian representatives officially and unofficially deny the existence of this doctrine.[16]

The escalate-to-deescalate concept is doubtful in the context of the Russia–US/NATO juxtaposition in the European region. There is a common belief in Russia that any armed conflict with the United States and NATO will quickly escalate to global and full-fledged nuclear war.[17] Vladimir Putin made the most recent statement about that in his Presidential Address to the Federal Assembly while commenting the low-yield nukes option of the US 2018 Nuclear Posture Review: "Any use of nuclear weapons against Russia or its allies, weapons of short, medium or any range

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[14] "The Basic Provisions of the Military Doctrine of the Russian Federation," *Federation of American Scientists*, https://fas.org/nuke/guide/russia/doctrine/russia-mil-doc.html

[15] Embassy of the Russian Federation to the United Kingdom of Great Britain and Northern Ireland, *"The Military Doctrine of The Russian Federation,"* 29 Jun. 2015, https://rusemb.org.uk/press/2029

[16] TASS, *"US Claims on Russia"s 'Escalation for De-Escalation' Doctrine are Wrong – Envoy,"* 9 Apr. 2019, https://tass.com/politics/1052755

[17] "'Ogranichennoi' yadernoi voiny mezhdu SShA i Rossiei ne budet po opredeleniyu" [Inherently There Will not Be a "Limited" Nuclear War between USA and Russia], *Vesti FM*, 18 Jan. 2018, https://radiovesti.ru/brand/61009/episode/1642882/

at all, will be considered as a nuclear attack on this country. Retaliation will be immediate, with all the attendant consequences."[18]

On the other hand, there are indications of possibilities of Russian use of nuclear weapons pre-emptively, regionally, and in a conventional armed conflict. The military doctrine of 2014 portrayed nuclear weapons as an essential deterrent for "preventing an outbreak of nuclear military conflicts involving the use of conventional arms (large-scale war or regional war)."[19] The 2017 naval doctrine described the following role of tactical nuclear weapons: "During the escalation of military conflict, demonstration of readiness and determination to employ non-strategic nuclear weapons capabilities is an effective deterrent."[20] The most recent strategic exercise, "Thunder 2019," had a scenario resembling the escalate-to-deescalate concept: "The situation escalates along the perimeter of the Russian borders amid the persisting conflict potential, as a result of which a threat emerges to the country's sovereignty and its territorial integrity."[21] These examples show that Russia's pre-emptive nuclear use in a regional conflict with conventional forces involved cannot be entirely dismissed.

Meanwhile, Russia's leadership keeps describing Russia's nuclear posture as defensive.[22] It combines the elements of the "launch-under-attack" and "launch-on-warning," and some Russian authors describe it as a "reciprocal counter-strike." How long the doctrine will remain defensive is unclear, given the demise of the INF Treaty and the risk of intermediate-range missiles deployment in Europe. These developments might cause a change of the defensive posture to an offensive one. In any case, the ambiguity of the Russian nuclear posture may grow.

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[18] "Presidential Address to the Federal Assembly," *President of Russia*, 1 Mar. 2018, http://en.kremlin.ru/events/president/news/56957

[19] Embassy of the Russian Federation to the United Kingdom of Great Britain and Northern Ireland, *"The Military Doctrine of The Russian Federation,"* 29 Jun. 2015, https://rusemb.org.uk/press/2029

[20] Russia Maritime Studies Institute, *"Fundamentals of the State Policy of the Russian Federation in the Field of Naval Operations for the Period Until 2030,"* 28 Sep. 2017, https://dnnlgwick.blob.core.windows.net/portals/0/NWCDepartments/Russia%20Maritime%20Studies%20Institute/RMSI_RusNavyFundamentalsENG_FINAL%20(1).pdf?sr=b&si=DNNFileManagerPolicy&sig=fjFDEgWhpd1ING%2FnmGQXqaH5%2FDEujDU76EnksAB%2B1A0%3D

[21] TASS, *"Russian strategic nuclear forces" drills not aimed against third countries — top brass,"* 14 Oct. 2019, https://tass.com/defense/1083017

[22] President of Russia, *"Meeting of the Valdai International Discussion Club,"* 18 Oct. 2018, http://en.kremlin.ru/events/president/news/58848

Russia is also developing and testing new offensive weapons. It has recently announced the Burevestnik nuclear-powered long-range cruise missile, the Poseidon nuclear-powered underwater drone, the Kinzhal air-launched supersonic missile, the Sarmat silo-based heavy ballistic missile, and the Avangard hypersonic glide vehicle.[23] It has reportedly already replaced 82 per cent of the weapons and equipment of the Strategic Rocket Forces with new systems.[24] The US official position is that these weapons are destabilizing.[25]

China

For several decades after its first nuclear test in 1964, China maintained a restrained nuclear posture. The Chinese leadership assigned its nuclear weapons a "sole purpose" role, to be employed only in response to a nuclear strike.[26]

The most recent 2015 nuclear doctrine of China repeats the main principles of this restrained policy, including the no first use pledge and unconditional negative security assurances for non-nuclear weapon states and nuclear-weapon-free zones. The document highlighted the defensive character of the nuclear posture.[27]

Reflecting these principles, China keeps its nuclear capabilities at the minimum level required for deterring probable adversaries. Chinese nuclear weapons probably do not need to be at high alert. China may have its nuclear warheads separated from delivery systems.[28] The alert level will only change in crises.

Some aspects, however, may indicate the changing nature of China's nuclear doctrine. Among the UN Security Council's five permanent members, or P5 countries, only China refuses to declare the

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[23] "Presidential Address to the Federal Assembly," *President of Russia*, 1 Mar. 2018, http://en.kremlin.ru/events/president/news/56957

[24] President of Russia (2018), "Presidential Address to the Federal Assembly," 1 March, http://en.kremlin.ru/events/president/news/56957 accessed 7 May 2020.

[25] http://statements.unmeetings.org/media2/21998264/united-states.pdf

[26] Zhenqiang Pan, "A study of China's No-First-Use Policy on Nuclear Weapons," *Journal for Peace and Nuclear Disarmament*, 2018, vol. 1, no. 1, p. 115.

[27] Information Office of the State Council, *"China's Military Strategy,"* May 2015, http://english.www.gov.cn/archive/white_paper/2015/05/27/content_281475115610833.htm

[28] Shannon Kile and Hans Kristensen, "Chinese Nuclear Forces," *SIPRI Yearbook 2019. Armaments, Disarmament and International Security,* (SIPRI, Stockholm: 2019) p. 318.

scale of its nuclear arsenal. The state justifies this opacity by the small number of its nuclear weapons and their greater vulnerability if the number is disclosed. These explanations however, do not remove concerns about the growing size of China's nuclear arsenal, which according to some assessments, could exceed the those of France and the United Kingdom.[29] China's promise to join multilateral nuclear arms control when the nuclear arsenals of the United States, Russia, and China are of similar sizes,[30] suggests China's unwillingness to join any arms control in the foreseeable future.

China's practice of keeping the nuclear arsenal de-alerted in peacetime is uncertain. Beijing has never confirmed this practice and never declared it as a de-alerting measure. In the absence of official statements, it is hard to assess open-source reports that China separates warheads from delivery systems.

In fact, the path of China's nuclear arsenal development may make this practice unfeasible. China pursues credible sea-based nuclear deterrence. Currently, it has four operational submarine-launched ballistic missiles (SLBM) of Type 094, and the next generation submarine Type 096 will be launched in 2020.[31] However, the SLBM submarines will be a credible deterrent only if nuclear-tipped missiles are on board. This development would mean the end of China's practice of de-mating warheads from delivery systems. Also, China is pursuing the replacement of silo-based liquid-fueled missiles with new mobile solid-fuel systems, such as three-stage missiles Dong Feng-31/AG (DF-31/AG) and Dong Feng-41 (DF-41). With the ranges of 11,200 and 12,000 km accordingly, these weapons may replace the obsolete silo-based ICBMs.[32] Again, the operationalization of the new mobile weapons would contradict the practice of de-mating warheads from delivery systems.

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[29] A. Arbatov, "China and Stability," eds. A. Arbatov, V. Dvorkin, and S. Oznobishchev, *Russia and Dilemmas of Nuclear Disarmament,* (IMEMO, Moscow: 2012), p. 33.

[30] Ministry of Foreign Affairs of the People's Republic of China, "Maintaining Global Strategic Stability, Reducing Risks of Nuclear Conflicts. Statement by H.E. Mr. Fu Cong, Director-General of the Department of Arms Control of MFA at the 16th PIIC Beijing Seminar on International Security," 16 Oct. 2019, https://www.fmprc.gov.cn/mfa_eng/wjbxw/t1708326.shtml

[31] Department of Defense, *"Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2019,"* P. 36, https://media.defense.gov/2019/May/02/2002127082/-1/-1/1/2019_CHINA_MILITARY_POWER_REPORT.pdf

[32] Shannon Kile and Kristensen, "Chinese Nuclear Forces," *SIPRI Yearbook 2020. Armaments, Disarmament and International Security,* (SIPRI, Stockholm: 2020), p. 357.

Another new development may be related to the possible replacement of the retaliatory posture with launch-on-warning. The 2013 edition of the Science of Military Strategy offered the following option: "If we can indeed confirm that the enemy has launched nuclear missiles against us, we can quickly launch nuclear missiles in retaliation, before the enemy's warheads reach and detonate over the targets to cause real damage to us."[33]

Shifting from the delayed retaliation to launch-on-warning would constitute a significant change in China's nuclear operation.[34] It would require early warning. The recent statement of the Russian president Vladimir Putin, who mentioned the ongoing cooperation between Russia and China on the space-based early warning, suggests China's interest in early warning capabilities.[35]

France

At first look, the nuclear posture of France is defensive with a relatively high threshold. France's 2017 Defence and National Security Review, one of its most recent doctrinal documents, portraited the nuclear arsenal as the last-resort weapon.[36] France signaled there is no place for nuclear weapons in offensive scenarios.[37] The state does not intend to achieve any gains on the battlefield with nuclear weapons. France no longer has a nuclear triad. Its arsenal contains only air- and sea-based capabilities.[38]

On closer scrutiny, however, France probably has the highest level of ambiguity among the P5 countries regarding the circumstances under which it would employ nuclear weapons. Its doctrine states that the French nuclear deterrence capabilities protect France "from any aggression against our vital interests emanating from a state, wherever it may come from and whatever form it may

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[33] Cited in: Michael Chase, "China's Transition to a More Credible Nuclear Deterrent: Implications and Challenges for the United States," *Asia Policy*, Jul. 2013, no. 16, p. 60.
[34] Tong Zhao, "Kitaiskaya strategiya i voennye programmy," [Chinese strategy and military programs] Arbatov, A., Dvorkin, V., *Politsentrichnyi yadernyi mir: vyzovy i novye vozmozhnosti* [Polycentric nuclear world: challenges and new possibilities] (Carnegie Moscow Center, Moscow: 2017), p. 91.
[35] President of Russia, *"Valdai Discussion Club session,"* 3 Oct. 2019, http://en.kremlin.ru/events/president/news/61719
[36] Ministère des Armées, "*Revue stratégique de défense et de sécurité nationale,"* 2017, p. 72-73, https://www.defense.gouv.fr/content/download/514684/8664656/file/2017-RS-def1018.pdf
[37] Ministère des Armées, *"Dissuasion,"* 11 Jan. 2017, https://www.defense.gouv.fr/dgris/politique-de-defense/dissuasion/dissuasion
[38] Shannon Kile and Hans Kristensen, "French Nuclear Forces," *SIPRI Yearbook 2019. Armaments, Disarmament and International Security,* (SIPRI, Stockholm: 2019) p. 316.

take."[39] This has created fertile soil for speculation because the "vital interests" is a vague notion not directly linked to sovereignty.

Statements made by French officials indicated that the nuclear arsenal might be a deterrent against non-nuclear threats as well, including conventional and terrorist ones.[40] The planned nuclear modernization process in France during the next two decades reflects concerns about emerging threats, such as cyber offence and anti-satellite capabilities.[41]

The correlation of France's nuclear posture with its membership in NATO produces additional ambiguity about France's nuclear policy. France's government sees its nuclear arsenal as a means for protecting common European "vital interests" and as contribution to global nuclear deterrence by NATO, along with the United States and the United Kingdom.[42] At the same time, France remains outside NATO's nuclear planning process. France is not a part of the NATO extended deterrence posture. The concrete circumstances challenging European and NATO security under which France would employ nuclear weapons and how France would synchronize and measure its nuclear response in concert with the responses from other NATO allies therefore remains unclear.

United Kingdom

Unlike other nuclear-armed states, the United Kingdom has set a concrete unilateral limit on its nuclear stockpile: 180 nuclear warheads with 120 warheads operationally deployed in the mid-2020s. In comparison to United States, Russia, China, and France, the United Kingdom demonstrates a maximum level of transparency of its nuclear posture and capabilities vis-à-vis non-nuclear weapon states. For instance, the United Kingdom became a core country of the Quad

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[39] Ministère des Armées, "*Revue stratégique de défense et de sécurité nationale,*" 2017, p. 72, https://www.defense.gouv.fr/content/download/514684/8664656/file/2017-RS-def1018.pdf

[40] B. Tertais, *"La France et la dissuasion nucléaire: concept, moyens, avenir,"* (Direction de l"information légale et administrative, Paris: 2017) p. 107.

[41] Direction de l"information légale et administrative, "*Dissuasion nucléaire: quel financement pour sa modernisation,"* 13 Jul., 2017, https://www.vie-publique.fr/en-bref/19689-dissuasion-nucleaire-quel-financement-pour-sa-modernisation

[42] Sénat, "Rapport d'information fait au nom de la commission des affaires étrangères, de la défense et des forces armées (1) par le groupe de travail "La modernisation de la dissuasion nucléaire," par MM. Xavier Pintat, Jeanny Lorgeoux, co-présidents, MM. André Trillard, Pascal Allizard et M. Claude Haut, sénateurs," 23 May 2017, p. 56, https://www.senat.fr/rap/r16-560/r16-5601.pdf

partnership investigating the role of non-nuclear weapon states in verifying nuclear-warhead dismantlement.[43]

In its 2015 National Security Strategy and Strategic Defence and Security Review, the United Kingdom reaffirmed its commitment not to use nuclear weapons against NNWS-parties to the NPT. However, the 2015 document stated that the government reserved the right to "review this assurance if the future threat, development or proliferation of these weapons make it necessary." It also highlighted the continuous process of reviewing its nuclear posture "in the light of the international security environment and the actions of potential adversaries." The United Kingdom did not rule out the first use of nuclear weapons.

The Strategic Defense and Security Review of 2015 kept some level of ambiguity regarding "precisely when, how and at what scale we would contemplate their use, in order to not simplify the calculations of any potential aggressor."

The UK government's standard practice is to have a ballistic missile submarine on deterrent patrol at any given time. The authorities claim that the missiles on the submarine are not on launch-ready alert.

The United Kingdom is currently replacing its Vanguard-class submarines with a Dreadnought-class. The first of the new class will enter service in the early 2030s. It is expected that the new class will constitute the backbone of the United Kingdom's continuous at-sea deterrent into the 2060s.

India

India does not have an official nuclear doctrine. By the decision of the Cabinet Committee on Security (CCS) dated January 4, 2003, "India's nuclear doctrine can be summarized as follows: (1) building and maintaining a credible minimum deterrent; (2) a posture of no first use: nuclear weapons will only be used in retaliation against a nuclear attack on Indian territory or on Indian forces anywhere; (3) nuclear retaliation to a first strike will be massive and designed to inflict

[43] T. Erästö, U. Komkomžaitė, and P. Topychkanov, *Operationalizing nuclear disarmament verification*, (SIPRI, Stockholm: Apr. 2019) p. 10.

unacceptable damage."[44] Although India is committed to no first use of nuclear weapons and plans a retaliatory strike only, its nuclear forces are not yet survivable and reliable enough to endure a potential adversary's nuclear attack.

India has declared that it will adhere to credible minimum deterrence policies. For India, the main goal is to prevent the use of WMD by another state. In the case of India, minimum nuclear deterrence requires: (*a*) sufficient, survivable and operationally prepared nuclear forces; (*b*) a robust command and control (C2) system; (*c*) capable intelligence and early warning capabilities; (*d*) comprehensive planning and training for operations in line with the strategy; and (*e*) the will to employ nuclear forces and weapons.[45] In attempting to increase the credibility and effectiveness of its nuclear weapons as a deterrent, however, India fails to limit itself to minimum deterrence. Also, since India does not currently possess effective second-strike capabilities (e.g., SLBMs), and is actively developing its ballistic missile defense (BMD), many experts doubt that New Delhi adheres strictly to the NFU policy.[46] If India's BMD architecture achieves completion, it might create a feeling among the political leadership of the national ability to intercept the majority of incoming missiles from Pakistan. It would potentially convince them to act more aggressively without fear of Pakistan's retaliation.

Pakistan

Pakistan has declared that it will adhere to minimum deterrence as well. As Pakistani Prime Minister Nawaz Sharif said on May 20, 1999, "nuclear restraint, stabilization and minimum credible deterrence constitute the basic elements of Pakistan's nuclear policy."[47] For Pakistan, the goal is to prevent a war in which India uses WMD and conventional weapons against it.

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[44] "Cabinet Committee on Security Reviews Progress in Operationalization India's Nuclear Doctrine," Press Information Bureau, (Government of India, New Delhi, 4 Jan. 4, 2003) http://pib.nic.in/archieve/lreleng/lyr2003/rjan2003/04012003/r040120033.html

[45] Arpit Rajain, *Nuclear Deterrence in Southern Asia: China, India and Pakistan* (Sage: New Delhi, 2005), p. 229.

[46] I. Khalid, "Nuclear doctrine: ramifications for South Asia", *South Asian Studies*, vol. 27, no. 2 (July–Dec. 2012), p. 319.

[47] "Remarks of the Prime Minister of Pakistan, Nawaz Sharif, on Nuclear Policies and the CTBT, National Defence College, Islamabad, May 20, 1999," Cit. in: Ayaz Ahmed Khan, "Indian Offensive in the Kargil Sector," *Defence Journal*, Jun. 1999, http://www.defencejournal.com/jun99/indian-offensive.htm

In contrast to India, Pakistan plans to use its nuclear weapons not only against political and economic centers, but also against conventional forces in India's territory, or in Pakistan's territory, should India invade.

Pakistan's deployment patterns change according to risks of pre-emption and interception. For example, Pakistan regards the US–India nuclear deal of 2008[48] as creating a change in regional circumstances because it allows India to improve its nuclear arsenal, and US cooperation helps India to develop its BMD systems. In response, Pakistan defends its right to increase the number of nuclear warheads in its arsenal and its nuclear delivery systems. This is why Pakistan refuses to support the CTBT or FMCT. According to some Pakistani experts, even if India signs and ratifies these treaties, Pakistan will not be interested in following suit.[49]

There is a danger that India's expanding capabilities in both defensive and offensive arms may provoke an asymmetric response on the part of Pakistan, including sabotage and terrorism. Pakistani experts realize that such a response would have an extreme destabilizing effect, but this choice can be driven by internal factors and implemented despite the experts' opinion.

When are Nuclear-armed States ready to Strike First?

A state's readiness for the first use of nuclear weapons makes it an instrument of warfighting. An intention of using nuclear weapons first goes beyond the nuclear deterrence goal of preventing the adversary's first strike via one's own survivable retaliatory capabilities. First nuclear use is associated with disarming and decapitating attacks. The first nuclear strike capabilities may be seen as a response to adversary's conventional superiority (by preventive strike means) and to the adversary's disarming and decapitating strike capabilities (by pre-emptive strike means).

[48] Agreement for Cooperation between the Government of the United States of America and the Government of India Concerning Peaceful Uses of Nuclear Energy, Agreed Text, 1 Aug. 2007, https://web.archive.org/web/20080915224216/http://www.hcfa.house.gov/110/press091108h.pdf

[49] R.A. Siddiqi, "The politics of US–India nuclear deal", *Strategic Studies*, no. 4 (2015), http://issi.org.pk/wp-content/uploads/2016/07/SS_No_4_2015_Dr-Rashid-Ahmed.pdf

Putting the nuclear-armed states on a line from the most offensive nuclear posture to the least one, Pakistan would probably be first, and the United Kingdom would be last.

Pakistan's nuclear arsenal has an unequivocally offensive nature with their exceptional reliance on first use due to both strategic necessity and technical characteristics. Facing India's conventional superiority, doctrinal shifts, and political support for cross-border surgical strikes, Pakistan has to rely on the tactical nuclear weapons in several scenarios, including a hypothetical invasion by India.

Russia might be considered as a nuclear-weapon state, having a nuclear posture closest to the Pakistani one. Perceiving the variety of strategic offensive and defensive systems in the United States and its NATO allies as a threat to the Russian nuclear arsenal, the latter keep relying on nuclear weapons to face this challenge.

The third position tentatively belongs to the United States due to its objective situation and military capability. It has no incentive for the first use of nuclear weapons. However, the provisions of its doctrine and allied obligations result in at least declaratory reliance on the concept of the first use of nuclear weapons.

The United States is followed by India, with its obligation of no first use. It is most likely that in practice it will continue to maintain the capability of disarming strike against Pakistan but remain vulnerable for a counterforce strike by China. India assumed the obligation of no first use to avoid provoking a pre-emptive strike on the part of China or Pakistan.

The fifth position goes to China. From the beginning, it assumed a declarative obligation of nuclear no first use without any reservation. However, China's retaliation strike capability is insufficient compared to the superior forces of the United States and Russia. Over time China will certainly accumulate such potential vis-à-vis the United States and Russia and improve offensive (counterforce) capabilities of its nuclear forces.

The sixth country is France, whose doctrine relies on nuclear deterrence for a wide variety of purposes, including the first use of nuclear weapons. Yet neither its nuclear forces nor its geostrategic situation, being a NATO member-state, implies either feasibility or necessity for first nuclear use.

The United Kingdom occupies the last position. The country has debated complete renunciation of nuclear weapons as well as first use. The United Kingdom defines the idea of first use vaguely, probably deeming it unnecessary but trying to avoid additional political complications with the United States and NATO.

Finally, there is Israel and the DPRK, which so far could not fit in the ranking for various reasons. As was mentioned above, nuclear doctrine has a dual meaning as a political document and operational plans. Since Israel maintains silence regarding its nuclear arsenal, it cannot have a public policy on nuclear weapon use. This is the main reason why discussion on the nuclear doctrine of Israel has to remain speculative. The only possible way to describe the posture is through the term of deliberate ambiguity.[50]

The DPRK case requires a particular focus. First, despite several official statements on nuclear weapons purposes,[51] this state lacks an official public nuclear doctrine. Second, having accepted denuclearization as a long-term goal, the DPRK's leadership has agreed to the possibility of removing its nuclear arsenal from its strategic calculations, though in a distant future. Finally, the DPRK continues building regional nuclear warfighting and nuclear inter-continental deterrence capabilities.[52] According to the Japanese official assessment of 2019, the DPRK has miniaturized nuclear weapons to fit ballistic missile warheads.[53] How do these efforts reflect the military doctrine of the DPRK, and how do they comply with the long-term denuclearization goal? These questions remain unclear so far.

In sum, the military strategies of most nuclear-weapon states have lowered the threshold for the use of nuclear weapons.

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[50] L.R. Beres, "Changing Direction? Updating Israel"s Nuclear Doctrine," *Strategic Assessment*, Oct. 2014, vol. 17, no. 3, p. 94.

[51] Ministry of Foreign Affairs DPRK, "*DPRK Will Bolster Nuclear Deterrence at Maximum Speed: Foreign Ministry Spokesman,"* 1 May 2017, <http://www.mfa.gov.kp/en/dprk-will-bolster-nuclear-deterrence-at-maximum-speed-foreign-ministry-spokesman/>; "Kim Jong Un meets nuclear weapons researchers, guides nukes manufacturing," *Pyongyang Times*, http://www.pyongyangtimes.com.kp/?bbs=21666

[52] M.B.D. Nikitin, "*North Korea's Nuclear and Ballistic Missile Programs*," (Congressional Research Service, Washington: 6 Jun. 2019) p. 2.

[53] *"Defense of Japan 2019"* (Ministry of Defense, Tokyo: 2019) p. 96.

Conclusion

The political and expert communities in nuclear-armed states must awake to the fact that, without progress towards a nuclear-weapons-free world, it will be impossible to curb the proliferation of nuclear weapons.

It is therefore in line with the long-term interests of nuclear-armed states to progress toward a higher level of transparency of their nuclear doctrines and planning with regard to their strategic and non-strategic nuclear forces, their condition, and their development plans. This need is especially crucial in the context of the US-Russia-China relations to realize limitations of their strategic offensive arms.

Nuclear-Capable Missiles

Nick Hansen

Introduction

Six countries with nuclear weapons and missiles capable of carrying them (hereafter "nuclear missiles") were examined in this study. It is interesting to note the diversity of the missiles in each country and the history of when they acquired each type. Diversity can be explained by where they are launched from: land, sea (including sub surface) or air, the ranges of the missiles: short to long range, and the basing mode for land-based missiles: mobile and silo. Many other factors also enter in to these decisions but the major one is the enemy country and its location relative to the possessing state.

Table 1 shows how these countries planned and deployed nuclear missiles.[1] Compared with two decades ago, this table now shows a high level of nuclear-missile activity.

[1] If the square is blank, it shows the country is not developing this type of missile or its status is unknown.

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Table 1: Nuclear-capable missiles in six Indo-Pacific countries [2]

	USA	Russia	PRC	India	Pakistan	DPRK
Ballistic Missiles						
SRBM	X	X	X	X	X	X
MRBM			X	X	X	X
IRBM			X	X	X	X
ICBM	X	X	X	D		D
SLBM	X	X	X	X		D
ALBM		X				
Cruise Missiles						
Land Short Range			X		X	
Land Long Range		X	X	X		D
Air Long Range	X	X	X			
Sea Long Range		X				
Land Nuclear-Powered		D				
Long Range Submarine						
Nuclear-Powered Torpedo		D				

X =	Deployed missiles
D =	Missile in Development
Blank =	Country not developing this type of missile or unknown if D or X
Missile Ranges	
SRBM	300-1000 km
MRBM	1000-3000 km
IRBM	3000-5500 km
ICBM	5500 km >
SLBM	Sub/Ship all Ranges
ALBM	Air all Ranges

United States and Russian Nuclear Missiles

Long-range, nuclear-capable missiles were developed and deployed as an extension of the United States and Soviet post-World War 2 bomber aircraft and German V-missiles. Throughout the Cold War they deployed various nuclear-capable missiles in hardened silos and on mobile vehicles,

[2] The United States and USSR/Russian strategic bombers have carried nuclear equipped ALCMs for around 40 years.

ballistic missile submarines, and various bomber aircraft. The START treaty (Strategic Arms Reduction Treaty) limited and reduced the numbers of these weapons significantly to what the United States and Russia have today. The New START treaty will continue for five years until February 2026. No other treaty restricts nuclear weapons in the Indo-Pacific region beyond these limits in two of the six states with nuclear missiles.

The timing, situation between countries, geography, and available technology largely determines nuclear weapons development. The United States and former Soviet Union were allies during World War 2 but as they became adversaries, both deployed nuclear weapons in the 1950s. Each developed tactical and strategic platforms that could deliver nuclear warheads. Tactical weapons included short- and medium-range missiles to fight a war in Europe and the western Pacific. Long-range missiles were deployed to destroy homeland targets from afar, either from the own homeland or from at sea on submarines.

Both deployed families of inter–continental ballistic missiles (ICBMs) from the 1950s to the mid-1960s. The ICBM was the weapon of choice as bombers became more vulnerable to improving air defenses. To extend the life of the bomber fleet, standoff cruise missiles that launched outside the adversary's air defense zone were developed. The bombers with these types of missiles are still deployed and each state plans to use them until at least the mid-21st century. Both countries consider their fleet of SSBNs (Submersible Ship Ballistic Missile Nuclear) as the most survivable leg of their respective nuclear triads.

The United States and Russia are in the process of replacing each element of the nuclear triad. Of the two, Russia is further along. The United States is just getting started. Russia has deployed four new Borei SSBNs and plans to add another six. These submarines carry a new SLBM, (submarine-launched ballistic missile), the Bulava. Russia is also replacing its ICBMs with new missiles and have ordered ten new Tu-160MS bombers and are designing a Tu-PAC stealth bomber.

The United States plans on replacing its 400 silo-based 50-year-old Minuteman 3 ICBMs with the new Ground Based Strategic Deterrent (GBSD) missile and its Ohio Class SSBNs with Columbia class SSBNs that will enter service in 2031. The long-range bombers will also be replaced starting in 2025 by a new stealth bomber, the B-21. One hundred of the B-21 bombers have been ordered along with a new Long Range Stand Off Missile (ALCM).

Peoples Republic of China (PRC)

The PRC tested it first atomic bomb in 1964 and its first ICBM in May 1980. It deployed eighteen of these liquid fuel DF-5 ICBMs that were upgraded in 2015. Over the next 35 years China built out its nuclear triad with mobile ICBMs and currently deploys six SSBNs with at least seventy-two launch tubes. It has begun to test a next generation of SLBMs and construction of a new class of SSBN to carry it. It also finished building about 100 new H-6K intermediate-range bombers and began production of the H-6N bomber capable of carrying a variant of the DF-21 ballistic missile. A new H-20 stealth bomber with an estimated range of 8,500 km is expected to begin testing in late 2021 or 2022.

The biggest surprise in 2021 was the discovery of over 200 missile silos under construction in the western desert for DF-41 solid fuel ICBMs. This discovery and the other additions to the nuclear triad shows that China may double their nuclear weapons arsenal by 2030—as asserted by the US Department of Defense.[3] This development wouldportend a huge departure from their 30 years of deterrence and possibly also their declaratory doctrine of no-first use.

India

India has joined the nuclear triad club late and is now adding modern delivery systems. The strongest part of their triad is ground-launched ballistic missiles. The nuclear-capable Prithvi 1 and 2 and Agni 1 to 5 missiles are mobile and include short- and intermediate-range weapons with an ICBM under development. India's naval SSBN force currently consists of two operational submarines with two more under construction. The two existing SSBNs have a total of thirty-six short-range missiles, but some or all of these will be replaced with twelve intermediate-range missiles in the near future. The aircraft triad piece consists four types of short-range fighter-bombers. They mainly carry unguided free fall bombs. However, forty Su-30MKI fighters have

[3] "Two decades later, the PLA's objective is to become a "world-class" military by the end of 2049—a goal first announced by General Secretary Xi Jinping in 2017. Although the CCP has not defined what a "world-class" military means, within the context of the PRC's national strategy it is likely that Beijing will seek to develop a military by mid-century that is equal to—or in some cases superior to—the U.S. military, or that of any other great power that the PRC views as a threat." US Department of Defense, *Military and Security Developments involving the People's Republic of China*, 2020, Office of the Secretary of Defense, Annual Report to Congress, at: https://media.defense.gov/2020/Sep/01/2002488689/-1/-1/1/2020-DOD-CHINA-MILITARY-POWER-REPORT-FINAL.PDF

been modified to carry the BrahMos supersonic nuclear capable cruise missile. BrahMos missiles are also launched from ground Transporter, Erector, Launchers (TEL), surface ship, and submarines. A hypersonic version of this missile is under development.

India's large number of short to medium range missiles reflects their primary historical nuclear adversary was Pakistan. Over the last 20 years, however, China has become a major problem for India as the two countries have had several skirmishes along India's northern border with China. These actions and the fact the China has become Pakistan's primary arms supplier has probably driven India to deploy IRBMs and to develop their ICBM.

Pakistan

Since the Partition, Pakistan has viewed India to be its mortal enemy. All Pakistani deployed missiles were developed with India as their target. Pakistan is also close to developing a nuclear triad. The ground-launched ballistic and cruise missiles are the largest portion of this triad. The Mirage 3 fighter-bombers can deliver nuclear bombs and some were probably modified to carry the Ra'ad-1 nuclear-capable cruise missile. The Ra'ad-2 longer-range version is planned to replace the older version beginning in 2021. The Babur-3 nuclear-capable cruise missile is the submarine version of missile and was tested at sea in 2017 and 2018. It is possible it will be deployed on the three current Agosta class submarines and the eight Hangor class submarines ordered from China.

Democratic Peoples' Republic of Korea (DPRK)

The DPRK's nuclear-capable missiles today are land-based and mobile. They are short- to intermediate-range operational missiles, with at least three intercontinental range missiles under development. September 2021 was a very busy month for testing new missiles. The first of these were two long-range ground launched cruise missiles. The DPRK reported these were successful. Next were three short-range ballistic missiles that were successfully launched from a rail train car. These were quickly followed by a ground launch what they called the HS-8 hypersonic missile. Its booster appears to be a one third shorter version of the HS-12 IRBM. Then on 19 October 2021 they launched a short-range missile probably from the submerged Gore submarine and clamed it was successful.

The DPRK is testing an intermediate-range submarine ballistic missile and modifying a conventionally powered submarine with three launch tubes for these missiles. This submarine is expected to be in the water in 2021/2022. They may also be building a nuclear powered submarine with six launch tubes although there is no hard evidence of this intention. The DPRK's air force also has at least two types of aircraft that are capable of carrying gravity nuclear bombs. There is no publicly available data, however, to indicate any of them have been modified to carry these bombs or any nuclear-armed missiles.

DPRK has a very diverse arsenal of missiles. How this came to be is not typical. The DPRK first acquired Soviet Scud missiles from Egypt, copied them and deployed them against the ROK and US forces in the ROK. They soon determined there was a market for these missiles in the Mideast and Pakistan and sold not only the missiles but also the factories to make them. They scaled up the technology and produced a longer-range missile that also sold. With time, they established a strong relationship with Iran and continue to work with them on the latter's space program.

The DPRK were assisted by Russia or Ukraine to obtain high energy fuel engines. They were also assisted by China on solid fuel motors and commercial trucks, which they modified into TELs. The DPRK continues to surprise most experts on what they will do next. But it is self-evident that the DPRK's highest priority is to develop an ICBM that threatens the US mainland.

Missiles in Detail

The nuclear-capable missiles discussed in this chapter are all offensive weapons launched from silos, vehicles, surface ships, submarines, and aircraft. They are classified as ballistic missiles, cruise missiles, and a few are hybrid missiles, mainly the new hypersonic glide vehicles. The ballistic missiles can have one to four stages, where cruise missiles usually have a booster and a sustainer stage. Missiles can have solid fuel motors, liquid fuel engines, or a combination of both to power them, and Russia is now developing a nuclear engine.

In this chapter, missiles are grouped together by maximum range: Close 50 to 300km, Short 300 to 1,000km, Medium 1,000 to 3,000km, Intermediate 3,000 to 5,500km, and Intercontinental 5,500 to 15,000+km. Submarine and air launched missiles are listed as SLGMs (submarine-launched guided missiles) and SLBMs and ALCMs (air-launched cruise missiles) followed by their ranges.

The typical ways these ranges are shown are by range rings radiating out from the country or launch site. Maps in most media presentations show these rings to compare the various missiles a country has deployed and the areas they cover. If not updated, these graphics can show bogus information. For example some DPRK rings maps include the Hwasong-10 (Musudan) IRBM and Hwasong-13 (KN-08) ICBM as deployed when they are terminated programs and the Unha 2/3 (Taepo Dong-2) as an ICBM when it is a space launch vehicle. Shorter-range missiles usually carry lower yield nuclear warheads where throw weight is restricted. Longer-range missiles can carry one large warhead or multiple warheads, some with a post boost vehicle so they can be independently targeted.

This essay divides missile states into three groups. Group one includes United States, Russia, People's Republic of China, and India. These countries all have operational nuclear triads that consist of land-based missiles, either in silos and mobile vehicles or both, sea based ballistic or cruise missiles in nuclear submarines, and airborne cruise missiles or bombs. Group two consists of countries that have nuclear weapons that are mainly deployed on ground vehicles. These countries include Pakistan and the DPRK. Group three comprises countries that do not currently have nuclear weapons but have the capability to produce the warheads and the missiles to carry them. These countries include Japan, the ROK, and Taiwan. A fourth country, Indonesia, was not included because it currently has limited capability to develop nuclear weapons and the missiles to deliver them. Group one and two countries are discussed in this essay.

If one sorts these countries according to those that are currently missile or missile component proliferators, one finds that this the list includes China, Russia, and the DPRK. A few of the countries that received missile-related material are in Group two—Pakistan, India, and the DPRK. In the 1970s and 1980s, for example, Pakistan received liquid fuel missile technology from the DPRK and solid fuel technology from China. The DPRK reverse engineered Soviet liquid fuel Scud missiles received from Egypt and sold the missiles they made to several Mid-Eastern countries and Pakistan.

Most of the countries with the exception of Pakistan have space launch vehicle (SLV) programs. The majority started using rockets derived from earlier missile programs; these include the United States, Russia, China, and India. Japan received early help from the United States. The

ROK received the Atlas design and manufacturing plant from the United States in 1974, and Russia provided the first stage for the ROK's first KSLVs.

All missile and space-launch rocket countries have developed satellites and satellite components. The most advanced are the Group one countries plus Japan. These are followed by the ROK and Taiwan. With Chinese help, Pakistan has a modest capability and the go-it-alone DPRK has the most primitive program having launched and orbited two satellites, neither of which became operational.

In the last few years two new classes of hypersonic weapons have matured and begun deployments. These are hypersonic glide vehicles (HGV) launched by a rocket before gliding to a target and hypersonic cruise missiles powered by high-speed air-breathing engines or scramjets. Russia has stated they deployed an HGV in December 2019 identified as Avangard aboard two SS-19 ICBMs and armed them with a nuclear warhead. China also has the DF-17 medium-range ballistic missile (MRBM) that reached initial operating capability (IOC) in 2019 and is a DF-ZF HGVs mounted on a DF-16 ballistic missile. They have reportedly not decided if these weapons, once they are deployed, will be nuclear- or conventional-armed or dual-capable. The United States has in development at least four hypersonic missiles but has not decided to deploy any of them yet. As of mid-2010 they have made decisions these hypersonic weapons would only be conventionally armed. India also has a hypersonic cruise missile under development with help from Russia. The DPRK had their first launch of a hypersonic missile in September 2021.

United States of America

In the 1950s, the United States deployed both strategic and tactical nuclear weapons systems consisting of surface-to-surface missiles, submarine-launched missiles and air-launched missiles from bomber aircraft. In the 1960s and 70s the US nuclear triad consisted of 1000 Minuteman 1 intercontinental ballistic missiles (ICBMs), forty-one George Washington class submarines each carrying 16 Polaris SLBMs with single warheads, and B-52 heavy bombers.

Due to the various Strategic Arms Treaties with the USSR/Russia, the United States reduced its nuclear capable weapons today to 400 silo-based Minuteman 3 ICBMs with one warhead,[4]

[4] Fifty Minuteman silos are reportedly unmanned and on warm standby—that is, can be quickly made operational.

fourteen Ohio class submarines each armed with 20 Trident 2 D5 missiles [5] with up to ten warheads but normally these missiles carry only four today; and 20 B-B-2A and 46 B-52H[6] nuclear-capable bombers. The B-2As are only authorized to carry nuclear gravity bombs whereas each B-52H may be loaded with up to twenty nuclear-capable ALCMs (AGM-86B cruise missiles). The B-52s are no longer are authorized to carry nuclear gravity bombs. The 62 B-1 heavy bombers in service today have not been nuclear capable since 2007 when their nuclear capability was disabled for START treaty compliance.

The New START Treaty went into force in 2011 and was set to expire 5 February 2021. On that date the United States and Russia agreed to extend this treaty until 5 February 2026. On February 5, 2018, both the United States and Russia announced they had met the New START limitations, which limits the number of nuclear warheads and launch systems for long-range nuclear capable weapons as of March 2019 to the following:

- number of nuclear warheads - 1,550, United States 1,365, Russia 1,461
- deployed long-range delivery vehicles-700, United States 656, Russia 524
- deployed and non-deployed launchers and delivery vehicles: United States 800, Russia 760

With the exception of the nuclear gravity bombs carried on the 20 B-2 bombers all the other US warheads are carried by missile systems.

Inter-Continental Ballistic Missiles, Land Based

The only operational ICBMs today are the 400 Minuteman 3 missiles deployed at Malmstrom Air Force Base (AFB), Montana, Minot AFB, North Dakota, and F.E.Warren AFB, Wyoming. The three-stage solid fuel missile is 18m in length and 1.67m in diameter and has a range of 9700 kilometers plus. The first of these missiles was loaded in an operational silo in April 1970 and had three re-entry vehicles (RV). With the START 2 treaty these missiles were De-MIRVed to one RV

[5] Four of the 18 Ohio Class SSBNs were converted between 2002 and 2006 to SSGNs and no longer are nuclear capable. Each can carry up to 154 Tomahawk cruise missiles. In addition four of the missile tubes on the remaining fourteen Ohio class SSBNs were deactivated in 2011 In anticipation of the New START treaty for a total of fifty-six launch tubes no longer nuclear capable.

[6] Eighteen B-52H are in reserve and 12 more are in long-term storage. The B52H bombers are starting a big upgrade by getting new engines and electronics that will keep them in service into the2050s. See "Rapid Fire, Ageless Bomber," *The American Legion Magazine,* November 2021, p 56.

starting in 1996. Today the 400 deployed Minuteman 3 missiles continue to have only a single warhead. Currently four to five Minuteman 3 missiles are tested from Vandenberg AFB each year to a mid-Pacific impact area located at Kwajalein. For the remaining about ten plus years that Minuteman 3 will be operational, the yearly launch rate will fall to two to three per year because of a dwindling supply of these missiles.

The United States Air Force is in the early phase of replacing the 400 Minuteman 3 ICBMs. The program is identified as the Ground Based Strategic Deterrent (GBSD). It includes a new missile and much of the ground-based infrastructure at the three existing Minuteman missile bases. The Minuteman 3 system will be well over 60 years old in 2027-29 when the GBSD begins deployment.

The GBSD missile is in development and will consist of three solid fuel stages and is planned to carry a single RV with a W87 Mod 0 nuclear warhead. The current plan is to produce 642 missiles to replace the 400 deployed Minuteman 3 missiles. The other 242 missiles are for flight tests and spares to be used over the 50-year lifetime of the GBSD. Due to the change of administrations in 2021 these dates and numbers may change.[7]

SLBMs

To be compliant with the New START Treaty the Navy reduced the number of Trident 2 D5LE[8] (UGM-133) missiles carried by each of the fourteen Ohio Class SSBNs from twenty-four to twenty. Currently there are total of 280 Trident 2 D5LE missiles operational in the United States Navy and sixty-four in the United Kingdom's Royal Navy. Each US missile now has a single nuclear warhead, but when first deployed they had three MIRV warheads. This Trident 2 D5 missile was first tested in January 1987 from a flat pad at the Cape Canaveral Air Force Station and first launched from a submarine in March 1989. Its first deployment took place in 1990. The missile is 13.58m long and 2.11m in diameter. Its stated range is 12,000km (7,500mi), but its exact range is classified.

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[7] John A. Tirpak, "New GBSD To Fly in 2023; No Margin Left for Minuteman - Air Force Magazine," *Air Force Magazine*, June 14, 2021, https://www.airforcemag.com/new-gbsd-will-fly-in-2023-no-margin-left-for-minuteman/

[8] "Reduce the Number of Ballistic Missile Submarines," Congressional Budget Office, November 13, 2013, https://www.cbo.gov/budget-options/2013/44770

Currently eight Ohio Class SSBNs are based at Naval Base Kitsap, Washington State, and six are bases at Naval Submarine Base Kings Bay, Georgia. Two of the converted Ohio-Class SSGNs are based at both of these bases. These SSGNs are each loaded with 154 Tomahawk BGM-109 cruise missiles that are not nuclear-capable.

The Columbia-Class SSBN program, the replacement for the Ohio-Class SSBN, is under way. The first will enter service in 2031. The current plan is to deliver one of these submarines per year with all twelve to be completed by 2042 and remain in service until 2085.

The new submarines contain sixteen missile tubes for a total of 192 Trident 2 D5LE (Life Extension) missiles with each planned to carry four[9] warheads. This is the same missile carried by the Ohio class SSBNs today. The first of these missiles went into service in 1990 on the Ohio class submarines. Life extensions are planned to remain in service on the Columbia Class until 2042. The missiles will have about a 50-year lifetime. There is no information on a replacement missile system at this time.[10]

ALCMs carried by Long-Range Bombers

The United States currently operates two types of nuclear-capable strategic bombers. These are the 70 year old B-52H Stratofortress models and the newer 30 year old stealth B-2 Spirits. The 20 B-2 bombers are now only authorized to carry nuclear gravity bombs. The United States also operates a third long-range bomber, the B-1 Lancer, that since 2007 is no longer nuclear-capable. Sixty two of these bombers are currently in service.

There are fifty-eight B-52H bombers in service with eighteen in reserve and twelve more in long-term storage. The B-52H bombers are equipped to carry up to twenty nuclear capable AGM-86B Air Launched Cruise Missiles (ALCM). The aircraft are no longer authorized to carry nuclear

[9] Correction made by author on March 24, 2022. The original sentence said ‘single’ instead of ‘four’ warheads.

[10] Ronald O’Rourke, “Navy Columbia (SSBN-826) Class Ballistic Missile Submarine Program: Background and Issues for Congress” (Washington DC: Congressional Research Service, 30 June 2021); “Columbia-Class Submarine,” Wikipedia, accessed September 6, 2021, https://en.wikipedia.org/w/index.php?title=Columbia-class_submarine&oldid=1042774524; Huntington Ingalls Industries, “Huntington Ingalls Industries Awarded Contract for Construction of First Two Columbia-Class Submarine Modules,” *Huntington Ingalls Newsroom*, November 23, 2020, https://newsroom.huntingtoningalls.com/releases/huntington-ingalls-industries-awarded-contract-for-construction-of-first-two-columbia-class-submarine-modules; “Columbia Class,” General Dynamics Electric Boat, accessed September 7, 2021, http://www.gdeb.com/about/oursubmarines/columbia/

gravity bombs. The AGM-86B has been in the inventory since 1982 and 1715 were produced. The missile is 6.3m in length and 620mm in diameter. It is subsonic at 890km/h and has a nominal range of 1,100km (680mi).[11]

The US Air Force (USAF) plans to replace the AGM-86B with a new cruise missile, the Long Range Stand off (LRSO) AGM-181. This missile will be capable of being armed with either nuclear or conventional warheads. The USAF awarded a contract on 1 July 2021 for engineering and manufacturing development that, with options, could be valued at about $2 billion. The AGM181 would be deployed on B-52H, B-2, and the new B21 bombers late in the decade. The B-21s will be based at three existing bomber bases: Ellsworth AFB, South Dakota; Whiteman AFB, Missouri; and Dyess AFB, Texas.[12]

The B-21 Raider is the new intercontinental stealth bomber that will enter service in 2025 and will replace some or all of the B-52H, B-1, and B-2 bombers. The initial order is for 100 B-21s, with possible future orders. The aircraft will be able to deliver conventional and nuclear weapons. It is also possible that the AGM-183A Hypersonic Glide Vehicle would also be carried on the B-21 bombers. The first B-52H is currently going through integration for the AGM-183A missile. The B-21s will be based at three existing bomber bases, listed above. Like the Minuteman replacement program, the numbers of the LRSO/AGM-181 and AGM-183A missiles and B-21 bombers may be cut back by the 2021 administration.[13]

Hypersonic Glide Vehicles

The US Department of Defense (DOD) has at least three Hypersonic Glide Vehicles currently under development. These are Air Force, AGM-183A Air-Launched Rapid Response weapon; Army, Long Range Hypersonic Weapon (RHW); and Navy, Intermediate Range Conventional

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[11] Missile Defense Project, "AGM-86 Air-Launched Cruise Missile (ALCM)," Center for Strategic and International Studies, last modified July 31, 2021, https://missilethreat.csis.org/missile/alcm/

[12] O. Pawlyk, "The Air Force is discussing plans to house its new B-21 stealth bombers," *Military.com* , January 15 2021, at: https://www.businessinsider.com/air-force-discusses-building-hangar-for-future-b21-stealth-bomber-2021-1?r=AU&IR=T

[13] "B-21 Raider," U.S. Air Force, July 6, 2021, https://www.af.mil/About-Us/Fact-Sheets/Display/Article/2682973/b-21-raider/

Prompt Strike (IRCPS). In addition DARPA is doing research on the Hypersonic Technology Vehicle-2.[14]

All are designed to carry conventional warheads to ranges of 1,500-3,000 nautical miles (nm). According to official DOD statements none are planned to fly greater that 3,000nm or be armed with nuclear weapons. The Army and Navy have combined their programs. The Army plans to deploy it's first battery in Fy2023. The Navy's program will come online two years later. The B-52 and the future B-21 bombers would probably carry the AGM-183A if it were deployed. Flight-testing has begun and an early operational capability is now planned for late FY 2022.[15]

Russian Federation (Russia)

The former Soviet Union (USSR) deployed its nuclear triad in the 1950/60s on a pace with the United States. By the end of the Cold War, all elements of the now Russian triad had been upgraded with new launchers, missiles, and support equipment. After signing the various arms control agreements with the United States, one class of missiles were eliminated (IRBMs) and limits on strategic weapons (ICBMs), SLBMs, and long-range bombers were put into place. As the Cold War ended and Soviet Union broke apart, US-Soviet era arms control treaties were continued with Russia. The strategic weapons Russia inherited from the USSR became the treaty-counted weapons. Many of these are still deployed and operational today.

ICBMs

Russia is upgrading and replacing much of the older Soviet nuclear weapon systems and developing unique new weapons. New START is the last remaining nuclear treaty between the two countries, and Russia and the United States agreed to extend it for five years until 5 February 2026.

The USSR deployed its first ICBM in 1957 and development of these missiles continues with Russia.

[14] Steve Trimble, "ARRW Revealed," *Aviation Week and Space Technology*, July 26, 2021.
[15] "U.S. Hypersonic Missile Upgrade Concepts Are Now Advancing," *Aviation Week Network*, July 16, 2021, https://aviationweek.com/defense-space/missile-defense-weapons/us-hypersonic-missile-upgrade-concepts-are-now-advancing

Table 2: Russia's ICBMs Currently Deployed

Missile[16]	Status
SS-18/Satan	46 Heavy ICBM operational in silos
SS-19/Stiletto	2 operational silos with the Avangard WH
SS-25/Topol	36 operational, mobile being phased out
SS-27/Topol-M1	78 operational mobile,
SS-29/Sarmat	Heavy ICBM being deployed, replaces the SS-18

The Soviets/Russians developed and tested sixteen ICBM missile systems since 1957 and deployed thirteen of them. Of the deployed systems, four are in service in 2020 and one is being installed. This number does not include the many variants of most of the deployed systems

SS-18 Mod-6

The liquid fuel SS-18 Satan, considered a heavy ICBM, replaced the SS-9. It was deployed in SS-9 silos in 1974 and it has appeared in six variants with only the single warhead Mod 6 deployed today. The initial operational capability was in 1975. As of 2020, Russia has forty-six SS-18 Mod-6 missiles operational and the SS-29 Sarmat is replacing them at the Dombarovsky Air Base and the Guards Rocket Army at Uzhur

SS-19M4 with the Avangard HGVs

Of the nearly 400 SS-19 missiles that were deployed in the 1980s, twenty remained in service in 2016 and two SS-19M4s were in service in 2020. These two were located at the Dombarovsky ICBM site with Avangard Hypersonic Glide Vehicles (HGV) warheads. It was reported that twelve Avangard would be deployed using the SS-19M4 booster until the Sarmat heavy ICBMs are

[16] These missile names and designated numbers are those given by Western intelligence agencies and are not those used by the Soviet military.

deployed. The Avangard HGV was one of the new weapons released by President Putin in his February 2018 speech.[17]

SS-25 Topol, RS-12M

This missile is identified as Sickle by the United States and has a Russian program name RT-2P. The SS-25 Topol is a three-stage solid fuel mobile ICBM with a single warhead. At its high point, 400 of the SS-25 missiles were deployed. About thirty-six of the SS-25 missiles were reportedly deployed in early 2020 and will be phased out in two to three years. Currently the SS-27M1 and SS-29M2 missiles are replacing them.

SS-27 Topol-M, RS-12M1 mobile and RS-12M1 silo

This missile has been named Sickle B by the United States and has a Russian program name RT-2PM2. The SS-27 appears to be an improved SS-25 and was deployed in a mobile version as Mod 1 and Mod 2 silo version. Only eighteen Mod 1s were deployed at the Teykovo ICBM Base and sixty mod 2s at the Tatishchevo missile site. The Russians announced in 2009 that production of the SS-27 missiles was complete. It is probable that no more will be deployed. This limited deployment may have been in response to the launcher limits of the New START treaty.[18]

SS-27 Mod 2, RS-24 (Yars) mobile and silo versions

The Yars RS-24 was identified by the USAF National Air and Space Intelligence Center (NASIC) as similar to the SS-27 Mod-1 and not a new missile as claimed by Russia. The United States identifies it as the SS-27 Mod2. However, Russia has said it is a new missile and should be identified as such. In addition, a rail-transported version of the missile identified as RS 24 BZhRK Barguzin, designated the SS-X-32, was under development. Because of lack of funds, however, Barguzin development was frozen in December 2027.[19]

SS-X-31 Frontier, RS-26 Rubezh, (Avangard booster)

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[17] Missile Defense Project, "Avangard," Center for Strategic and International Studies, last modified July 31, 2021, https://missilethreat.csis.org/missile/avangard/

[18] Missile Defense Project, "RT-2PM2 Topol-M (SS-27 Mod 1 "Sickle B")," Center for Strategic and International Studies, last modified August 2, 2021, https://missilethreat.csis.org/missile/ss-27/

[19] Missile Defense Project, "RS-24 Yars (SS-27 Mod 2)," Center for Strategic and International Studies, last modified August 12, 2021, https://missilethreat.csis.org/missile/rs-24/

The RS-26 is a two-stage missile with upgraded Yars first and second stages. The United States claims that it replaces the SS-20 IRBM eliminated by the INF treaty and can only fly to the minimum ICBM range with a light or no warhead. Its first test from Pletesk on 27 September 2011 failed. But on its second test on 23 May 2012, it flew 5,800 km to the Kura impact site on Kamchatka. Three additional tests on 24 October 2012, 6 June 2013, and 18 March 2015 flew 200km from Kapustin Yar to the Sary Shagan impact area.

The SS-X-31 missile is estimated to be 12m long and 1.8m in diameter. On 22 March 2018 Tass reported all work on Rubezh had been put on hold until the end of 2027. Work on the Avangard HGV would continue for deployment on other booster rockets.[20]

SS-29 (Satan 2), RS-28 (Sarmat) Heavy ICBM

The SS-29 is the replacement for the more than 30 year old SS-18 Satan heavy ICBM. Russian officials state that the missile with begin serial production in 2020 and enter service in 2021, a delay of five or six years from the initial first service 2016 date. The missiles will be deployed at the two remaining SS-18 sites, the Dombarovsky Air Base and the Guards Rocket Army at Uzhur, and will be deployed in modified SS-18 silos. The SS-29 is a two-stage rocket, 35.5m long and 3m in diameter. The maximum range is 18,000km with ten MIRVs. Avangard HGVs are also planned to be warheads for SS-29 booster rockets. Russia also has more than 120 SS-18 and SS-19 non-deployed missile silos that are preserved for future potential new ICBMs.[21]

Russian SLBMs

At the end of the Cold War in 1991, Russia inherited sixty-two SSBNs with 940 launch tubes compared to the United States with thirty-four SSBNs and 632 missiles, as a result of the START and then New START treaties. As of late 2020 Russia has eleven operational SSBNs with 180 missiles. They also have four project 955A Borei-2 submarines deployed and plans for at least two more. These will replace the remaining Delta-3 and 4 submarines. They have also retained one Typhoon Program 941UM SSBN as a Bulava SLBM test submarine.

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[20] Missile Defense Project, "RS-26 Rubezh," Center for Strategic and International Studies, last modified July 31, 2021, https://missilethreat.csis.org/missile/ss-x-31-rs-26-rubezh/

[21] Missile Defense Project, "RS-28 Sarmat," Center for Strategic and International Studies, May 17, 2017, last modified July 31, 2021, https://missilethreat.csis.org/missile/rs-28-sarmat/

Nuclear-Capable Missiles

There are three types of SLBMs currently operational in the Russian Navy. The oldest is the liquid fuel SS-N-18 Stingray on one Delta-3 submarine in the Pacific Fleet. The SS-N-18 missile will be replaced in one or two years by the solid fuel Bulava SS-N-30 when the next Borei SSBN arrives in the Pacific. There are 6 Delta-4 SSBNs operational on the North Fleet and each carries sixteen liquid fueled Skif SS-N-23 SLBMs for a total of ninety-six launch tubes. The North and Pacific Fleets currently each have two Borei class SSBNs. The North Fleet has one Borei with sixteen launch tubes and a Borei-2 with twenty tubes. It is probable that the Northern Fleet will get at least four more Borei-2 submarines and the Pacific Fleet at least two more.

SS-N-32 RSM-56 Bulava SLBM

The RSM-52 Bulava SS-N-32 missile is the third solid propellant SLBM deployed by the Russian Navy and it appears to be a distant relative of the Topal M SS-27. The one remaining Typhoon, Dmitriy Donskoy, was modified from 1990 to June 2002 to be the test submarine for the Bulava SS-N-32 missile. It had twenty launch tubes, one of which was fitted with a Bulava launcher for the new missile.

The Bulava missile is a three-stage missile with stages one and two solid fuel and stage three liquid. It is 12.1m long and 2m in diameter. It carries six to ten warheads and has a range of 8,000 to 10,000km. First stage tests were completed in late 2004, and tests from the Dmitriy Donskoy began in 2005. These tests into 2009 had six failures in thirteen flights. Tests were then put on hold until October 2010. In June 2011 the first test from a Borei submarine took place. Because of failures more testing took place. The Russian Navy finally accepted the missile into service in June 2019. Its range is greater than 9,000km.[22]

Kanyon weapons systems, Poseidon/Status-6/ Skif seabed-launched variant

Kanyon has been referred to as a "new intercontinental, nuclear-armed, nuclear-powered undersea autonomous torpedo." Not a true missile, it is not covered by the New START Treaty. The first mention of this weapon was on Russian television in 2015, and President Putin highlighted it in his February 2018 national address. The weapon was estimated to be capable of traveling

[22] Missile Defense Project, "RSM-56 Bulava (SS-N-32)," Center for Strategic and International Studies, August 10, 2016, last modified August 2, 2021, https://missilethreat.csis.org/missile/ss-n-32-bulava/

thousands of nautical miles at about 70-100 knots at depths of 1,000m. It has been designed to be a strategic weapon to destroy naval bases, ports, and coastal cities with a two-megaton nuclear warhead detonated under water. Estimates are Kanyon will become operational in the late 2020s.

The torpedo is 24m in length and 1.6m in diameter. Underwater testing was reported to have begun in December 2018, but systems tests could have started in 2016. The massive torpedo will be capable of being launched from the Sarov test submarine, the Khabarovsk class of operational submarines, the Belgorod special mission submarine (crewed but not controlled by the Russian Navy), and possibly from launchers emplaced on the seabed.[23]

Sarov B-90 Test Submarine

Construction of the test submarine Sarov B-90 began in Nyhny Novgorod in 1988 as a Kilo class conventional powered attack submarine but was stopped because of funding in 1998 when it was 40 percent complete. It was moved via the inland waterway to the Sermash shipyard in Severodvinsk sometime around 2003 and construction resumed. It was renamed Sarov B090. It was heavily modified with a nuclear electric power plant and a single large torpedo tube about 25m long 2m in diameter in the bow. It was accepted into Navy service in August 2008. Tests of the Status 6 torpedo started at least by September 2009 in the White Sea.[24]

Belgorod SSN

The second unit that carries the Status 6/Skif nuclear torpedo is the afore-mentioned Belgorod Project 09852 Special Mission Submarine. The Belgorod was an unfinished Oscar-2 SSGN that has been extensively modified starting in 2012 and finally launched in April 2019 from the Sermash shipyard. The Belgorod is manned by the Navy but operated under the Main Directorate Deep Sea Research (GUGI). GUGI's main missions are underwater intelligence and placement of weapons and sensors on the sea floor. The Belgorod is reported to be the longest submarine the

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[23] Charlie Gao, "Russia's Deadly Status-6 Nuclear Torpedo: 1 Fact You May Not Know," *The National Interest*, March 2, 2019, https://nationalinterest.org/blog/buzz/russia%E2%80%99s-deadly-status-6-nuclear-torpedo-1-fact-you-may-not-know-46002; H.I. Sutton, "Analysis - Russian Status-6 Aka KANYON Nuclear Deterrence and Pr 09851 Submarine," Covert Shores, December 19, 2016, http://www.hisutton.com/Analysis%20-%20Russian%20Status-6%20aka%20KANYON%20nuclear%20deterrence%20 and%20Pr% 2009851%20submarine.html

[24] "Russian Submarine Sarov (B-90)," Wikipedia, last modified May 29, 2021, https://en.wikipedia.org/w/index.php?title=Russian_submarine_Sarov_(B-90)&oldid=1025823327

world. It entered the White Sen in June 2021 to start sea trials and could be delivered to the GUGI/Navy probably in 2022.[25]

Khabarovsk SSNs

The first of a new Khabarovsk Class, Project 09851, SSNs is planned to be launched in the fall of 2021 from the Sermash shipyard.[26] Work started on this submarine in 2014 and three more are reportedly to be built. The second of these is reported to be under construction. These submarines are based on the design of the Borei class SSBNs minus the section that carries the ballistic missiles. Like the Belgorod it will carry six of the Status 6 nuclear torpedoes mounted in the bow. If all four of these submarines are built, then two will likely be delivered to both the Northern and Pacific fleets.

Seabed based Status 6/Skif launched variant

A question that needs to be answered is why was the Belgorod modified to carry the Status 6 nuclear inter-continental torpedoes? Russia already had the Sarov test submarine and the first of operational Khabarovsk Class submarines that will carry six of the Status 6 torpedoes will be launched in the fall of 2021.

Where does the very expensive Belgorod that does not report to the Navy and has several other missions fit? One of the possibilities is a test sub for the procedures to handle and load the six torpedoes for crews that will man the Khabarovsk subs. A second possibility is the Belgorod had space for these weapons and made it available to the Navy so there would be six more weapons in the Northern fleet. Although possible, neither of these possibilities is realistic because the Navy does not operate the Belgorod and the submarine will have other very sensitive missions, such as cable tapping, installing underwater sensors, and sonar imaging foreign targets.

[25] H.I. Sutton, "New Details of Russian Belgorod "Doomsday" Submarine Revealed," *USNI News*, February 25, 2021, https://news.usni.org/2021/02/25/new-details-of-russian-belgorod-doomsday-submarine-revealed

[26] Xavier Vavasseur, "Russia's Khabarovsk Submarine to Be Launched in Fall 2021," *Naval News* (blog), April 19, 2021, https://www.navalnews.com/naval-news/2021/04/russias-khabarovsk-submarine-to-be-launched-in-fall-2021/

Skif version of Status-6 launcher on the seabed

A few reports mentioned a seabed-based Skif version of the Status 6 torpedo, but it is not known if this variant exists. If it does, that would explain perhaps that the Belgorod and GUGI would be involved. Belgorod could be the delivery means to place the Skif torpedoes in their protective enclosures undetected on the seabed and probably under the ice during winter. The Skif system would need reliable, secure, and redundant communication links to send status and local surveillance data back to the onshore command authorities. That authority would require return links to update targeting data and issue launch orders.

A ready-made communication system that will exist in the Arctic is the Russian project Harmony underwater listening system. To power the Harmony sensors, GUGI has developed small nuclear-powered electrical generators that also sit on the seafloor. These generators could also power the Skif launchers. Harmony already has all the facilities needed to support the Skif system including providing surveillance of the specific Skif deployment area and the surrounding sea.[27]

ALCMs carried by Russian Long-Range Bombers

Tu-160MS Blackhawk Bombers

Russia has two long-range bombers, the 40 year old Tu-95MS Bear H and the 30 plus year old Tu-160MS Blackhawk (Russian name White Swan). Production of the Tu-160MS began in 1981 and thirty-six bombers were produced through 1987. At the fall of the USSR, Russia had seventeen and the Ukraine had nineteen of the bombers. They returned eight to Russia and elevyn were scrapped. A new Tu-160MS was assembled from leftover parts and delivered to the Air Force in 2017, and there was a further order for 10 aircraft that are under construction. Of the remaining Tu-160MS, as of March 2020, sixteen were included in the bomber count for the New START treaty.[28]

[27] Garmoniya/Harmony - RUSOSUS, GlobalSecurity.org, https://www.globalsecurity.org/intell/world/russia/harmony.htm
[28] "Tupolev Tu-160," Wikipedia, accessed August 23, 2021, https://en.wikipedia.org/w/index.php?title=Tupolev_Tu-160&oldid=1040318700

Nuclear-Capable Missiles

Tu-95MS Bear H Bombers

The Tu-95MS was based on the design of the 1950s Tu-95A/B and modified with new engines and electronics. Construction began in 1981 and it entered service in 1987. A production run of sixty-five to seventy of these bombers ended in the late 1980s. Sixty-three were counted in 2010 for the New START Treaty and fifty-five are in service as of 2020. Modernization of these airplanes has continued. The Tu-95MS are planned to remain in service until 2050s as an engine replacement program and new electronics installation are underway.

Stealth Bomber Tu-PAC DA nearing testing

Russia also has under construction a Tupolev PAC DA stealth strategic bomber prototype. Planning for the aircraft began in 2009, and building of the prototype began early 2020 to be completed in 2021. If successful this aircraft would be built in small numbers and not enter service until the late 2020s.[29]

Kh-101/102 Raduga stealth cruise missile

The Tu-95MS and Tu-160MS bombers are being configured to carry the Kh-101 (conventional warhead)/102 (nuclear warhead) ALCMs. The Tu-95MS can carry eight missiles on under wing pylons and the Tu-160 can carry twelve missiles internally. These missiles are replacing the Kh-15SM Granet/AS-15 Kent that has been in service since 1984 are still carried on the bombers that have not yet been upgraded.

The Kh-101/102 has a range of 4,500-5,500km and a speed of 900km/h. These missiles are subsonic, fly a low altitude profile (30-70m off the ground), and can receive updated target information while on-route. The Kh-102 is a standoff nuclear missile for the Russian strategic bombers. The Kh-101/102 entered service in 2012.

An improved version of the Kh-101/102 identified as the Kh-BD is set to enter service on the Tu-160MS bombers in 2020. Its range has been extended out to 6,000 to 7,000 km.[30]

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[29] Kris Osborn, "PAK DA: Russia's Mysterious Stealth Bomber Is Coming," *The National Interest*, July 20, 2021, https://nationalinterest.org/blog/buzz/pak-da-russias-mysterious-stealth-bomber-coming-190021

[30] Douglas Barrie, "Kh-101 Missile Test Highlights Russian Bomber Firepower," *IISS* (blog), February 8, 2019, https://www.iiss.org/blogs/military-balance/2019/02/russian-bomber-firepower

Kh-47M2 Kinzhal air-launched ballistic missile (ALBM)

One of the new weapons President Putin called a strategic missile in his 1 March 2018 state of the nation address was the nuclear-capable Kinzhal ALBM. The Kinzhal, one of the new hypersonic glide vehicles (HGV), is 8m long and 1m in diameter. It is based on the Iskander short-range ground launched missile. The Kinzhal entered service in December 2017 and has been launched by Mig-31K long-range fighter aircraft and Tu-22M3M medium range bombers. These aircraft are flown by the Russian Aerospace Force (VKS). In 2016 the VKS planned to upgrade 30 their 60 operational Tu-22M3 bombers to the M3M variant to carry 4 Kinzhal missiles.

The Tu-22M3M has a range of 7,000km and the Kinzhal, when launched from that aircraft, has a stated range of 3,000km. The New START Treaty does not cover the Tu-22 M3M and the Kinzhal Kh-47M2 missile, yet they could hit nearly all US targets and have become a major concern to the United States. As of mid 2020 there is no evidence the Russians plan to put these missiles on their inter-continental Tu-160MS or Tu-95MS bombers any time soon.[31]

New ground/surface ship-launched missiles

9M730 Burevestnik/SSC-X-9 SkyFall nuclear powered nuclear armed cruise missile

The Burevestnik missile is 12m in length including its 3m-booster solid rocket, needed for launch. The booster is dropped after it is expended and the missile continues using its nuclear power plant. For testing it is launched from a permanent rail, hydraulically elevated at about 45 degrees. The missile is probably subsonic, flies at low altitude on an unpredictable track, and has an unlimited range.

The testing history of this missile is not well known. The US initially identified this missile as the KY-30. The KY identifies some phase of the program was tested at Kapustin Yar. This may have been airframe and launcher testing without the small nuclear power reactor. The 9M730 Burevestnik program, starting in 2014, built a major test complex at Kapustin Yar that was operational by mid 2016. Consisting of a launch pad with a permanent rail launcher, a pad support area that normally has ten green painted van trailers and a 36m X 16m bunker. Four hundred and

[31] Missile Defense Project, "Kinzhal," Center for Strategic and International Studies, March 27, 2018, last modified July 31, 2021, https://missilethreat.csis.org/missile/kinzhal/

twenty-five meters directly in front of the launch pad is a large triangular bermed impact area for testing the booster rockets used at launch. The movable shelter that encloses the launch rail and missile was in place by July 2017 indicating full missile tests could take place. The only evidence tests may have taken place at this time is the activity inside the bermed impact area.

Testing then appears to have moved to the Arctic on Novaya Zemlya at a small isolated site identified as Pan'Koro. This launce site was built in a remote area from 2013 to 2016. The tests were conducted from a concrete pad with an environmental shelter that moved on tracks forward before the test. Four tests were reported between November 2017 and February 2018, all of which failed after take off. The November 2017 test flew for two minutes and went 22 miles (35.4km) before it failed, but it was assessed as a partial success.

On his 1 March 2018 state of the nation speech President Putin included the 9M730 Burevestnik missile. Sometime in 2018 or early 2019 testing shifted to a launch pad at the Nyonoska/Nenoska Missile Test Range on the shore of the White Sea. The pad had been used to test naval ballistic missiles and the launch tube was removed by 2016. The new launch pad was probably complete in late 2017 and was similar to pads at Kapustin Yar and Pan'Koro. The launch azimuth is 90 degrees over the White Sea. The first test from this pad may have been in mid 2018 and it was a launch failure. An explosion of a Burevestnik missile on 8 August 2019 occurred during an underwater recovery operation that killed seven people. Reports on the explosion stated the missile had been under water for about one year. That was probably the missile from the launch failure in mid 2018. No further tests from Nenoska have been reported.

On 29 January 2019 it was reported a Burevestnik missile was launched from Kapustin Yar and it was considered a partial success. Also noted was this was the first launch in nearly a year. There have been thirteen reported launches of the Burevestnik missile. Two were considered to be partial successes. If tests continue and the results improve, a decision could be made to deploy the Burevestnik missile. Recent 2020 activity at the Pan'Koro test area indicates the program may be ready for more testing. Any deployment probably would not occur until the late in this decade.[32]

[32] Thomas Newdick, "It Looks Like Russia's Nuclear-Powered Cruise Missile Test Program Is Back In Business," *The Drive* (blog), October 21, 2020, https://www.thedrive.com/the-war-zone/37191/it-looks-like-russias-nuclear-powered-cruise-missile-test-program-is-back-in-business

3M22 Tsirkon (Zircon)/SS-N-33 ship/submarine-launched hypersonic cruise missile

The Tsirkon hypersonic missile is in the late stage of its development and is expected to become operational in 2023. Tsirkon was developed as an anti-ship missile and is launched from the 3S-14 vertical launch systems from several classes of Russian Navy ships and can also be launched from the new Yasen-class submarines. Tsirkon also has the capability to attack ground targets. On 24 December 2019 President Putin said a land-based version of this missile was being developed, probably to replace the old anti-ship missiles that are deployed. There is a report that the Tsirkon is nuclear capable.

Testing may have begun from a Tu-22M3 supersonic bomber in 2012/13. This may have been to test the scramjet. In 2015 testing from a ground platform took place—probably to integrate the missile with its booster. Its first success was reported in 2016. Testing continued with a launch in April 2017 when it attained the speed of Mach 8. Further tests took place in June 2017 and December 2018. The first tests that used a naval ship were successfully launched from the Admiral Gorshkov in early January 2020 while in the Barents Sea, to a target in the Northern Urals at a distance of 500km. The Gorshkov was again used for a test on 7 October 2020 from the White Sea when, for the first time, it destroyed a naval target in the Barents Sea at a 450km range. The latest test was also from the Admiral Gorshkov in the White Sea to a target in the Barents Sea 350km away. It took place on 19 July 2021 and was successful.

The Tsirkon missile is 10-12m in length. It uses a solid fuel booster rocket to get it supersonic so the liquid fuel scramjet engine can start. The missile's range is 1000km, and it flies at an altitude of 28-29km and at speeds on Mach 8-9. Its warhead weight is 300-400kg. It is noteworthy that India announced they would use the same scramjet Zircon technology for their joint hypersonic missile, BrahMos-2.[33]

[33] Mark Episkopos, "Russia's Tsirkon Hypersonic Missile Keeps Inching Closer to Reality," *The National Interest* (blog), February 2, 2021, https://nationalinterest.org/blog/buzz/russia%E2%80%99s-tsirkon-hypersonic-missile-keeps-inching-closer-reality-177512

People's Republic Of China (PRC)

The PRC is not party to arms control treaties and therefore is not treaty-limited to the numbers of warheads or types of launchers they can build and deploy. Thus, the PRC was free to announce that it plans to double its strategic nuclear arsenal by 2030. In mid 2021 two new bases for silo launched DF-41 ICBMs were identified under construction in the western desert. The first located near Yumen with 120 silos and the second 380km northeast of Yumen at Hami with 110 silos, in addition fourteen training silos were reported at the Jilastal training area.

The PRC already reached a goal of achieving its triad with the deployment of the Type-094 type SSBN that carries the JL-2 ICBM. Currently six of these submarines are operational with two entering service in 2020. The land-based component of the triad currently consists of the following ICBMs: twenty 1970 vintage DF-5 silo based missiles, about tenty-five DF-31 mobile missiles, and thirty to forty DF-41 road mobile missiles. The strategic bomber fleet consists of about 160 H-6s, a greatly upgraded variant of the 1950s Soviet Tu-16. Under development is the PRC's first dedicated strategic bomber, the stealth H-20. Although some reports indicated that it was to be displayed to the media in November 2020, in fact it was not. It is unlikely to enter service until the late 2020s.[34]

Chinese SLBMs

JL-1 SLBM/CSS-N-3

The PRC's first attempt at a Chinese SSBN was one Type-092 SSBN Xia Class carrying twelve Jl-1 ballistic missiles. The submarine was commissioned in 1987 but had numerous problems and conducted one patrol inside Chinese regional waters. The submarine is probably no longer operational. The JL-1/CSS-N-3 is a two-stage solid fuel missile with a range of 1,700km. It is a close relative to the DS-21 MRBM.

[34] Kris Osborn, "China's New H-20 Stealth Bomber to Arrive This Year," *The National Interest* (blog), July 21, 2021, https://nationalinterest.org/blog/buzz/chinas-new-h-20-stealth-bomber-arrive-year-190085

JL-2 SLBM /CSS-N-14

Six Type-94 Jin-Class SSBN each carrying twelve JL-2 ICBM range missiles are operational. The first submarine was commissioned in 2010 and the sixth in 2020. The six Type-94 SSBNs are all based at the Sanya Submarine base on the southern tip of Hainan Island.

The JL-2/CSS-N-14 is a two-stage solid fuel missile with a range of 8,000-9,000km. It is a close relative to the DF-31 ICBM. Its test program is similar the CSS-N-3, probably with shore launches in the mid 1980s and the first test from the Golf SSB in 2001/02. The first successful launch from a Type-94 SSBN was in 2009. The missile is 13m in length, 2m in diameter and can carry a 1 megaton RV or 3-8 MIRVs.[35]

JL-3 SLBM/CSS-N-?

The JL-3 missile testing began before the first Tang-Class Type-96 SSBN that will carry it commenced. Reportedly, construction of the first of six Type-96 submarines, each with sixteen launch tubes began in 2020.

The JL-3 missile appears to have been first tested in August 2017 probably from the shore site and then from a new test submarine with two launch tubes, identified as a Qing-Class Type-32 test submarine. Tests have continued in 2018 and 2019 with launches from the Bohai Sea to the Gobi Desert impact area. The JL-3 is considered an ICBM with a range of up to 12,000km. It is a close relative to the road mobile DF-41 ICBM. It may take until 2025 to integrate it with the new Type-96 SSBN.[36]

Chinese Land-Based Ballistic Missiles

China’s land-based missiles range from greatly upgraded 1970s silo based DF-5 (CSS-4) liquid propellant ICBMs to late 1990 DF-31 and 2010 DF-41 road-mobile ICBMs. The PRC also has several MRBMs and long-range cruise missiles with nuclear warheads. These missiles are operated by the PLA rocket force, formally the Second Artillery Corps. The construction of two new silo

35 “JL-2 Submarine-Launched Ballistic Missile,” *Military Today*, accessed September 8, 2021, http://www.military-today.com/missiles/jl2.htm

36 “JL-3 Submarine-Launched Ballistic Missile,” *Military Today*, accessed September 8, 2021, http://www.military-today.com/missiles/jl3.htm

based DF-41 launch complexes will add at least 200 plus ICBMs when completed, probably in 2023.[37]

DF-5 Mods 1 and 2, CSS-4 B and C ICBM

The DF-5 is a two-stage liquid fuel missile 32.6m long with a diameter of 3.35m. Its range is 12,000 to 15,000km. The DF-5 missile was first tested in the 1971 and entered service in 1981. It is deployed in three brigades each with six silos. The latest versions of this ICBM are the DF-5B and 5C that entered service in 2015. There are ten DF-5B launchers, each having three warheads for a total of thirty. There are eight DF-5C launchers, each with ten MIRVs for a total of eighty warheads. The DF-5 missile is the base for the Chang Zheng (CZ- 2,3, and 4) satellite launch vehicles with over 230 launched since 1975 and still in use today.

DF-31, 31A, 31AG / CSS-10 ICBM

The DF-31 missile is a three-stage solid fuel missile. It's road-mobile and is the land-based variant of the submarine launched JL-2 ICBM. The first successful flight was in August 1999. It was accepted into service in 2006. The DF-31 has a range of 7,200-8,000km. An improved version identified as DF-31A with a range of 11,200km entered service in 2007. To get the extended range the third stage was lengthened. A third version identified as DF-31AG/DF-31B is the DF-31A missile on a new TEL.

The DF-31A is reported to be 18.4m in length with the first and second stages 2m in diameter and the third stage, 1.5m. It is cold-launched after being vertically erected by the TEL. Reports vary on the number of DF-31A missiles deployed, but between twenty-five to thirty is a likely number. It carries a single 1 megaton thermonuclear weapon. The KT-2 satellite launch vehicle is based on the DF-31.[38]

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[37] Chun Han Wong, "China Appears to Be Building New Silos for Nuclear Missiles, Researchers Say," *Wall Street Journal*, July 27, 2021, https://www.wsj.com/articles/china-appears-to-be-building-new-silos-for-nuclear-missiles-researchers-say-11627401364

[38] "DF-31," Wikipedia, accessed July 15, 2021, https://en.wikipedia.org/w/index.php?title=DF-31&oldid=1033682099

DF-41, CSS-20 ICBM

The DF-41 is the newest and largest of the PRC's solid fuel ICBMs. It was first tested in July 2012 and accepted into service in 2017. The missile is cold-launched and has been deployed in a canister on an eight axle TEL. Reports have mentioned silo- and rail-based modes. A probable DF-41 training silo was identified at the PLARF nuclear missile training area near Jilanti in the Gobii desert. In 2021 fourteen more silos were seen under construction at Jilanti. About 230 probable operational silos were reported under construction for the DF-41 missiles in the western desert. A test from a rail car was reported in December 2015, but there is no evidence it has been deployed.

The missile has three stages and is 21m in length and 2.25m in diameter, with a range of 14,000 to 15,000km. Since 2012 there have been at least elevyn DF-41 launches. Reportedly, there are up to twenty-four to thirty of these road mobile missiles deployed and probably none yet of the silo or rail-based missiles.[39]

Nuclear-Capable MRBMs and IRBMs

The PRC has several missiles that are nuclear-capable with shorter ranges. The most prominent are the DF-21/CSS-5 range MRBM. These missiles are dual mode and can carry nuclear and conventional warheads. The range of these missiles is around 2,500km. A version of the DF-21 was used to launch the Chinese anti-satellite interceptor in January 2007 and is the basis for the KT-1 & 1A satellite launch vehicles.

The DF-26 IRBM is a two stage solid fuel IRBM with a range of 3,000 to 4,000km. The missile entered service in 2016 and it is estimated 80 missiles are deployed with another 80 reloads. These missiles are dual mode and can carry nuclear and conventional warheads. An anti-ship version may be under development.

[39] "New Missile Silo And DF-41 Launchers Seen In Chinese Nuclear Missile Training Area," *Federation of American Scientists* (blog), September 3, 2019, https://fas.org/blogs/security/2019/09/china-silo-df41/.; Missile Defense Project, "DF-41 (Dong Feng-41 / CSS-X-20)," Center for Strategic and International Studies, August 12, 2016, last modified July 31, 2021, https://missilethreat.csis.org/missile/df-41/

DF-17 HGV

The DF-17 is classified as an MRBM but its real claim to fame is that it is probably the first deployed hypersonic glide vehicle (HGC). The DF-17 is boosted by a DF-16B short-range missile and carried by a modified DF-16 TEL. The HGV is identified as DF-ZF. It was tested at least nine times between January 2014 and November 2017, was displayed in a parade in October 2018, and reached IOC in 2019.

The DF-17 is about 11m in length and 1.2m in diameter. The DF-16 booster accelerates to Mach 5 (6125km/h) before the DF-ZF HGV is released. The range of the DF-17 is 1800 to 2500km. Deployment of at least one brigade at a missile site across from Taiwan has taken place.[40]

PLAAF Long Range Bombers, H-6K and H-6N

Two versions of the H-6 aircraft, the K and N models, make up China's current strategic bomber force. The K model was tested in 2007 and as of 2020 about 100 of these bombers are in service. The N model went into service in 2019 and at least 4 of these bombers have been seen. It has been reported that the yearly production rate for the N model is about six per year. The N models have several improvements over the K models. They have a fueling probe for air-to-air refueling to greatly extend their range and in place of the bomb bay the capability in the centerline to carry a single variant of the DF-21 ballistic missile, a DF-17 missile with a DF-ZF hypersonic glide vehicle (HGV) or a supersonic DF-100 cruise missile. In addition, the H-6N bomber can also carry the WZ-8/DR-8 hi-speed short-range reconnaissance drone.[41]

CJ-10A (called DF-10 until 2011)

The K models of the H-6 bomber can carry the CJ-10A cruise missile. The latter is a subsonic missile with a range of 1,500km powered by a single turbofan engine. It appears to have been derived from the Soviet Kh-55 cruise missile. Six missiles can be carried under-wing mounts. The missiles can have a nuclear or conventional warhead. Other variants of this missile are ground-

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[40] Ankit Panda, "Introducing the DF-17: China's Newly Tested Ballistic Missile Armed With a Hypersonic Glide Vehicle," December 28, 2017, https://thediplomat.com/2017/12/introducing-the-df-17-chinas-newly-tested-ballistic-missile-armed-with-a-hypersonic-glide-vehicle/

[41] Greg Waldron, "H-6 Evolves from Cold War Relic to Beijing's Hammer," *Flight Global* (blog), September 4, 2020, https://www.flightglobal.com/fixed-wing/h-6-evolves-from-cold-war-relic-to-beijings-hammer/140043.article

and ship-launched. Currently this missile is the PLAAF's only stand-off weapon for the strategic bomber fleet.

CH-AS-X-13

The CH-X-13 is an air-launched variant of the DF-21 MRBM. It currently can be launched only from the new H-6N bomber, modified with launch position along the aircraft centerline. The missile has two stages and a range of 3,000km. The missile has been tested at least five times between December 2016 and January 2018 and probably more since then. This missile may be deployed by 2025.[42]

DF-17 carrying a DF-ZF HGV

The DF-17 missile seen being carried on a H-6N bomber appears similar to the ground-launched missile discussed in the previous section. It is mounted semi-recessed into the fuselage along the centerline position of the aircraft underside. See the previous discussion of this new missile.[43]

CJ-100 /DF-100

The CJ-100 is a high supersonic (Mach 4.5Km) cruise missile powered by a ramjet engine. The two canisters carying the ground-launched version were seen in the October 1, 2019, parade painted DF-100. A video shows the missile as it exits one of the canisters. The propulsion needed to start the ramjet is provided by two or three segments of a DF-11 or 15 SRBM solid fuel motor. The airborne missile has an estimated range of 2,000km and increases the H-6N bombers unrefueled strike range out to 6,000km.[44]

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[42] H. I. Sutton, "China's New Aircraft Carrier Killer Is World's Largest Air-Launched Missile," *Naval News* (blog), November 1, 2020, https://www.navalnews.com/naval-news/2020/11/chinas-new-aircraft-carrier-killer-is-worlds-largest-air-launched-missile/

[43] Greg Waldron," Chinese H-6N appears with mysterious ballistic missile," *FlightGlobal,* October 19, 2020, https://www.flightglobal.com/defence/chinese-h-6n-appears-with-mysterious-ballistic-missile/140671.article

[44] Orion_INT, "Demystifying The DF-100: A Deeper Look At China's Mysterious Cruise Missile," *Overt Defense* (blog), August 2, 2021, https://www.overtdefense.com/2021/08/02/demystifying-the-df-100-a-deeper-look-at-chinas-mysterious-cruise-missile/

H-20 Stealth Bomber under development

The H-20 has been under development since the early 2000s and is the first dedicated bomber developed by the PRC. Reports indicate it will be a long-range subsonic flying wing stealth aircraft to complement the H-6 aircraft and eventually will replace some of them. The aircraft has not yet flown, but tests are expected in the early 2020s. If the tests are successful construction could begin in 2025 and it could enter service by the late 2020s. The bomber will be capable of carrying nuclear and conventional weapons with a range estimated to be greater than 8,500km without aerial refueling. The H-20 will probably be capable of carrying some of the new missiles being developed for the H-6N.[45]

India

India has joined the nuclear triad club late and is now adding modern delivery systems. The strongest part on their triad is ground-launched ballistic missiles. The nuclear-capable Prithivi 1 and 2 and Agni 1 to 5 missiles are mobile and include short-to intermediate-range weapons with an ICBM under development. The naval SSBN force currently consists of two operational submarines with two more being built. The two units have a total of thirty-six short-range K-15 ballistic missiles, but some or all of these will be replaced with twelve intermediate-range K-4 missiles in the near future. The aircraft triad piece consists of four types of short-range fighter-bombers. They mainly carry unguided free fall nuclear bombs. Forty Su-30MKI fighters have been modified to carry the BrahMos supersonic nuclear capable cruise missile. BrahMos missiles are also launched from ground TELs, surface ships, and submarines. A hypersonic version of this missile is under development.

India’s land-based missiles

India has developed and deployed both long-range ballistic and cruise missiles and has a very active space launch program. Most of the long-range missiles have been tested from the facilities

[45] Peter Suciu, “Xian H-20 Stealth Bomber: Is This What It Will Look Like?,” *19FortyFive* (blog), January 28, 2021, https://www.19fortyfive.com/2021/01/xian-h-20-stealth-bomber-is-this-what-it-will-look-like/

on Abdul Kalam Island. The old name for this facility was Wheeler Island and it is also called the Integrated Test Range (ITR).[46]

Ballistic missiles

India has two lines of land-based missiles, Prithvi and Agni. The Prithvi 1 and 2 are single stage liquid fuel missiles and Prithvi 3 uses solid fuel. The first two have been deployed, are probably operational, and are operated by the Strategic Forces Command (SFC). Prithvi 3 is an anti-ballistic missile, the development of which is complete. Deployment is planned in three to four years to protect the capital city.

Prithvi surface-to-surface missiles

Prithvi-1 was first tested in 1988 and came into service in 1994. The range of the missile is 150km and it is 8.5m in length and 1.1m in diameter. The upgraded Prithvi-2 was first tested in 1996 and entered service in 2003. The propellant tanks were extended to increase its range to 250km. The measurements are length 9.4m and diameter at 1.1m. The Indian Navy's version of this missile is identified as Dhanush, and it had been deployed on at least two surface ships. The Dhanush has been used as a target for the ABM program. These missiles are dual capable with nuclear and conventional warheads.

The Prithvi- 3 is the booster for India's Anti Ballistic Missile (ABM) and Anti Satellite Missile (ASAT). The ABM is a hit-to-kill vehicle and has been tested a reported nineteen times. The program has completed testing and is waiting for a decision to deploy it first around the capital. It is non-nuclear.[47]

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[46] The launch site for most if not all the Agni missiles is Abdul Kalam Island (formerly Wheeler Island). During the testing the missiles are moved from a retractable shelter to the launch point by a rail TEL on Pad 1. When the tests are shown on video this rail TEL usually can be seen. This rail TEL is part of the test equipment and not an operational deployed TEL. It could be that seeing the test rail TEL has caused the identification that some of these missiles are actually operationally launched from rail TELs.
[47] Malcolm Claus, Brian Cloughley, and Nick Hansen, "Kill Vehicle, Examining India's ASAT Missile (Standing Tall)", *Janes Intelligence Review*, June 2019.

Nuclear-Capable Missiles

Agni family of ballistic missiles

There are two sub-families Agni missiles. The Agni 1, 2, and 4 make up one and the Agni 3 and 5 is the other. Available information on the Agni is at best confusing and at worst wrong. All Agni missiles are solid fuel and are nuclear-capable.

India developed much of its solid fuel technology in the 1980s and early 1990s for their space launch programs with the help of the Soviet Union.

Agni-1 is a short/medium-range single stage solid fuel missile with a 700 to 1,200km range. Flight testing began in 1989.[48] It mounts a single warhead and is carried on a truck TEL. Agni-1 entered service with the 334th Missile Group and became operational in 2007. It was estimated that nearly twenty of the launchers for this missile were deployed. The missile is 14.8m long and 1m in diameter.

The Agni-2 is a medium-range 2-stage solid fuel missile, with an 820 to 2,000km range. It mounts a single warhead and appears to be rail mobile with the 335th Missile Group. It entered service in 2008 and became operational in 2011. It is estimated only about ten of these missiles were deployed. The missile is 21m long and 1m in diameter

The Agni-4 was initially called the Agni-2 Prime. This two-stage missile has an intermediate range of 3,500km and mounts a single warhead. The truck mobile missile was deployed and became operational in 2019. About ten of these missiles have been deployed. This missile is about 20m long and 1m in diameter.

The Agni-3 is the first of the 2m diameter solid fuel missiles. It is a two-stage missile, 16.3m in length, and is classified as an intermediate-range missile with a range of 3,200km+. The first test of the Agni-3 was in July 2006, and it went into service in 2011. This missile has been reported as rail mobile but that is questionable. A NASIC 2017 report showed India had deployed fewer than ten of these missiles. By late 2020 that number had certainly increased. The latest test on 30 November 2020 failed.

[48] AGNI-1, Missiles of the World, CSIS Missile Defense Project, https://missilethreat.csis.org/missile/agni-1/

The newest member of India's ballistic missile family is the Agni-5. Some consider it to be an ICBM and others an IRBM. Its range is over 5,000km but some assert a strike range of 6,000km. The missile has 3 stages, is road mobile, and is enclosed by a canister for environmental protection. The missile is cold-launched from the canister. The first test took place in April 2012 and it entered service in 2019. This missile uses the first and second stages of the Agni-3 with a new third stage. The Agni-5 is 17.5m long and 2m in diameter. The number of missiles deployed is unknown—probably less than ten. The Agni-5 was last launched on 27 October 2021.

Is there an Agni-6 under development? India has not mentioned an Agni-6, but there is speculation that one is being developed.[49]

Long-range cruise missiles

The Nirbhay long-range cruise missile can carry conventional and small nuclear warheads. The missile is subsonic and powered by a turbojet engine with a range of 800 to 1,000km. It measures 6m long and 0.5m in diameter and is launched from a wheeled TEL. The first test in 2013 failed, but subsequent tests starting in 2015 were successful. It was developed by India and has a limited deployment. These Nirbhay and the BrahMos-1 missiles were deployed in 2020 by India to support the continuing border conflict with China.

Hypersonic Technology Demonstrator Vehicle (HSTDV)

An Agni-1 rocket was used as the booster for two tests of India's indigenous hypersonic cruise missile. The first test in June 2019 failed after launch. The second test on 7 September 2020 was successful. The booster lofted the missile up to 30km to start the scramjet that achieved a Mach 6 speed. There are three more tests planned, making it a weapon capable of carrying conventional and nuclear warheads.[50]

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[49] Hans M. Kristensen and Matt Korda, "Indian Nuclear Forces, 2020," *Bulletin of the Atomic Scientists* 76, no. 4 (3 July 2020): 217–25, https://doi.org/10.1080/00963402.2020.1778378

[50] "Hypersonic Technology Demonstrator Vehicle," Wikipedia, accessed August 21, 2021, https://en.wikipedia.org/w/index.php?title=Hypersonic_Technology_Demonstrator_Vehicle&oldid=1039857461

BrahMos 2 Hypersonic Cruise Missile

The BrahMos 2 missile is under joint development by India and Russia. Initial flight-testing was in Russia and will soon begin in India. Like the BrahMos-1, when deployed, this missile will launch from ships, submarines, aircraft, and land mobile vehicles. The Indian development plan is to achieve Mach 4.5 by 2015 and Mach 6/7 by 2026/27 with deployment by 2028. The Russian-developed scramjet engine from the Zircon missile will power the missile. The range of the missile is 450-600km at speeds of Mach 7 (8,500km/h).[51]

Indian SLBMs

The third leg of India's triad is just now coming into being. It consists of the INS Arihant nuclear submarine that has four missile tubes and currently carries twelve K-15 missiles, three in each tube. The INS Arihant is currently completing sea trails, while the long-range K-4 missile is completing testing. Also part of the SSBN project is a large new submarine base, INS Varsha, nearing completion on the east coast south of Visakhapatnam. In addition, two new VLF antennas and bunkered transmitter and C3 building were added to the existing VLF station at INS Kattabomman. These new communications systems will allow the national command authority positive control of the deployed SSBN force —that is, assurance that nuclear weapons are available for immediate use at all times.

The SSBN INS Arihant has four missile tubes and can carry twelve K-15 missiles or four K-4 missiles. The second SSBN INS Arighat has eight missile tubes and can be loaded with twenty-four K-15 or eight K-4 missiles or a combination of each. It is expected the two SSBNs being built will have the same configuration as the INS Arighat.

The K-15 missile is an underwater-launched two stage solid fuel short-range SLBM. Its range is 750m and has a single warhead. Development began in the late 1990s leading to land-based tests from Abdul Kalam Island. In February 2008, the tests moved to a submersible pontoon barge. After a successful barge test series, testing from HIS Arihant began November 2015 with a final

[51] "BrahMos-II," Wikipedia, accessed August 9, 2021, https://en.wikipedia.org/w/index.php?title=BrahMos-II&oldid=1037838310

test series of three missiles launched on 11 and 12 August 2018. It was declared operational later in August. The K-15 missile is 10m long and 0.74m in diameter.[52]

The K-4 is classified as medium-range missile with a range of 3,500km. It is a two-stage solid fuel nuclear capable missile that is underwater-launched and carries a single warhead. It was probably developed as a variant of the Agni-3. An ejection test was conducted from a submerged barge in November 2010. Also from the barge, a powered flight took place on 24 March 2014, as did a test on 7 March 2016, both successful. The next barge tests took place on 19 and 24 January 2020 and were the final developmental tests before the missile would go into production. There have been no launches to date of the K-4 missile from either of the SSBNs that are capable of launching it. The K-4 missile is 12m long and 1.3m in diameter.[53]

India has a 5,000km K-5 missile under development that could be ready for testing in 2022. This missile could be launched from the INS Arighat class SSBNs. India is also looking into a K-6 missile that would have a range of 6,000 to 8,000km and require a new S-5 Class submarine. The missile would be significantly larger, that is, greater than 12m in length and 2m in diameter.[54]

Anti-satellite (ASAT) program

India has attempted two anti-satellite tests from the Abdul Kalam Island. The first on 12 February 2019 was a launch failure and the second on 27 March 2019 was a success. It used a kinetic hit-to-kill vehicle and destroyed a dedicated target satellite launched on 24 January 2019. The ASAT kill vehicle was boosted to match the target's orbit by a 2-stage solid fuel rocket before the kill vehicle was separated from it. This booster was reported to be a modified Prithvi-3 missile designated the PDF Mark 2/XSV-1. The latter is the same basic missile used for the ABM system and does not carry a nuclear warhead. The TEL carried ASAT is 13.2m long and 1.4m in diameter.[55]

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[52] "Sagarika (Missile)," Wikipedia, accessed August 13, 2021, https://en.wikipedia.org/w/index.php?title=Sagarika_(missile)&oldid=1038587463

[53] "K-4 (Missile)," Wikipedia, accessed July 24, 2021, https://en.wikipedia.org/w/index.php?title=K-4_(missile)&oldid=1035239009

[54] Arfa Javaid, "K Missile Family of India: Here's Everything You Need to Know," *Jagranjosh.Com* (blog), October 6, 2020, https://www.jagranjosh.com/general-knowledge/k-missile-family-1601983618-1

[55] Malcolm Claus, Brian Cloughley, and Nick Hansen, "Kill Vehicle, Examining India's ASAT Missile (Standing Tall)," *Janes Intelligence Review*, June 2019

Aircraft launched nuclear capability

India has two aircraft, sixteen Mirage 2,000H, and thirty-two Jaguars configured to carry nuclear freefall gravity bombs as a secondary mission. They have also modified forty of their SuMKI fighters to carry the BhraMos non-nuclear cruise missiles. The only nuclear-capable missile in their inventory is the Nirbhay cruise missile. The air-launched version of the missile is still under development and was photographed under the centerline of a SuMKI fighter.

A second new missile under development is the Long-Range Land Attack Cruise Missile (LRLACM). This missile will have a 1,000km range. It is planned for use by all three Indian services with its first tests begining in early 2023. If successful it could become operational in late 2020s.[56]

Pakistan

Since the Partition, Pakistan has viewed India to be its mortal enemy. All Pakistani deployed missiles were developed with India as their target. Pakistan is closing in on a nuclear triad of its own. The ground-launched ballistic and cruise missiles are the largest portion of this triad. The Mirage 3 fighter-bombers can deliver nuclear bombs and some were probably modified to carry the Ra'ad-1 nuclear capable cruise missile. The Ra'ad-2 longer-range version is planned to replace the older version beginning in 2021. The Babur-3nuclear-capable cruise missile is the submarine version of the missile and was tested at sea in 2017and 2018. It may be planned to go on the three current Agosta class submarines and the eight Hangor class AIP submarines ordered from China in 2017.

Pakistan has three active missile test ranges. Liquid fuel Ghauri missiles were tested from the north of the country at the Mashhood firing range also called the Tilla missile test range. Since Pakistan adopted solid propellant missiles, only an occasional troop-training Ghauri launch now takes place at Tilla. The solid fuel ballistic and cruise missiles are launched from two closely spaced test ranges

[56] Krishnan M. Anantha, "India Set to Develop Long Range, Land Attack Cruise Missile," *OnManorama*, February 6, 2020, https://www.onmanorama.com/news/india/2020/02/06/india-defexpo-long-range-land-attack-cruise-missile.html

located on the south of the coast of Sonmiani Bay. The newest of these test ranges is called the Winder missile test range where the Shaheen longer range solid propellant and cruise missiles tests take place. The older and larger Sonmiani test center is 19km to the southeast of Winder. The early Hatf-1-3 was tested here and the ground launched cruise missile crew training for the Hatf-9/NASR may be done here.

Pakistan's land-based missiles

All of Pakistan's land-based ballistic and cruise missiles are operationally launched from road-mobile TELs.

The Hatf 1 and 2 shortrange missiles date back to the late 1980s. The Hatf-1A may still be in the field today and a newer version of the Adali Hatf-2 with a range of 200 miles entered service in 2015, and ten may be deployed. The Hatf-3 Ghaznavi is a solid fuel missile with a range of 300km. This missile is derived from the Chinese DF-11 with a conventional warhead transferred to Pakistan in 1992. Pakistan made these missiles nuclear-capable and the first flight was on 26 May 2002. It became operational in February 2004 with the Army Strategic Forces Command. Fewer than fifty of these missiles are deployed and the missile was last tested on 19 August 2019.

Testing of the Hatf-1-3 missiles probably began in the late 1980s to early 1990s at the Sonmiani test range. The the missiles were fired into the desert on a 314 degree azimuth.

The Shaheen solid fuel missiles

The Hatf-4/Shaheen 1 missile also was derived from Chinese missiles, the M-11 and M-9. Testing of the solid fuel motor and flight sets was transferred to the Winder test range. Motor test were completed July 1997, the missile was converted to be nuclear-capable and shown to the public in the March 1999 National Day parade. Flight tests from Winder followed and 750km range Hatf-4 was accepted into service in 2006. An improved version of the missile, the Shaheen-1A with a 900km range was tested in November 2014 and is operational. The single stage Shaheen-1 and 1A are 12m long and their diameter is 1.0m. Less than 50 are deployed.

The Shaheen-2/Hatf-6 is a two-stage solid fuel MRBM first seen in the October 2003 National Day parade. Its development may have had help from the Chinese M-18/DF-11. The first test took place in March 2004 from the Winder test range and it went into service in April 2008. The range of this missile is 2,500km and less than fifty are thought to be deployed. Its length is 17.5m and diameter is 1.4m and is carried on a WS21200 Chinese TEL.

The Shaheen-3/Hatf-10 is a two-stage solid fuel MRBM Based on the Shaheen-2 with a 2m lengthened second stage. The first test of the missile was on 9 March 2015 and a second test on 11 December 2015, both successful. A Shaheen-3 missile was seen erected on Pad 2 at Winder on 28 January 2018 during a training exercise and VIP visit, but it was not launched. No additional tests of the Shaheen-3 have been reported. Since this missile is a Shaheen-2 with a longer 2nd stage and the Shaheen-2 is operational, it is probable that two tests were adequate. The Shaheen-3 may have entered service in 2019-2020. The missile is 19.3m in height and 1.4m in diameter. The Shaheen-3 has a range of 2750km and is carried on a Chinese TEL the WS51200.

The Shaheen-3 is the booster for the 3 stage Abebeel MIRVed MRBM. The Chinese also were reported to have helped with the MIRV technology carried on the Ababeel missile. The Ababeel was tested from Winder only once on 24 January 2017 and was reported to have been successful. In a "Statement for the Record: Worldwide Threat Assessment" March 2, 2018, US Lt. General Ashley DIA stated "Pakistan conducted the first test launch of its nuclear-capable Ababeel ballistic missile, demonstrating South Asia's first MIRV payload."[57] Why there have been no additional tests is unknown. The missile has not been deployed or seen in a parade.

The Ababeel stands 21.5-22.1m high and the booster and second stage diameter is 1.4m—the same as the Shaheen-3—and the payload faring is 1.7m in diameter. The second stage has been extended in place of the Shaheen nose cone, and a 1.7m third stage added below the payload. This is probably the post-boost vehicle needed to target the warheads. The payload shroud is 3.4m long and separates after second stage ignition. The three war heads are mounted on the third stage and are released independently.[58]

[57] Robert Ashley, "Statement for the Record: Worldwide Threat Assessment," *Defense Intelligence Agency*, March 6, 2018, https://www.dia.mil/News/Speeches-and-Testimonies/Article-View/Article/1457815/statement-for-the-record-worldwide-threat-assessment/

[58] Missile Defense Project, "Ababeel," Center for Strategic and International Studies, September 12, 2017, last modified July 31, 2021, https://missilethreat.csis.org/missile/ababeel/

Ghauri/Hatf-5 liquid fuel missiles

The Ghauri missiles are single stage liquid propellant missiles. Between twelve to twenty-four of the DPRK's Nodong-1 missiles were purchased by Pakistan in the late 1990s and renamed Ghauri. The first test of the missile launched by a North Korean crew occurred in April 1998 and failed, as did a second test in April 1999. A third test took place in May 2002 and was a success. The Ghauri entered service in January 2003. Three more tests took place in 2004 for troop training. These missiles have a MRBM range of 1,250km.[59]

Pakistan has improved the No dong-1 (Ghauri–I) missiles originally purchased by Khan Research Laboratories (KRL) in Kahuta by extending the propellant tank 1m to get longer range and improving the warhead. In some reports these missiles were identified as Ghauri-2 with a range of 1,800km. The liquid engine test stand at KRL was built for the Ghauri program. Most if not all twelve known Ghauri missiles have been launched from the Mashhood Firing Range (also called the Tilla Missile Test Range) into either the Southwest desert or Arabian Sea.

A planned two stage Ghauri-3 missile with a 3,000km range had its funding cut in 2000 and was terminated in 2004. The last known test launch of a Ghauri was October 2018. If Pakistan only purchased twenty-four missiles and twelve have been launched, then this missile likely is being phased out. The Ghauri-2 is 18m long and 1.35m in diameter.

NASR/Hatf-9

The NASR/Hatf-9 is a nuclear-capable short-range ballistic missile. It was first tested at Windar on 19 April 2011. It was launched again five times and was seen on pad 3 at Sonmiani on 1 May 2018. The most recent launch was on 24 January 2019. It probably entered service in 2013 after four missile salvo. The NASR missile is probably a modification of the Chinese solid propellant Norico AR series launched from a four tube TEL. It is capable of launching low yield nuclear and conventional weapons to a range of 60-70km. The missile is 6m in length and 0.4m in diameter.[60]

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[59] Feroz Khan, *Eating Grass: The Making of the Pakistani Bomb* (Stanford University Press, 2012).
[60] Ankit Panda, "Pakistan Conducts Second Nasr Nuclear-Capable Ballistic Missile Test in a Week," *The Diplomat*, February 4, 2019, https://thediplomat.com/2019/02/pakistan-conducts-second-nasr-nuclear-capable-ballistic-missile-test-in-a-week/

Nuclear-Capable Missiles

Babur-2/Hatf-7 cruise missile

The Babur-2/Hatf-7 cruise missile is designed to carry both conventional and nuclear warheads. The missile is boosted from its launch tube by a solid fuel rocket and is then powered by a turbojet engine. The Babur missile may be a reverse-engineered US Tomahawk missile that was recovered unexploded from a US airstrike on Afghanistan on 10 August 1998. The Babur-1 is nuclear-capable and can carry conventional payloads. The missiles were first tested on a single launcher from the Winder test range in August 2005. The range of the Babur-1 was estimated to be 350km. The Babur-2 is launched from a quad TEL with the first launch in April 2018. This missile has an estimated range of 700km and is 6.25m long and 0.52m in diameter.

Babur-3

The Babur-3 is the first missile that is planned to be Pakistan's sea-based part of the triad. The missile has been tested twice from a barge in the Arabian Sea, in 2017 and again in 2018. It is to be installed on Pakistan's three Agosta submarines and later probably on the ten Hangor submarines ordered from China. Today there is no evidence that this missile has been tested further or deployed. It has an estimated range of 450km.[61]

The Ra'ad/Hatf-8 air launched cruise missile (ALCM)

These Ra'ad missiles, along with gravity bombs, are the airborne component of Pakistan's triad. It is deployed on the Mirage 3 EA fighter aircraft. They probably plan to deploy the missile on the JF-17 fighter being purchased from China. The heritage of this missile is possibly from a South African missile but has not been confirmed. The test of the first version of the missile was in August 2007 and had a range of 350km. The Ra'ad-2 version has the range extended to 600km. This version was shown in a March 2017 parade and it has been significantly modified. The latest test of the Ra'ad-2 missile was on 16 February 2010 and it achieved a 600km range. The missile is 4,85m long and 0.5m in diameter.[62]

[61] Reuters, "Pakistan fires 'first submarine-launched nuclear-capable missile'", Staff Writers, Islamabad (Reuters) Jan 9, 2017, https://www.reuters.com/article/us-pakistan-missiles-idUSKBN14T1EL
[62] "Hatf-VIII (Ra'ad)," Wikipedia, accessed August 8, 2021, https://en.wikipedia.org/w/index.php?title=Hatf-VIII_(Ra%27ad)&oldid=1037799321

Democratic People's Republic Of Korea (DPRK)

The DPRK's nuclear capable missiles today are land based and mobile. They are short to intermediate range operational missiles, with at least three intercontinental range missiles under development. They are also developing a long-range submarine ballistic missile and are modifying a conventionally powered submarine with three launch tubes for these missiles. This submarine is expected to be launch in 2021/22. Their air force also has at least two types of aircraft that are capable of carrying gravity nuclear bombs. There is no publically available data, however, to indicate any of them have been modified to carry these bombs.

Hwasong-5(SCUD A), 6(SCUD B) and 7(Nodong 1&2)[63]

The DPRK got its start with long-range missiles with Soviet SCUD B missiles obtained from Egypt in the 1970s. The North Koreans reversed engineered these missiles and identified them as Hwasong-5. Tests began in the late 1980s from the Tonghae missile range. They then improved the missiles and called them Hwasong-6 and deployed them internally and sold them to mainly Middle East countries. The DPRK became the largest supplier of missiles to Iran during the Iran-Iraq war from 1980 to 1988 and set up a production facility for these missiles in Iran in 1985. The sales of missiles and the construction of production facilities for missiles became a large source of currency for the DPRK. As of 2020 fewer than 100 of the Hwasong 5/6 and their variants are deployed in the DPRK. The latest variant is the 1,000km extended range Scud first launched in 2016.

The next missiles in the SCUD/Hwasong-5 line were the Hwasong 7, commonly known as Nodong-1(Rodong-1). These were up-scaled Hwasong-6 missiles and tested from the Tonghae missile range from 1900 to1993. The first customer for the Hwasong 7 missile was Pakistan, which purchased twelve to twenty-four of them and called them Ghauri. They were delivered unassembled in 1997. The DPRK set-up an assembly facility in Pakistan for these missiles but not a full production facility. Iran was the second client for the Hwasong-7 and called them Shahab-3.

[63] Please note there are three nomenclatures in use for North Korean missiles: DPRK Hwasong-1-X, US and ROK KN-01-X and some were given names by the U.S. based where or near where they were first launched from, Taepodong, Nodong and Musudan. To confuse even more, the Musudan was never launched from Musudan. For this section the use of the DPRK Hwasong naming will be used where possible.

Testes began in 1998 and it entered Iranian service in 2003. The Shahab-3 is the first stage of the Iranian Safir space launch vehicle. In the DPRK in 2020 there were fewer than 100 Hwasong-7 deployed.[64]

Paektusan (Taepodong-1) and Unha (Taepodong-2) Space Launch Vehicles

Starting in the mid to late 1990s the missile program seems to have turned into a space launch program. The first of the rockets was called Paektusan (Taepodong-1) and it used a Hwasong-7(Nodong) first stage, a Hwasong-6(SCUD) second stage, and a small solid fuel third stage. It was launched from the Tonghae only once on 31 August 1998. This was a one off mission that failed to put a small satellite into orbit but did prove out staging and control systems. It was not a weapon.

Next came the larger Unha (Taepodong-1/2) rocket with a first stage of four clustered Hwasong-7 engines, a second stage with a probable Hwasong-6 engine, and a possible Iranian third stage. The first launch Unha-1 was from Tonghae on 4 July 2006 and it failed after around 40 seconds. The next launch on 5 April 2009 was called an Unha-2. It was another satellite attempt that failed during the third stage. After this mission, the launch program was moved to the Sohae Satellite Center where starting on 12 April 2012 three Unha-3 SLVs have been launched. One failed and two successfully launched satellites into orbit. Since the 7 February 2016 launch they have not attempted another Unha-3 space launch as of November 2021. In a later DPRK article it stated they had six more Unha rockets and had assigned space missions to each of them.

This short discussion of the Paektusan and Unha rockets has been included because in many documents they are listed as missile weapons.

Hwasong-10 (Musudan) and Hwasong-13 (KN-08)

The Hwasong-10 missiles along with the Hwasong-7(Nodong) were first shown to the West in a 10 October 2010 parade in Pyongyang. The Hawasong-13 was first seen in the 15 April 2012 parade. The design of both missiles probably began in the late 1990s. The parade missiles were probably not flight articles. Also propellant for both missiles is probably IRFN/Kerosene similar to the older Hwasong 5, 6 and 7 missiles and the Unha space launch vehicles.

[64] Feroz Khan, *Eating Grass: The Making of the Pakistani Bomb* (Stanford University Press, 2012).

The Hwasong-10 (Musudan) is single stage missile 12m in length and 1.5m in diameter. The missile was first reported to be an IRBM but was probably an MRBM. It is mounted on a demilitarized Russian SS-20 TEL that was remilitarized in the DPRK to again carry a missile, the Hwasong-10.

The flight test program began in April 2016 and included eight launches of which only one was successful on 22 June 2016. Testing ended in October 2016. Three or four of these tests exploded on or near the TELs destroying them. None of these tests took place from an established missile test range; they were all from unimproved field sites. The Hwasong-10 was last seen in a parade in 2016 and was not present in the 2017 and 2018 parades. By all accounts the program has probably been terminated and the TELs given to the Hwasong-12 and other missile programs. The Hwasong -10 was never deployed.[65]

The Hwasong-13 (KN-08) is a three-stage liquid fuel mobile missile, reported in the West to have an ICBM range. It was first seen in the 5 April 2012 parade carried on a Chinese 8 axel WS-51200 tractor. Probable Hwasong-13 engine testing was observed at the Sohae Haasong-13 engine test stand first in late 2012 when the first stage was seen on the pad. Testing again started in mid 2013 and in March 2014 and was seen again in August 2014. Testing was terminated by 2015 when construction began to modify the test tower and add two new propellant bunkers and a mobile concealment building. These projects were completed by early 2016 and needed to ready the engine test facility for the higher energy propellants used in the upcoming tests, and Kim's visits.

No confirmed launches of the Hwasong -13 have been reported. There is speculation, however, that one or two of the last Hwasong-10 test failures may have been Hwasong-13s. Four new missiles paraded in 2015 were identified as the KN-14 or KN-08 Mod 2. The missiles were carried by the same TELs as the Hwasong-13 and only seen in the 2015 and 2016 parades. The missiles, six of them, were last seen on a warehouse floor at the Tae-Sung Machine facility in the video

[65] Missile Defense Project, "BM-25 Musudan (Hwasong-10)," Center for Strategic and International Studies, August 8, 2016, last modified July 31, 2021, https://missilethreat.csis.org/missile/musudan/

taken during Kim's visit to inspect the fission bomb on 9 March 2016. The KN-14 missiles were very probably fakes. Neither missile was ever deployed.[66]

Hwasong-12 (KN-17) IRBM and Hwasong-14 (KN-20) ICBM

Starting in September 2016 testing of high-energy propellant rocket engines began at the Sohae test stand. A second major test took place in March 2017. An assessment of the type of engine being tested was it is probably a liquid propellant RD-250 type, based on the Soviet engine. The RD-250 uses hypergolic propellants, UDMH fuel, and N204 oxidizer. These tests were very important as Kim attended and heaped praise on the test engineers after they were successful.

Four Hwasong-12 missiles were first seen in the 17 March 2017 parade carried on TELs that had previously been used by the Hwasong-10 missiles. It is a single stage missile using the RD-250 type engine with four vernier steering engines all using high-energy propellants. The missile is 16.5m in length and 1.5m diameter and an estimated range of at least 5500km. The Hwasong-12 was the first of the new missiles to be tested with three tests in April 2017 that all failed. The forth missile was launched on a lofted trajectory with an apogee of 2,111km. Successful launches on 29 August and 15 September were to long ranges of 2,700km and 3,700km. Both flew over Japan and caused an international incident. In April 2017 Kim threatened to bracket the US island of Guam with four missiles, probably Hwasong-12s, but never did it. The Hwasong-12 is the replacement for the failed Hwasong-10 missile and fills the IRBM range gap.[67]

The Hwasong-14 is classified in some reports as an ICBM. It is the second of the new missiles to appear. It was first seen in a video of it first launch on July 4, 2017. The second launch occurred on July 28, 2017. Both of these launches were successful. It is carried on the same WS-51200 TEL that had carried the Hwasong-13 (KN-08) missile. Eight of these WS-51200 vehicles were purchased from China in 2011 as logging trucks. These were then converted into Hwasong-14 TELs by the DPRK. They have also probably been copied and produced internally.

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[66] David Webb, "KN-08 / Hwasong-13," Missile Defense Advocacy Alliance, January 2017, https://missiledefenseadvocacy.org/missile-threat-and-proliferation/todays-missile-threat/north-korea/hwasong-13/

[67] Missile Defense Project, "Hwasong-12 (KN-17)," Center for Strategic and International Studies, May 16, 2017, last modified July 31, 2021, https://missilethreat.csis.org/missile/hwasong-12/

A small number of these TELs, one or two, were probably modified in the mid 2010s to launch the Hwasong-14. But when seen in parades starting in 2018 the Hwasong-14 was being carried on a semi-truck trailer and not by the TEL it was launched from in July 2017. At least four of these TELs were also modified to carry an unidentified canister missile in the April 17, 2017 parade.

Four more modified TELs with three additional axils were seen in the October 2020 parade carrying the Hwasong-16 missile. Why the Hwasong-14 was not on a TEL is possibly because of there were no TELs available.

There have been two tests of the second new missile the Hwasong-14. Both were lofted trajectories and impacted in the Sea of Japan. Apogee of the July 4,2017 test was 2,803km and the 28 July 2017 test was 3,700km. It is not clear that the reentry vehicle survived. The missile is 19.8m in height and 1.85m in diameter and uses a RD-250-type engine and four vernier steering engines. It is not known how many of these missiles exist or if they are currently deployed. The Hwasong-14 is probably the replacement for the Hwasong-13 that was not deployed.[68]

Hwasong-15 (KN-22) ICBM and Hwasong-16 (KN-27) ICBM

The Hwasong-15 large mobile ICBM was first shown to the world in a video of its first and only launch on 29 November 2017. The video shows Kim inspecting the launch preparations, the launch, and the celebration after a successful mission. Four of the missiles were next seen in the 8 February 2018 parade and again in the 10 October 2020 parade. One of the HS-15 missiles was seen on the floor of the EXPO on 11 October 2021 at the military exhibition in Pyongyang. There have been no further sightings or launches of the missile.

The November 2017 test was on a lofted trajectory and it reached an altitude of 4,475km and impacted in the Sea of Japan. Based on the lofted trajectory it has been estimated its operational range could be 13,000km with a payload of 1,000kg. The Japanese reported the reentry vehicle failed, however, other observers disagree. The missile's first stage uses a gimbaled two-chambered RD-250 type engine. The second stage engine is not known but is probably a version of the single chamber RD-250 type. The Hwasong-15 is about 22.5m in length and 2.4m in diameter.

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[68] Missile Defense Project, "Hwasong-14 (KN-20)," Center for Strategic and International Studies, July 27, 2017, last modified July 31, 2021, https://missilethreat.csis.org/missile/hwasong-14/

The missile is carried on a modified version of the Chinese WS51200 logging truck with a ninth axel and a new cab. Eight of these trucks were reported to have been imported in 2011. Modifications as a TEL, they were probably done by the March 16 Truck Factory in Pyongsong, DPRK, that added the missile erection system and its controls. Like the Hwasong-12 and 14s, this missile TEL also has a detachable launch stand allowing it to move away in case of a early launch failure.

The Hwasong-16 (KN-27) was the October surprise the DPRK said they would have when four of these missiles were paraded in Pyongyang the night of October 10, 2020. The Hwasong-16 is the largest liquid fuel mobile missile ever developed. It has not been flight-tested as of mid November 2021 and its development status is unclear. Therefore, the ICBMs shown at the parade were likely to have been engineering models. Estimates of its range is over 13,000km with a payloads of 2,000 to 3,500kg kg.

The only available information on the Hwasong-16 missile is the parade imagery provided by the DPRK and the analysis derived from it and the photo from EXPO on 11 October 2021 at the military exhibition in Pyongyang. The close up parade photos of the missiles had measurements that are probably good to plus or minus five percent. Its length is 25.2m and diameter is 2.73m. The length of the first stage is 15.5m, the second stage is 5.0m in length and has the same 2.73m diameter, and the nose cone is 5.1m long and tapers from the second stage to the rounded 1.0m diameter front end.[69]

Because the engines on each missile were covered by a red plastic, it cannot be confirmed the engines were even present or the same RD-250 type used by the Hwasong-15 missile. There are some clues, however, they probably are. The first is on some of the missiles the red plastic is wrapped around each chamber and that can be measured at 0.8m in diameter. That is the diameter of the RD-250 chambers. The red plastic on the missiles shows there are four nozzles at the end of the first stage. The missile's first stage probably uses two gimbaled two-chambered RD-250 type engines and they are movable to provide the steering during first-stage flight. The rear of the first stage is flared out about 0.2 m likely to provide clearance for the nozzle's movement. There is no way to identify the engine used in either the first or second stage, but good assessments are a two

[69] "Hwasong-16," Wikipedia, accessed August 29, 2021, https://en.wikipedia.org/w/index.php?title=Hwasong-16&oldid=1041233316

two-chambered RD-250 type engine in the first stage and a single two chambered RD-250 in the second stage.

The nose cone is 5.1m long and tapers from 2.73m at its base to 1.0m at its rounded top. It is capable of carrying multiple independently targetable re-entry vehicles (MIRVs) and the required post-boost vehicle needed to target them. However, the DPRK is unlikely to have the technology for these systems. To date, there is no evidence of any testing of more than a single re-entry vehicle or of a post-boost vehicle. They could however deploy multiple re-entry vehicles (MRVs) that are designed for release to bracket a target to ensure its destruction.

The four 11-axle TELs that transported the four Hwasong-16s in the parade are likely to be the largest ever built. The TEL itself is about 29.5 m long and about 4 m wide. The Hwasong-16 transport-erector portion includes the cab and the carrier that has the erector. The TEL has twenty-two 1,800 mm -wheels controlled independently and driven by a drive shaft from the diesel engine behind the cab. Three hydraulic jacks on each side of the carrier are extended to the ground to stabilize the erection process. The jacks are positioned to support the weight of the carrier as it shifts during the erection process

The big questions are when will the first test launch occur and where will it be launched. With the current data available these cannot be answered. A good guess at the second question is it will not be from an established test range but from a remote unprepared location. The answer to the first question is known only to Kim and his engineers, but probably later in 2021 or 2022.

HS-8 Hypersonic Glide Vehicle (HGV)

September 2021 was full of more surprises as on 29th an announcement and a photo just after launch of the HGV, were realest. Then at the EXPO on 11 October 2021, at the military exhibition in Pyongyang, the missile and its TEL were displayed. Almost no information was released on the launch other than it was fired from the western side of the country. From the announcement, it was not clear that it was a complete success. The photos of the HGV taken at the EXPO were more revealing. The booster is a three quarters length HS-12 IRBM. The HGV has orange stripes painted on it that are similar to those on the HGV launched on 29 September. These are use for optical tracking. The TEL is similar to the one that carried the HS-14. More tests can be expected.

Shorter-range ground launched ballistic missiles

The Pukkukson-2 (KN-15)

The Pukkukson-2 is a two stage solid fuel track vehicle-mounted MRBM. The missile was first observed in a video of its first launch on February 11, 2017, at the Riku-dong training facility 4.2km from Kusong, with Kim supervising. Six of these missiles were seen in the April 15, 2017, parade. Kim also attended the second and last known launch on May 21, 2017. Both the February and May tests were lofted trajectories and were successful. Kim then declared the Pukkukson-2 ready for mass production. It was reported deployed in 2019.

The Pukkikson-2 is a land-based variant of the submarine based Pukkukson-1. It is 10m in length and 1.5m in diameter with an estimated range of 1,200 to 2,000km. It is cold launched from a tube in the vertical position from a tracked vehicle. It is probably a replacement for some of the Hwasong-7 (Nodong 1 and 2).[70]

The KN-23

The KN-23 is a short-range single stage solid fuel missile and either is a Russian-built Iskander-1 missile or a copy of it. It is hot launched off the rear of the TEL. The missile was first seen in the February 8, 2018, military parade. The first of eight launches occurred on May 4, 2018. The missile has been seen launched from both wheeled and tracked TELs. The most recent launch of the KN-23 was on July 31, 2019.

Both the 4 axle wheeled and tracked TELs carry two missiles. The missiles are 7.5m in length, 0.95m in diameter, and have a range of 450km with a 500kg warhead. These missiles are probably replacing the Hwasongs 5 and 6 SRBMs.[71]

Probable KN-23-2/ KN-28

In the January 14, 2021, military parade six larger versions of the KN-23 missile were seen mounted on five axle ten-wheel truck TELs. The truck beds have been extended about 1.5m to

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[70] Missile Defense Project, "Pukguksong-2 (KN-15)," Center for Strategic and International Studies, March 5, 2017, last modified July 31, 2021, https://missilethreat.csis.org/missile/pukkuksong-2/

[71] Missile Defense Project, "KN-23," Center for Strategic and International Studies, July 1, 2019, last modified July 31, 2021, https://missilethreat.csis.org/missile/kn-23/

accommodate the fifth axle and longer missile. The truck bed is similar to the first KN-23, but the cab is a new design. The missile appears to have the same nearly 1m in diameter and is about 1m to 1.5m longer. As of mid-August 2021 no Hwasong number has been identified but the KN-28 may have been assigned to these missiles.

Two of the new missiles were launched on 25 March 2021 at 7:06 am and 7: 25 am (Japan Standard Time) from South Hamgyong Province. According to North Korean's KCNA news agency they impacted in the East Sea for a range of 600km with a 2,500kg warhead and hit their target. Kim did not attend the launches. Senior official, Ri Pyong Chol, supervised the launches.

The ROK and Japan probably had sensors that observed some or all of these flights. They take issue with the ranges and warhead weight given by the DPRK. Their conclusions suggest these missiles flew around 450km with a smaller warhead. They believe the DPRK inflated the numbers to make their missile technology look better. The 1-1.5m of additional solid fuel rockets could have increased their range possible out to 600km, however.[72]

Rail launched KN-23/28

Yet another September 2021 surprise was three KN-23/28 missiles launched from an open rail car, two on September 15 and one on September 28. The DPRK reported both missiles were successful and flew to 800km at an altitude 60km. Photos released by the DPRK of both dates show the missile launches from a mountain location with a railway tunnel in the background. These trains consisted of an engine, boxcar, and the open car with two KN-23/28 missiles. This car appeared to have a similar truck erector launcher system installed in it. The placement of the launch near a rail tunnel was meant tell how they plan on hiding the trains.

KN-24

KN-24 is a mobile short-range single stage solid propellant ballistic missile similar in appearance to the US Army MGM-140 ATACM. The missile was first tested on 10 August 2019 when two were launched with Kim in attendance. It was hot launched from the rear of the tracked TEL from

[72] Vann H. van Diepen, "Initial Analysis of North Korea's March 25 SRBM Launches | 38 North: Informed Analysis of North Korea," *38 North* (blog), March 30, 2021, https://www.38north.org/2021/03/initial-analysis-of-north-koreas-march-25-srbm-launches/

inside an open ended rectangular enclosure. Two more were launched on August 16 and the last two launches were on 21 March 2020. The latest sighting of these missiles was in the January 14, 2021, military parade when six tracked TELs were seen, each with two missiles. These missiles were inside rectangular enclosures with the front-end open so the missile warheads were seen.

The KN-24 has been measured to be 4.5-5.5m in length and 0.7-0.85m in diameter. It has flown to ranges from 230km to 410km on non-ballistic trajectories. It is estimated to be able to carry a 400-500kg warhead and has been launched with the two missiles from the same TEL, 5 minutes apart.[73]

DPRK submarine launched ballistic missiles

The DPRK has demonstrated it has the capability to develop and successfully launch two submarine ballistic missiles, the Pukkuksong-1 and 3. To do this they had to first build the infrastructure that allows the construction and testing of all the elements that make up the weapons system. For the missiles these included the solid rocket motors, the launch tubes, and cold gas ejection system. These were tested first on shore then from a submersible barge and then from a conventional test submarine. On top of this, they were building an extensive hardened submarine base probably for the operational missile submarines near Sinpo. This is a very expensive program.[74]

Probably as result of the costs, Kim took a special interest in the program by visiting most of the elements involved. Among them was a test at the solid motor test facility and a test at the shore-based ejection test facility. He supervised the checkout and loading on the test submarine of the Pukkuksong-1 missile and its launch. He observed most the Pukkuksong-1 launches from the barges and test submarine.

In a most visible appearance he visited the submarine construction hall at Sinpo to assess the progress on the conversion of a 1950s vintage R-class submarine into a Pukkuksong missile

[73] Missile Defense Project, "KN-24," Center for Strategic and International Studies, April 15, 2020, last modified July 31, 2021, https://missilethreat.csis.org/missile/kn-24/
[74] Nick Hansen, “North Korea Building New, Larger Submarine Pens,” *HIS Janes Defence Weekly*, July 27, 2016.

submarine with three launch tubes. That was in mid 2019, but this submarine has not entered the water as of October 2021.

Pukkuksong-1 (KN-11)(Bukkeuksong-1) SLBM

The Pukkuksong-1, based on a range estimate of 1,200km, is considered MRBM range. Development of this missile began in the early 2010s. A dummy mass model missile went through ejection tests at the Sinpo test facility in October and November 2014. In December 2014 it went through more ejection tests from the barge and more tests with a test missile in April and May in 2015. In November 2015 it was reported an ejection test caused some damage to the conning tower of the test submarine so testing went back to the submersible barge. The submarine was repaired and in April and July 2016 missiles from the submarine failed shortly after launch. The first true success was the launch occurred on 24 August 2016 when the missile flew on a lofted trajectory to a range of 500km. As of October 2021 there have been no additional launches of the Pukkuksong-1.

The Pukkuksong-1 is two-stage solid fuel missile with an estimated range of 1,000 to 1,500km. It is 9m in length and has a diameter on 1.5km. Pukkuksong-1 was first seen in launch videos in 2015. Six missiles on naval trucks were first seen in 15 April 2017 parade. This missile is closely related the land mobile Pukkuksong-2.

The Sinpo-1/ Gorae-SSB is the test submarine for the Pukkuksong-1 missile. It was first seen at the dock in Sinpo in 2014. It was built to test launch the Pukkuksong-1 missile and was reported to have damage to the conning tower during its first launch of the missile on 28 November 2015. This submarine went on to launch three more Pukkuksong-1 missiles in 2016. The last, on 24 August 2016, was successfully launched on the lofted trajectory.

Based on the material above there is a reasonable chance the Pukkuksong-1 program spun off the land launched Pukkuksong-2 system. However, the Pukkuksong-1 may have been only to prove out the various technologies for future SLBMs. Its two main test components are the submersible barge and the Sinpo-1 submarine, both of which will find use in the Pukkuksong-3 missile test program. It was probably this barge towed from Sinpo to Wonsan that launched the Pukkuksong-3 missile on 2 October 2019.[75]

Pukkuksong-3 (KN-26) SLBM

The Pukkuksong-3 SLBM has been seen twice, the first in a wall poster in August 2017 at the Chemical Materials Institute during Kim's visit and again on 2 October 2019 in three photos released by the DPRK of its only launch. Kim also witnessed a test of what was probably its solid fuel motor at the Magunpo Solid Rocket Motor Test Facility in March 2016. The Pukkuksong-3 has never been seen in a parade and was not displayed at the EXPO on 11 October 2021 at the military exhibition in Pyongyang.

The Pukkuksong-3 is a two-stage solid fuel missile. Because it was seen only in the three still photos just coming out of the water with nothing in the background, its length and diameter measurements are estimates and vary considerably. They range from nearly 8m to 10.6m in length and 1.5m to 1.8m in diameter. Please note these estimates are not far from those of the Pukkuksong-1 that are 9.7m in length and 1.5m in diameter that ~~was~~ can be launched from the submersible barge and the Gorae/Sinpo-1 test submarine. Based on the similar sizes of the Pukkukson 1 and 3 it is expected the Pukkuksong-3 will use the barge and Gorae test SSB for future tests.

The missile was cold launched from probably the Sinpo submerged barge, off the Wonsan coast and flew a lofted trajectory with an apogee of 910km and a range of 450km. That works out to an estimated range of 1,900km if flown on a normal trajectory. This test was successful. More tests from the barge and Gorae/Sinpo-1 test submarine can be expected probably from the Sinpo area.

The modified R-Class submarine with three launch tubes will probably carry the Pukkuksong-3 SLBM. It has been in the Sinpo submarine construction building since before 2019 and is estimated it will be launched in 2021/2022. It is interesting this building has two submarine construction ways but the video only covered the modified R-Class submarine on the south way.

[75] "Pukkuksong-1," Wikipedia, accessed August 6, 2021, https://en.wikipedia.org/w/index.php?title=Pukkuksong-1&oldid=1037427898

The Pukkuksong-4 and Pukkuksong-5

This short write up is placeholder for two new long-range missiles seen in a 2020 and a 2021 parade. The Pukkuksong-4 was on the same type truck trailer as the navy's Pukkuksong-1 seen in the April 2017 parade, but it was painted olive drab and not navy blue. Seated on the bench in front of the missiles were four army soldiers. It is possible it will be a mobile army missile.

The Pukkuksong-5 is a Pukkuksong-4 with and elongated second stage. It is carried on the exact same trucks the Pukkuksong-4 used. The only difference was the missile shroud extended past the bench and the bench was removed. Since it was painted olive drab, it could also be a land mobile missile. Both of these paraded missiles were either fakes or early engineering models. They were not flight articles.

Possible Pkkuksong-6 short range SLBM

To the surprise of most DPRK analysts the DPRK conducted a test of an underwater launched short-range ballistic missile from Sinpo on October 19, 2021. The missile was probably launched from the Gorae test submarine, but it could also have come out of the submergible barge. The DPRK did not release the name of the missile, but from the video it is probably a variant of the KN-23. No accurate dimensions can be determined from the photos. The only estimate is the size of the launch tube on the Sinpo-1. The tube had to fit the Pukkukson-1 missile that was reported to have a length of 9.3m and a diameter of 1.5m. The KN-23 would easily fit into this launch tube. The mission for the development of the submarine launch short-range missile is unknown.

Long-Range cruise missiles

The DPRK never had a long-range cruise missile until September 12, 2021, when they launched two from a ground TEL. The missiles are a descendent of the Soviet/Russian Kh-55/AS-15 of the mid-1980s. These missiles were then deployed to extend the range on the TU-95 strategic bombers and carried nuclear weapons. These DPRK missiles are ground-launched and probably have a ground attack mission. The big question is what country sold them the technology. Russia, China, and Iran have modern versions of these missiles, and Iran obtained them from Ukraine in 2001.

Conclusion

This chapter describes the missiles-deployed or under development by the six nuclear weapons states in the Asia-Pacific region. Nuclear weapons states rely on ballistic missiles for the most part to deliver WMD, especially nuclear warheads, due to their combined speed of delivery and geographical reach to overwhelm any possible defense against nuclear attack. Asia-Pacific states present a myriad of lethal missiles, the development and deployment of which is driven by many domestic and international factors, but especially the presence of an external missile threat leading to offsetting, action-reaction missile development. Thus, it is evident that US-Russian and US-Chinese missile advances are primarily the result of competition, whereas in other cases (the DPRK and India, for example) missile acquisition is a three or even four-way dynamic whereby the most capable missile sets the range and lethality standard that drives the other states to match, albeit often in a-symmetric ways that use new missile technology such as hypersonic missile speeds to leapfrog the old.

Treaties and agreements that controlled missile proliferation by the US and USSR/Russia in the twentieth century have either collapsed or are no longer fit for purpose. The New START treaty needs to be renegotiated to include the new nuclear weapons that did not exist when the original treaty went into effect. This treaty could be the starting point for a more comprehensive agreement to include the other nuclear states. It is urgent, therefore, for states to find ways to reduce the immediate risk of war posed by rapidly advancing missile systems and to resume the search for ways to reverse the tide.

For some states, their strategic context suggests that missile reduction measures must accompany those aimed at missile control in agreements with the United States and Russia, whether undertaken bilaterally or trilaterally. For others, bilateral measures will suffice to meet strategic imperatives and in some instances such as the DPRK, unilateral missile disarmament may be the best available option, provided these are implemented as part of a comprehensive security solution with its adversaries and partners.

5. Nuclear Command, Control, and Communications (NC3) in Asia-Pacific

Peter Hayes

Introduction

Nuclear Command, Control, and Communications (hereafter NC3) is one of the least known but arguably most critical dimension of nuclear forces in Asia-Pacific. Put simply, NC3 combines wetware (people), hardware (sensor, communications, and control technology), and software (digital code that enables the digital elements to connect people with machines, although much of the technology is analog inherited from a pre-digital era in the older nuclear-armed states). The purpose of this combination is to enable commanders to target, operate, control, and use nuclear weapons by receiving data and advice from sensor systems and people tasked with interpreting it, to make decisions, and to send orders to nuclear forces to move, go on alert, or to strike targets. Most treatments of nuclear forces focus on nuclear warheads (type, number, megatonnage, and fissile material) and delivery platforms (type, range, accuracy, tactical versus theater versus strategic) and simply take NC3 as given. There is a reason, however, that David slung his stone into the forehead of Goliath rather than his musculature. Without a head connected to a body, a nuclear force is useless. Disregarding NC3 misses, it is perhaps the most critical element of making nuclear war. Therefore, it behooves us to pay attention to it.

Also, NC3 is arguably a potent "force multiplier" that makes a given combination of nuclear warheads with delivery systems far more lethal (if the NC3 systems are relatively robust and reliable) or—if destroyed by counter-NC3 attacks—far less able to annihilate an adversary in a first, retaliatory, or indeed, any strike at all (the "perfect" counter-NC3 strike being one that simply decapitates the nuclear forces of an adversary or vastly limits the damage incurred from its forces attacking one's own forces and/or society). Thus, more capable NC3 may substitute for additional

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nuclear forces at a given force level, making additional forces unnecessary even when adversarial forces expand or improve qualitatively. Or they may even offset reductions in nuclear forces.

Conversely, "improved" counter-NC3 forces may undermine such perceptions and force-enabling characteristics of NC3, and thereby increase the risk of first-strike instability between nuclear-armed adversaries. The worst case is improved NC3 forces combined with expanding nuclear forces and increasingly effective counter-NC3 forces, implemented either by one side creating an illusion of nuclear escalation and warfighting dominance; or, if implemented by both sides, increasing the perception that going first is the only option to limit damage from the inevitable first strike by a nuclear adversary given their NC3 vulnerabilities.

NC3 does not loom large in arms control or disarmament literature, with significant exceptions. In the American Cold War, use of NC3, which was distilled in the acronym NC3I for nuclear command, control, communications, and *intelligence* in standard theoretical and policy use in the mid-eighties, NC3 was indistinguishable from NC3I. That's because NC2—nuclear command-and-control—relied indispensably on communication systems—the third C in NC3—to communicate information from nuclear commanders in the command chain to and from nuclear forces and, in turn, to convey information from sensor systems that provided early warning, target identification, and damage assessment needed for nuclear commanders to make decisions, select strike options, and issue strike orders with nuclear forces.

Because these "national technical means" (NTM) were viewed as integral to sound nuclear decision making and indispensable to the operation of nuclear forces before, during, and after a nuclear war, many US-Soviet strategic nuclear arms control agreements included clauses banning "interference" with NTM. Otherwise, because NC2 and supporting communications systems are so opaque, making it impossible to verify compliance with various measures that might have been taken to control NC3 systems in these agreements, NC3 simply doesn't appear in strategic arms control agreements. And there are few tacit understandings let alone norms on behaviors related to NC3 and counter-NC3 operations.

Moreover, analysts of NC3 mostly assumed that "more NC3" is automatically better. After all, who could object to increasing negative controls over nuclear weapons (those organizational and technical measures that ensure nuclear weapons are never used by mistake) or positive controls over nuclear weapons (those organizational and technical measures that ensure nuclear weapons are always available for immediate use, the underlying basis of nuclear threat that creates the perception that nuclear retaliation is inevitable and therefore nuclear first use is never rational, the essential foundation of strategic deterrence and "stability" in nuclear threat dyads)? Thus, goes the argument, more NC3 means more bang for the buck at same or lower cost, and less risk of nuclear war due to enhanced strategic stability. So why worry about NC3-related arms control, let alone disarmament?

Unfortunately, this perspective was highly subjective, introspective, and parochial. In reality, nuclear armed states are in a conflict relationship, and a relationship is always based on communication of intention and capability—as was explained long ago by the first generation of strategic theorists. Such communication can take many forms—statements of doctrine, political threat rhetoric, back-channel messages, diplomatic demarche, changes in alert levels, force deployments, forward deployment, nuclear warhead and delivery platform testing…the nuclear practitioner's repertoire is quite extensive, even for small monadic forces, let alone "mature" triadic forces with global reach deployed by the United States, Russia, and China today. Among the most important information that is sent by one nuclear antagonist to another is that obtained by communications intelligence systems of what an adversary's nuclear command is saying to its own forces combined with direct observation via NTM of status and operations of deployed nuclear forces. Thus, sensors create information flows that continuously link adversarial forces in what is correctly termed "NC3 interdependence," thereby creating what a "tightly coupled" US-Soviet NC3 system (Paul Bracken),[1] and a "gigantic interacting system" (Ash Carter)[2] , although they did not analyze the resulting global dynamics of this NC3 "metasystem" even when it was relatively simple during the Cold War.

Today, with fifteen nuclear weapons and nuclear-delivery states each endowed with distinctive national and in some cases (NATO) multinational NC3, global NC3 interdependence is vastly more complicated to the point of true complexity and can no longer be ignored. It is now critical that NC3 be analyzed for its direct contribution to the increase or reduction of nuclear risk—

[1] P. Bracken, *The Command of Strategic Forces, Dissertation, Yale University,* 1982, p. 39.
[2] Ashton Carter, "Sources of Error and Uncertainty," in A. Carter, J. Steinbruner, and C. Zraket, ed, *Managing Nuclear Operations,* The Brookings Institution, Washington DC, 1987, p. 635.

depending on the contextual circumstances, and that policy measures be taken to control and disarm NC3 systems, not just the warheads and delivery systems for nuclear weapons. To not do so would be like analyzing the efficacy of global air traffic control systems without revealing the location of air traffic control towers, the frequency, procedures, and language used and harmonized by ICAO, and paying no heed to the communication systems employed to coordinate aircraft movement and to synchronize aircraft movement across whole airspaces under different routine and emergency circumstances. Anyone who proposed running air traffic control without minimal transparency, common standards and procedures, and interoperable communication systems sharing sensor data from radars and satellites would be dismissed or isolated (think airlines that assiduously avoid traversing DPRK airspace). Yet, that is the situation today with respect to NC3.

Definition Of NC3

To proceed, we first need a working definition of NC3. There is no agreed definition of NC3, however between or within nuclear armed states. It's not even clear that all nuclear-armed states even use such a term. Or if they do, whether it captures the same meaning and scope as its dominant usage in American and allied nuclear forces.[3] The concept is most developed in the United States and its allies, and in Russia, where it has long been the subject of military and budgetary definitions, although these have varied over time.

At a basic and universal level, the NC3 system connects senior nuclear commanders with their nuclear forces and enables them to control their use at all times. Control is a critical concept when it comes to nuclear weapons given their uniquely destructive capability. It is translated by many procedures, measures, and organizational systems, some of which may work against the other when it comes to combining negative and positive controls in routine, crisis, and wartime nuclear weapons operations. Also integral to NC3 is the notion of legitimacy and authority—the nuclear

[3] For example, Fiona Cunningham reports that there is no open-source clear definition of "NC3" with Chinese characteristics, although there are various command and control concepts in the Chinese literature that relate to elements of NC3 as defined by the United States and NATO. See Fiona Cunningham, "Nuclear Command, Control, and Communications Systems of the People's Republic Of China", NAPSNet Special Reports, July 18, 2019, https://nautilus.org/napsnet/napsnet-special-reports/nuclear-command-control-and-communications-systems-of-the-peoples-republic-of-china/

commander must be accountable under domestic and international law. And there must be systems to ensure that command decisions are authenticated and that nuclear weaponeers know that commands that they receive and act on are authentic and legal.

American nuclear weaponeers have long held that NC3 systems must be as reliable, robust, and capable to deter nuclear strikes.[4]

In this view, NC3 is a system. It is made up of all the elements that enable a weapon to be deployed, including appropriately trained personnel, parts, and the systems that allow an NC3 apparatus to work all the way from commander to weapons operator. The fit between the weapon and the NC3 system is never perfect.

The United States made a clear public statement as to what is meant by NC3. The US Department of Defense's *Nuclear Matters Handbook* (2020 edition) states:

> The U.S. command and control is necessary to ensure the authorized employment and termination of nuclear weapons operations, to secure against accidental, inadvertent, or unauthorized access, and to prevent the loss of control, theft, or unauthorized use of U.S. nuclear weapons. The President's ability to exercise authorities is ensured by NC3.[5]

It then goes on to state that NC3 can only be understood with reference to NC2:

> In order to understand NC3, it is important to define nuclear command and control (NC2). NC2 is the exercise of authority and direction, through established command lines, over nuclear weapon operations by the President as the chief executive and head of state. NC2 is supported by a survivable network of communications and warning systems that ensure dedicated connectivity from the President to all nuclear-capable forces. The fundamental requirements of NC2 are that it must be assured, timely, secure, survivable, and enduring

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[4] Termed $C^3$1: Ashton B. Carter, "The Command and Control of Nuclear War," *Scientific American* 252, 1 (Jan, 1985): 32-39, 32. Carter's work on vulnerability was preceded by a seminal paper by D. Ball, *Can nuclear war be controlled?* Adelphi Papers, 1981, 21: 169, pp. 1-2, at: http://www.tandfonline.com/doi/abs/10.1080/05679328108457385

[5] US Department of Defense, *Nuclear Matters Handbook*, chapter 2, accessed October 3, 2020, at: https://www.acq.osd.mil/ncbdp/nm/nmhb/chapters/chapter2.htm

> in providing the information and communications for the President to make and communicate critical decisions throughout the crisis spectrum.[6]

Elsewhere, it states more succinctly that "NC3, managed by the Military Departments, nuclear force commanders, and the defense agencies, provides the President with the means to authorize the use of nuclear weapons in a crisis."[7]

Viewed functionally, DOD states:

> NC3 assures the integrity of transmitted information and must be survivable to reliably overcome the effects of a nuclear attack. NC3 performs five critical functions:
>
> - detection, warning, and attack characterization
> - nuclear planning
> - decision-making conferencing
> - receiving presidential orders
> - enabling the management and direction of forces[8]

This functional capacity in turn is nested in supporting communication systems:

> NC3 relies on terrestrial (e.g., land-based secure and non-secure phone lines and undersea cables), airborne relay (e.g., E-4B and E-6B), and satellite (military and commercial) sensors to transmit and receive voice, video, or data. The ability to move trusted data and advice from sensors to correlation centers, from presidential advisors to the President, from the President to the NMCC, and from the NMCC to the nuclear weapons delivery platforms depends on NC3…These encompass a myriad of terrestrial, airborne, and satellite-based systems ranging in sophistication from the simple telephone, to radio frequency systems, to government and non-government satellites. Some of these systems are expected to be able to operate through nuclear effects, while others are expected to be subject to nuclear effect disruption for periods ranging from minutes to hours.[9]

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[6] US Department of Defense, *Nuclear Matters Handbook*, *op cit*.
[7] US Department of Defense, *Nuclear Matters Handbook*, *op cit*.
[8] US Department of Defense, *Nuclear Matters Handbook*, *op cit*.
[9] US Department of Defense, *Nuclear Matters Handbook*, *op cit*.

Figure 1 shows this nesting of the various elements of NC3, starting with nuclear commanders at the center, linked to nuclear weapons systems, and linked in turn to external sensor systems by communication systems.

Figure 1. Nested NC3 Systems.

Source: Figure 2.2. NC3 Weapon System and AFPEO/NC3 & AFNWC/NC Responsibilities, in "Special Management Nuclear Materiel Management," Air Force Materiel Command Instruction 90-204, 4 May 2016, p. 10 released under US FOIA request to Nautilus Institute.

These generic definitions of the elements of US NC3 are translated into binding directives by military combatant commands. The US Air Force, for example, states:

> **NC2.**—Nuclear Command and Control, NC2, is the exercise of authority and direction by the President, as Commander in Chief of U.S. Armed Forces, through established command lines, over nuclear weapon operations by military forces; as Chief Executive over all Government activities that support those operations; and as Head of State over required multinational actions that support those operations.

> **NC3.**—Nuclear Command, Control, and Communications, NC3, is the collection of activities, processes, and procedures performed by appropriate commanders and support personnel who, through the chain of command, allow for decisions to be made based on relevant information, and allow those decisions to be communicated to forces for execution. NC3 is a system of systems, stretching across services, combatant commands, and other DoD entities.[10]execution. NC3 is a system of systems, stretching across services, combatant commands, and other DoD entities.[11]

This reference to a "system of systems" is important. A system of systems is inherently complex. The US NC3 system is a sprawling patchwork of systems operated by each service, much of which is not inter-operable. And because the US military has three nuclear weapons forces run by its air force (missiles and bombs) and navy (submarine), each with global reach, it really operates three global NC3 systems, plus the fusion of these systems in the decision-support systems that extend to the Joint Chiefs and the US president, and then back to nuclear forces who must act on decisions. This very complexity is subject to the Byzantine Generals problem and may result in unanticipated cybernetic feedbacks, logical flow errors, and inadvertent outcomes.

A simplified, functional definition of the complete meaning of NC3 in terms of supreme commander control of nuclear weapons is provided in Table 1. Arguably, however achieved, these functions are universal among all nuclear-armed states in one way or another.

[10] US Air Force, "Air Force Nuclear Command, Control, and Communications (NC3), US Air Force Instruction 13-550, October 2, 2014, p.21, released under US FOIA request to Nautilus Institute.

[11] US Air Force, "Air Force Nuclear Command, Control, and Communications (NC3), US Air Force Instruction 13-550, October 2, 2014, p.21, released under US FOIA request to Nautilus Institute.

Table 1: Critical NC3 Functions

- detection, warning, and attack characterization
- nuclear planning and targeting
- decision-making
- receiving orders
- enabling the management and direction of forces

Source: Based on US Department of Defense, *Nuclear Matters Handbook*, chapter 2, accessed October 3, 2020, at: https://www.acq.osd.mil/ncbdp/nm/nmhb/chapters/chapter2.htm

Before turning to practical, plausible, and desirable NC3 policy measures, we need to first survey the uneven terrain of NC3 in the Asia-Pacific region that captures seven of the nine nuclear-armed states (Russia, China, the United States, Israel, Pakistan, India, North Korea) that are inextricably linked by mutual nuclear threat relationships.

Before analyzing what must be done with respect to NC3 to reduce the risk of nuclear war and to resume nuclear disarmament in the current context, we first describe the NC3 systems of each nuclear-armed state in this region.

NC3 Systems in Asia-Pacific

US NC3

NC2 (defined above as nuclear command and control) is conducted in nuclear command posts, the most important of which are in the White House, the National Military Command Center at the Pentagon, at Strategic Command HQ in Omaha, and at the unified command HQs in Hawaii and NATO HQ in Brussels. These are supplemented by a variety of mobile command posts, including presidential and the Air Force E-4 National Airborne Operations Center, the Navy's E-6 Mercury TACOMO aircraft, and various lang-based mobile backup centers (see figure 2).

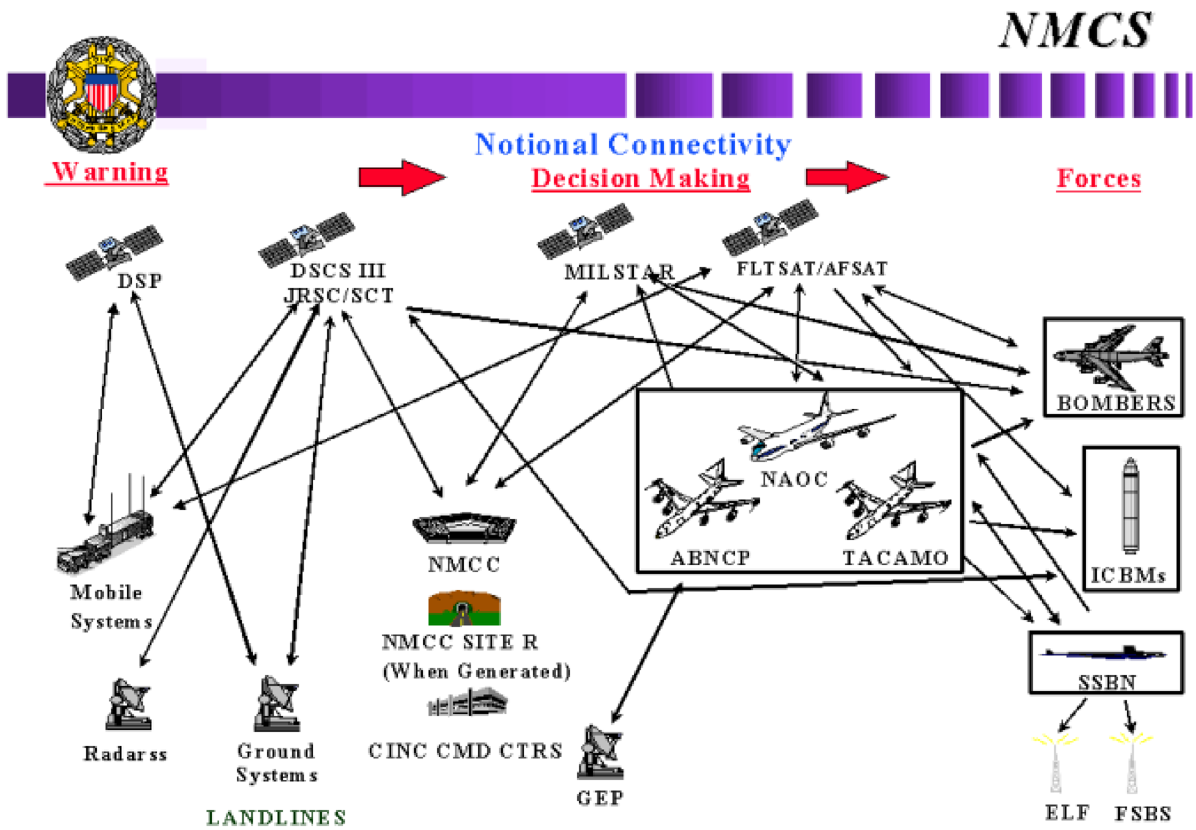

Figure 2. National Military Command System Connectivity to the Forces (2001).

Source: Robert Critchlow, *Nuclear Command and Control: Current Programs and Issues*, Congressional Research Service, RL33408, May 3, 2006, p. 7.

NC2 is supported and connected across nodes and with sensor and early warning systems on the one hand, and nuclear forces on the other, by a range of communications systems, adding the third C to NC3. These systems provide connectivity to NC2 whereby data and messages are sent via wireless and cable, some dedicated to nuclear forces, some shared with non-nuclear forces. The wireless networks use the entire spectrum from extremely low to ultra-high frequencies. Some are line-of-sight, some wrap around the Earth, and some are directed at satellites and are then sent back down to ground receivers or sideways to other satellites before being sent back to Earth. Some frequencies are hard to interfere with, while some work better in an atmosphere "perturbed" by nuclear detonations. Some have been hardened against the electromagnetic pulse emitted by a nuclear detonation while many have not, and some are able to penetrate the surface layer of the ocean to reach submarines. Antenna size and weight determines which delivery platform can use with which frequency-based system. In the digital era, NC3 now includes computer and cyber systems that are integral to computation, fusion, and transmission of data and messages over connectivity provided by digitized communications systems.

Over seven decades of nuclear warfare, each military service has developed its own communications systems, many of which are not able to be received by those of the other service. That is, they are not interoperable. The same problem arises with regard to nuclear allies within NATO and other US nuclear umbrella states such as Japan and the ROK. Figure 3 shows the NC3 systems operated primarily by the US Air Force. Figure 4 shows the NC3 systems operated primarily by the US Navy.

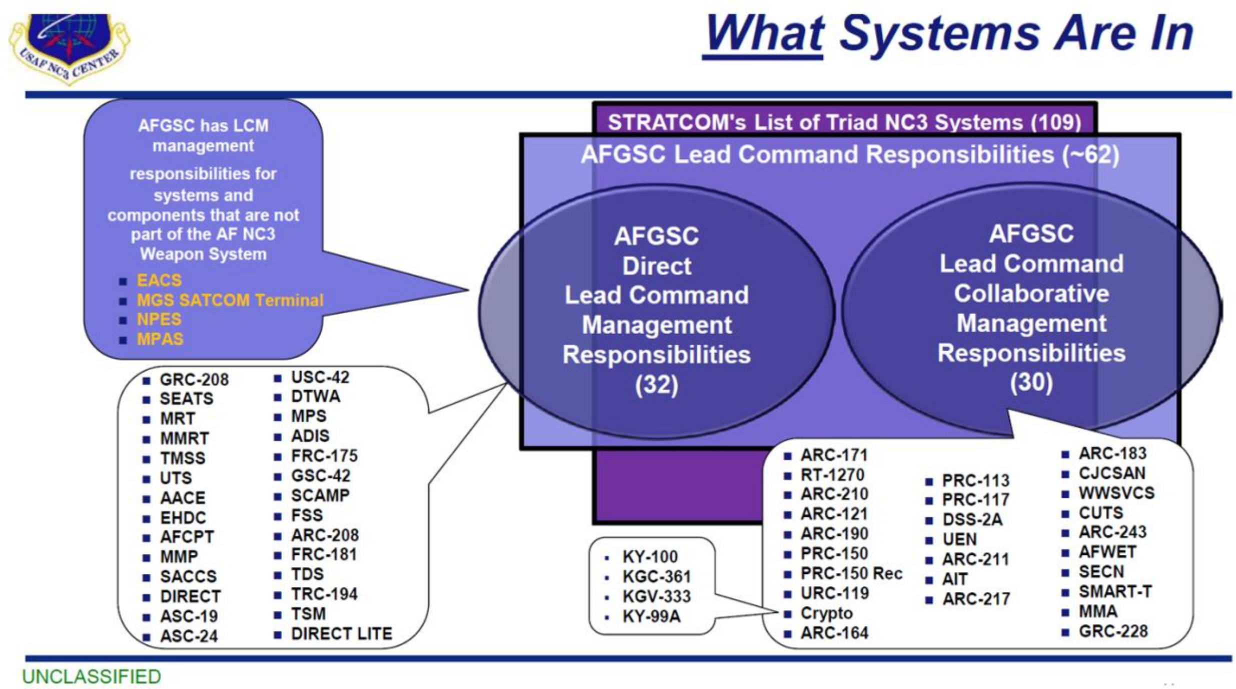

Figure 3. US Air Force and Other NC3 systems.

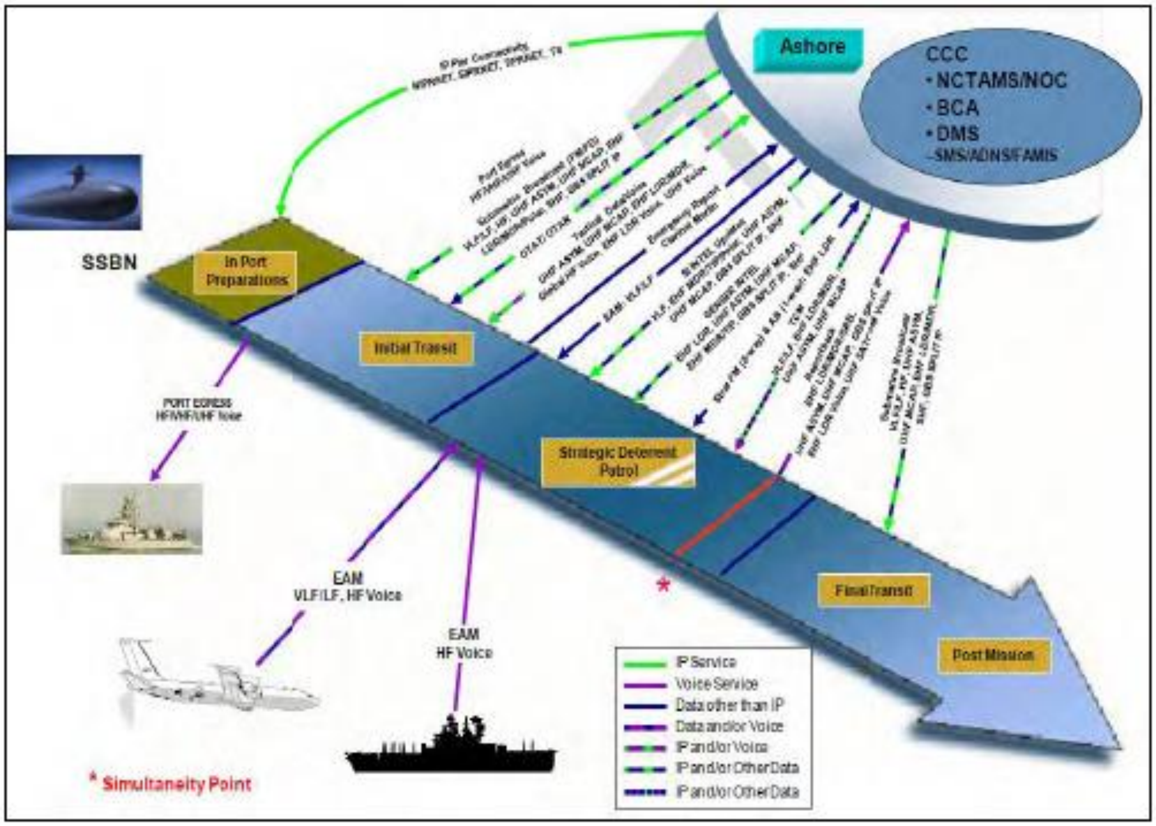

Figure 4: US Navy Strategic Communication Systems.

Source: "Figure 13 depicts the nuclear command, control and communications (NC3) infrastructure needed for mission communications while performing a strategic deterrent patrol. The BCA [broadcast control authority] provides the interface to the NC3 system for delivery of EAMs. Take charge and move out (TACAMO) aircraft and surface ships relay EAMs [emergency action messages] if there is a failure of the primary reception paths. The simultaneity point indicates when multiple communications paths will be available for use." M. Seime, Common Submarine Radio Room: A Case Study of a System of Systems Approach, thesis, Naval Postgraduate School, 2014, p.33, at: https://calhoun.nps.edu/handle/10945/43998

This global nuclear decision-making and communications apparatus would be useless without the ability to sense via many means the state of the world. The most important US nuclear sensors are those that provide early warning of nuclear attack. The earliest warning of missile attack comes from satellite-based infra-red sensors that see the heat of missile launch and exhaust. From forward-deployed radars, it would get the earliest confirmation by a physically disparate sensor if in range. If not, arcs of long-range radars in Alaska, Greenland, the UK, and on the three coasts of continental United States, supplemented by ballistic missile defense and NATO radars plus radars monitoring space, serve to identify missile launches and against whom they are targeted.12 A nuclear detonation detection system also operates in the United States to confirm actual nuclear attack on the United States. All this warning from 24/7 monitoring converges on ground stations where it is assessed continuously for false alarms or discounted as non-missile events, notably in the National Military Command Center in Washington, DC, the Global Operations Center at Offutt AFB, NE, and the headquarters of the North American Aerospace Defense Command and Cheyenne Mountain in Colorado.

When the nuclear communications infrastructure is combined with the nuclear command system, it is truly vast—so much so that it exceeds the ability of managers to grasp. As the Defense Information Systems Agency—the entity within the US Department of Defense responsible for integrating all these elements to ensure that nuclear command-and-control provided the necessary connectivity between national command authorities and nuclear forces—stated in 2010, "There is no one NC3 system. The NC3 system as it exists today is a patchwork of disparate systems, each with its own characteristics. There is no one operating system or coding language.[13] The true complexity is revealed in the evolution of estimates of the number of systems that constitute NC3. In 2017, for example, US General Robin Hand stated that "There are a huge number—107 different systems to get our hands around."[14] In 2019, a STRATCOM official estimated that there were 109 such systems.[15] At the same workshop, Jeffrey Larsen stated, " Depending on who you ask and how they count, the US NC3 system consists of as many as 160 different systems: satellites, aircraft, command posts, communication networks, land stations, radio receivers, and so on—a

[12] Jeffrey Larsen, "Nuclear Command, Control, and Communications: US Country Profile", NAPSNet Special Reports, August 22, 2019, https://nautilus.org/napsnet/napsnet-special-reports/nuclear-command-control-and-communications-us-country-profile/

[13] Answer to Question 1 at: Nuclear Command, Control, and Communications System Operational Assessment Program, Solicitation Number: HC104710R4009, Agency: Defense Information Systems Agency, Office: Procurement Directorate Location: DITCO-NCR, August 4, 2010, at: https://www.fbo.gov/index?s=opportunity&mode=form&id=ca9ed977f427844fb095c1e170a579ee&tab=core&_cview=1

[14] S. Magnuson, "Exclusive: Interview with Gen. Robin Rand, Head of Air Force Global Strike Command," *National Defense Magazine*, November 14, 2017, at: http://www.nationaldefensemagazine.org/articles/2017/11/14/global-strike-command-tackles-atrophying-nuclear-command-control-systems

[15] Presentation at NC3 and Global Stability, workshop, Stanford University, January 22-23, 2019. See Peter Hayes, Binoy Kampmark, Philip Reiner, Deborah Gordon, "SYNTHESIS REPORT–NC3 SYSTEMS AND STRATEGIC STABILITY: A GLOBAL OVERVIEW," NAPSNet Special Reports, May 05, 2019, https://nautilus.org/napsnet/napsnet-special-reports/synthesis-report-nc3-systems-and-strategic-stability-a-global-overview/

system of systems perhaps too complex for any one person to totally understand. "[16] By 2020, US Under Secretary of Defense Ellen Lord testified, "The NC3 portfolio comprises a complex architecture of more than 200 systems that allow detection of threats, support decision making, and enable force direction."[17] As a senior commander in charge of US NC3 systems stated in 2019, "I am confident that the NC3 system will work. I just don't know how and why it works.[18]

Russian NC3

NC2 in the former Soviet Union, now Russia, is dominated by the need to command and control the long-range nuclear missiles that constitute the bulk of its nuclear forces. A substantial fraction of these missiles is located in Siberia, far from the high command in Moscow. Russia also operates missile firing submarines but generally keeps them close to home-based anti-submarine forces to provide some cover against US forces tracking Russian submarines from air and sea. It also has long-range bombers that—like their American and Chinese counterparts—need communication systems at long-range. In the past, Russia based intermediate range rockets in the Far East, but these were removed under the Intermediate Nuclear Forces treaty, leaving only shorter-range missiles along the border with China, some bombers, and a strategic missile submarine force that has been reconstituted in Kamchatka after a long period at the end of the Cold War, when no such forces operated in the Russian Far East/Pacific region.

Russia's primary modern nuclear command post, the National Defense Command and Control Center, was opened in 2014 and contains within it the Nuclear Strategic Forces Command and Control Center. This Center manages nuclear weapons operations as directed by Russia's political

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[16] Jeffrey Larsen, "Nuclear Command, Control, and Communications: US Country Profile," NAPSNet Special Reports, August 22, 2019, https://nautilus.org/napsnet/napsnet-special-reports/nuclear-command-control-and-communications-us-country-profile/

[17] Statement of The Honorable Ellen M. Lord Under Secretary of Defense for Acquisition and Sustainment Before the Strategic Forces Subcommittee Committee on Armed Services United States Senate U.S. Nuclear Weapons Policy, Programs, and Strategy in Review of the Defense Authorization Request for Fiscal Year 2020 and the Future Years Defense Program May 1, 2019, at: https://www.armed-services.senate.gov/download/lord_05-01-19

[18] At the NC3 Systems and Strategic Stability: A Global Overview workshop, January 22, 2019, under Chatham House Rule. A month later, General John Hyten stated in testimony that he "I really can't effectively explain" why the NC3 systems works. In US Strategic Command, "U.S. Strategic Command and U.S. Northern Command SASC Testimony," March 1, 2019, at: https://www.stratcom.mil/Media/Speeches/Article/1771903/us-strategic-command-and-us-northern-command-sasc-testimony/

and military leaders.[19] Russia has two, possibly three underground nuclear command and control bunkers, one at Kosvinsky Kamen in the Northern Ural Mountains, and another at Mt. Yamantau in the Southern Ural mountains (the latter may have shut down and likely was a government continuity relocation site similar to the US Rock Raven facility outside of Washington, DC). Each of the military services (Strategic Rocket Force, Navy, Airspace Force, and the Army has its own command post with communications and computing support. In November 2020, Russian President Putin revealed that Russia has activated a new underground nuclear command bunker and, like the United States, also has stationary and mobile command posts spread across the country.[20] How many of the dispersed nuclear command posts around Moscow (said to be about eighty in the early 1980s) remain today is unknown.[21]

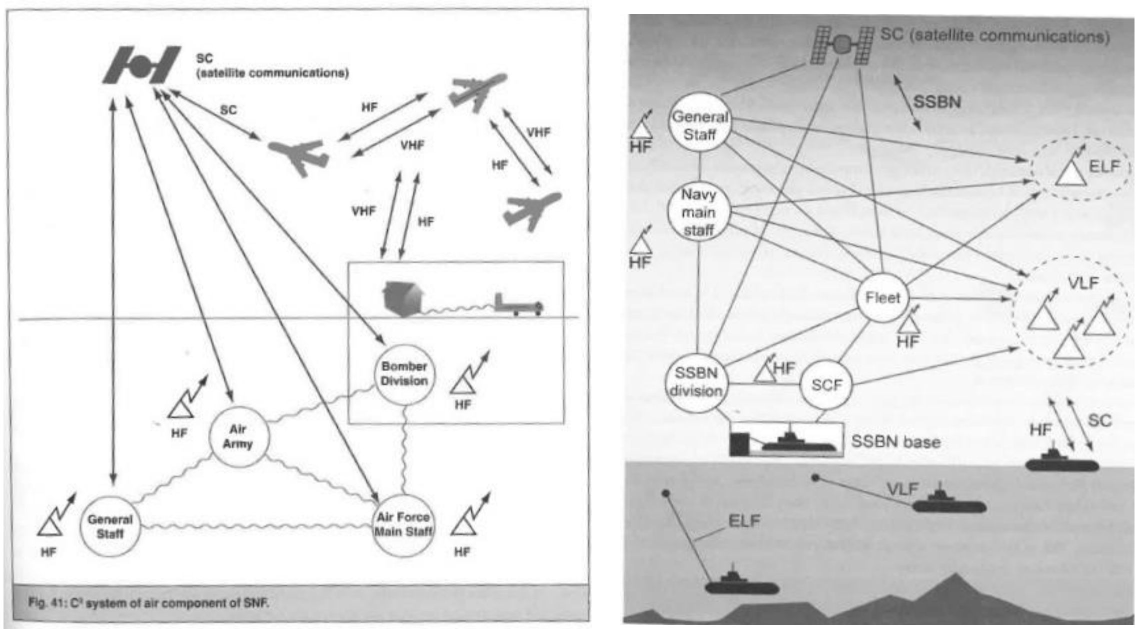

Figure 5. Former Soviet Union Strategic Communications Systems (Airborne Left, SSBN Right).
Source: V. Yarynich, *C3I: Nuclear Command, Control Cooperation*, Center for Defense Information, Washington DC, 2003, p. 135 *et passim*, at: https://www.scribd.com/doc/282622838/C3-Nuclear-Command-Control-Cooperation

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[19] Leonid Ryabikhin, "Russia's NC3 and Early Warning Systems", NAPSNet Special Reports, July 11, 2019, https://nautilus.org/napsnet/napsnet-special-reports/russias-nc3-and-early-warning-systems/

[20] J. Trevithick, "Putin Reveals Existence Of New Nuclear Command Bunker, November 11, 2020, The War Zone, at: https://www.thedrive.com/the-war-zone/37569/putin-reveals-existence-of-new-nuclear-command-bunker-and-says-its-almost-complete?mkt_tok=eyJpIjoiWVRObE5tTmlPR00wTURCbCIsInQiOiI4eWhUa3E4d2x6amRaeVBOQnVlK0lrcEJRSTNlY1JidUhtVEZJU2xUSUU2T05vSm1HZTNEVmx0XC9uajE4MWpWSVwvM0ZuWjJSR2xQWHZWXC9jNEs3eUtGV3o1SVNOd2RcL3F1TlpcL2YyT3E3VVdKREl4ekI4YmNOaSs2ZTdubWlibU1EIn0%3D

[21] K. Lippold, *U.S. and Soviet Strategic Command and Control: Implications for a Protracted Nuclear War*, thesis, US Naval Postgraduate School, Monterey, March 1989, p.124, at: https://calhoun.nps.edu/handle/10945/26326

Russia's strategic communications relied on an extensive array of radio and cable communications across frequencies and media to link these command posts with nuclear forces located across eleven time zones. Communications included landlines, radiotelephone, microwaves, and satellites. The mainstay of connectivity was long-haul HF communications which was then supplemented by satellites operating in low orbit and in elliptical orbits during the Cold War.

The system also reportedly has an automated launch system as well as a rocket. These were to be fired as a last resort and were dedicated to transmitting fire orders in extremis to nuclear forces should Russia's nuclear command posts be incapacitated or destroyed in a war.

As American nuclear forces shifted from bomber to missiles in the early 1960s, the former Soviet Union developed its early form of missile-detection radar. These became operational in 1970 in the form of two "Dnepr" radars near Murmansk and Riga and the Command Post near Moscow. The former Soviet Union {FSU] also began to develop its early warning satellites, although these remained far behind American satellite capabilities to provide a two-echelon missile tracking system that provided 360-degree monitoring along all borders. At the end of the Cold War and throughout the 1990s, the now-Russian early warning system more or less collapsed. For a period, Russia operated its forces without any operating early warning satellites, and the radars were also degraded by age, lack of funding, and de-staffing. In 2014, the decaying legacy satellite system was down completely,[22] leaving Russia solely reliant on its old radars.

Today, Russia has deployed two new modern Voronezh radars and a new constellation of early warning satellites known as the United Space System, or EKS, that have restored Russia's ability to detect early and confirm missile attack. However, by admission of the experts contracted to construct the system, it remains error-prone, especially the ground components.[23]

[22] "Russia's satellite nuclear warning system down until November," *The Moscow Times*, June 30, 2015, at: https://www.themoscowtimes.com/2015/06/30/russias-satellite-nuclear-warning-system-down-until-november-a47799

[23] Sergei Boev, the lead designer, explained in 2015, "The system's ground echelon…is a uniquely complicated technical system and malfunctions cannot be excluded. Here a lot depends on how the system's various components interact with one another: the false alarms that can occur in one station must be quickly analyzed and verified by the command post." In "Revealed: Russia's ambitious new ICBM early warning system," Sputnik News (19 August 2015, at: https://sputniknews.com/russia/201508191025927540-russia-nuclear-early-warning-system-development/

Overall, the Russian system is far flung but highly centralized and top down compared with the relatively flat and distributed American nuclear command and control system. During the Cold War, the former Soviet Union's (hereafter FSU) pyramidal structure made the Russian system prone to an error made at the top and center that is propagated quickly throughout the whole system, whereas the American system, being more devolved into regional commands, tends to not propagate errors across different parts of the world. Whether this remains the case today is an interesting question.

Chinese NC3[24]

Like Russia, China's NC3 imperatives are dominated by its small land-based nuclear missile force. Unlike the United States and Russia that sport a triad, China has been a monad until recently when it began to develop a naval (strategic missile submarines) leg,[25] and a possible dual-capable long-range aerial (bomber) leg. China's NC2 system is Chinese Communist Party-controlled. They make nuclear weapons decisions in conjunction with the People's Liberation Army (PLA), which operates the Second Artillery Force since 1966 that fielded nuclear missiles, renamed the PLA Rocket Force in 2016. Their leading policy that shaped its NC3 system was to field a small nuclear force sufficiently robust to retaliate after absorbing a first strike from a nuclear adversary, such as the United States, and after 1969, the FSU.

In 1986, the PLA established the Central Emergency Command Center (CECC) for continuity of government under attack. The primary underground hardened site built inside a mountain under Yuquanshan in Xishan outside Beijing, with two sub-centers reportedly at Wuwei (Langzhou military region) and Mianyang (Chengdu military region, later increased to five nodes with the addition of Taiyuan (Beijing military region), Luushan (Jinan military region), and Weining

[24] This section draws on F. Cunningham, "Nuclear Command, Control, and Communications Systems of the People's Republic Of China," NAPSNet Special Reports, July 18, 2019, https://nautilus.org/napsnet/napsnet-special-reports/nuclear-command-control-and-communications-systems-of-the-peoples-republic-of-china/

[25] T. Zhao, *Tides of Change: China's Nuclear Ballistic Missile Submarines and Strategic Stability*, Carnegie Endowment for International Peace, October 24, 2018 at: https://carnegietsinghua.org/2018/10/24/tides-of-change-china-s-nuclear-ballistic-missile-submarines-and-strategic-stability-pub-77490

(Chengdu military region). Other military command bunkers reportedly existed in Inner Mongolia Autonomous Region along with another 29 hardened bunkers connected by cables.[26]

In the early decades of nuclear armament, China used primarily radio communications and telephony to connect nuclear commanders with forces. Starting the 1990s, the PLA laid much fibre-optic cable and integrated microwave communications. Starting the early 1990s, China used DFH commercial satellites for military communications, and deployed its first military FH-1 military communications satellite in 2000, now supplemented by fiber-optic cables laid in the 1990s, and satellites.[27]

China's communication systems are dual use, supporting conventional and nuclear traffic between nuclear commanders and forces. Since 1998, China has semi-automated the issuance of nuclear strike orders and related messages to mobile missile brigades housed in underground tunnels or on the move, allowing central commanders to monitor movements and launches. Once China sends its strategic missile and nuclear attack submarines into the open ocean, it will use low frequency radio towers and transmissions to communicate orders, supplemented by airborne relay systems and satellite downlinks. Mobile missile launch units moving freely on the surface may be assumed to have field communication networks including telephone, videoconferencing, and command networks over wireless and satellite networks.

Because China's nuclear forces are configured to launch only after nuclear attack, it has historically had only minimal early warning radar coverage. As Cunningham explains:

> China has three phased array ground-based radars, similar to U.S. PAVE PAWS radars, located in Heilongjiang province in the country's northeast, Fujian province in its southeast, and Xinjiang in its northwest. Improving China's strategic warning capabilities was an explicit priority for the PLA in China's most recent 2015 defense white paper. China has

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[26] Ta-chen Cheng, "China's nuclear command, control and operations," *International Relations of the Asia-Pacific*, no 7, March 5, 2007 pp. 169-170, at: https://www.jstor.org/stable/26156651?seq=1. Stephen Polk states that as of early 2000s, China's NC2 is located at three sites: in Beijing, at the Central Military Commission office in the Ministry of Defense, the General Staff Directorate hardened bunker in western Beijing where the PLA controls its nuclear forces and issues orders, and the Second Artillery now PLA Rocket Force headquarters nearby in Qinghe. S. Polk, "China's Nuclear Command and Control," in Lyle J. Goldstein, ed, with Andrew S. Erickson, *China's Nuclear Force Modernization*, Newport Paper Twenty-two, Center for Naval Warfare Studies, 2005 at: https://digital-commons.usnwc.edu/cgi/viewcontent.cgi?article=1021&context=newport-papers

[27] S. Polk, op cit, p. 17.

> no space-based missile attack early warning system but is likely to be developing one. A space-based early warning system would enable China to shift to a launch-under-attack alert status if it chose to do so in the future. A Chinese space-based early warning system is, however, unlikely to be operational for approximately another decade.[28]

The same retaliatory doctrine of launch-after-or-under-nuclear attack only requires China to be able to detect a nuclear attack. This reportedly was built starting in 1974 and is a national reporting network of enormous significance to the credibility of China's nuclear force. [29]

DPRK NC3

In comparison with the great powers that are nuclear-armed, DPRK's nuclear command and control system is relatively simple, as is its current force structure and supporting connectivity.

DPRK law states clearly that Kim Jong Un is the supreme nuclear commander of the DPRK. In 2014, the Strategic Rocket Command was renamed and became the Strategic Forces Command. This change was to create a direct chain of command from Kim Jong Un to nuclear forces via automated missile launch systems to ensure that his orders are followed.[30] Having only land-based intermediate and largely untested long-range missiles capable of delivering nuclear weapons, the DPRK has a nuclear monad, although it has begun to develop submarine-launched missiles that could carry nuclear weapons in the future.

The DPRK has likely built an NC3 system that is dedicated solely to nuclear forces, both to preserve Kim Jong Un's sole control and to avoid any risk of loss of control due to organizational cybernetics or confusion arising from dual use communications and weapons systems that pose issues of queuing and priorities for message delivery. Although the high echelons of the DPRK military at the Joint Chiefs and Corps-level commands reportedly use computer-based C3 systems,

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[28] Cunningham, *op cit*.
[29] *Ibid.*
[30] This section relies on Myeongguk Cheon, "DPRK'S NC3 SYSTEM", NAPSNet Special Reports, June 06, 2019, https://nautilus.org/napsnet/napsnet-special-reports/dprks-nc3-system/

this does not extend to lower echelons in the conventional military, which relies mostly on telephone, radio, cable, and couriers, with fiber optic extending to forward echelons. However, fiber optic cable is likely to have been laid between the supreme command and missile and warhead bases, and from these bases to preselected sites for transporter erector launchers, to wait and receive orders that may be dispatched with very short time frames from decision to launch, given the complete lack of long-range early warning systems in the DPRK that would identify and respond to a US nuclear attack.

Similar to China, the DPRK's NC3 system includes a party control element at each critical point to ensure political loyalty and compliance with directives from above. It is likely that the DPRK's warheads are not mated to its missiles most of the time and are kept under the control the Korea Worker's Party's Central Military Committee. When ordered, a nuclear ordnance unit would receive warheads under party control and transfer them to missile units for mounting them. This transfer is a particularly fraught and perilous aspect of control in the DPRK NC2 system, and political commissars surely play a key role in ensuring that this integration is achieved during exercises and would do so in wartime.

Indian NC3

Not much tangible may be said in this section for the simple reason that there is almost no country-specific data about the NC3 architecture in India.

NC3 in India is understood to support the Nuclear Command Authority that manages its nuclear and missile forces and would authorize use of nuclear weapons with an operational command base established as early as 1998 on the outskirts of New Delhi.[31] But the command post locations, nodal-network structure, and its multiple, service-based[32] and likely non-interoperable communication systems have not been described in any detail in open source.

Given that India has an advanced scientific and engineering infrastructure and a globally competitive IT sector, one can safely infer that its current NC3 system relies heavily on cable,

[31] M.V. Ramana and Lauren J. Borja, "Command and Control of Nuclear Weapons in India", NAPSNet Special Reports, August 01, 2019, https://nautilus.org/napsnet/napsnet-special-reports/command-and-control-of-nuclear-weapons-in-india/

[32] Rakesh Kumar, Indian Nuclear Command and Control Dilemma, thesis, Naval Postgraduate School, Monterey, September 2006, pp. 31-32 at: https://calhoun.nps.edu/handle/10945/2639?show=full

especially fibre-optic cable, microwave links, and radio links, including non-dedicated satellite links between nuclear warhead sites, sufficient to support dispersed missile launcher sites and fighter-bomber units on various airfields.33 However, how effective such communications for mobile nuclear weapons has become remains an open question.34 According to former advisor to India's Prime Minister, Shyam Saran, India's nuclear command authority is connected to forces with radiation hardened, redundant, and secure nuclear communications systems with "back-up" facilities.35 Indian Cabinet Committee on Security reportedly has approved the construction of alternate chains of command, implying multiple command sites and communications systems for the contingency of loss of the primary nuclear command and control system.36 India's Strategic Forces Command, according to one blogger, "provisions the primary and alternative command posts, operations rooms, and communication.[37]

India also now operates missile-launching submarines and, in 2014, activated a naval very low frequency (VLF) transmission station for communicating with the deployed submarine at Kattabomman in Tamil Nadu on the southern tip of India.[38] In 2017, the Indian navy announced it would build a second VLF transmitting facility at Pudur in central India.[39]

India has two potential nuclear adversaries to monitor, Pakistan and China. In 2002, India acquired missile warning radars from Israel and reportedly deployed two of these units, which have been upgraded to support ballistic missile defenses.[40] Given range limitations and the extremely short flight times of missiles fired from Pakistan, these radars have limited utility of providing

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[33] S. Smith, Assessing the Risk of Inadvertent Nuclear War Between India and Pakistan, thesis, Naval Postgraduate School, Monterey, December 2002, p. 47, at: https://calhoun.nps.edu/handle/10945/3272

[34] R. White, "Command and Control of India's Nuclear Forces," *The Nonproliferation Review*, 21:3-4, 2014, p. 270, at: https://www.tandfonline.com/doi/abs/10.1080/10736700.2014.1072994?tab=permissions&scroll=top

[35] S. Saran, "Is India's Nuclear Deterrent Credible?" India Habitat Centre, New Delhi, April 24, 2013, p. 11, at: http://krepon.armscontrolwonk.com/files/2013/05/Final-Is-Indias-Nuclear-Deterrent-Credible-rev1-2-1-3.pdf

[36] A. Ahmed, "Indian Nuclear Command and Control," *Indian Defence Review*, part 2, July 13, 2011, at: http://www.indiandefencereview.com/spotlights/indian-nuclear-command-and-control--ii/

[37] A. Ahmed, "Indian Nuclear Command and Control," *Indian Defence Review*, part 1, July 12, 2011, p. 2, at: http://www.indiandefencereview.com/spotlights/indian-nuclear-command-and-control-i/

[38] "VLF Transmitting Station Commissioned at Tamil Nadu," Indian Navy, Press Release, no date, at: https://www.indiannavy.nic.in/content/vlf-transmitting-station-commissioned-tamil-nadu

[39] K. Mahesh, "Navy to reach ships and subs from Pudur," Times of India, December 27, 2017, at: http://timesofindia.indiatimes.com/articleshow/62261258.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

[40] J. Yogesh, F. O'Donnell, "India and Nuclear Asia: Forces, Doctrine, and Dangers," Georgetown University Press, 2019, Kindle Edition, p. 55.

meaningful early warning to India of attack from either Pakistan or India. India's satellite capabilities provide enhanced strategic warning but are limited in their technical capacity. Electronic, communications, and human intelligence will factor into India's decision-making calculus more than long-range sensor systems, although its expanding space program may shift this balance in its NC3 system.

Pakistani NC3

As with India, little is known publicly about Pakistan's NC3 system. Like India, the NC2 or nuclear high command organizational structure is reasonably understood. As Feroz Khan summarizes this system:

> At JSHQ [Joint Service Headquarters], the communication systems of the three services, along with civilian and military intelligence agencies inputs, are integrated to produce a net assessment of threats that is available to the highest civilian and military leadership. JSHQ is responsible for the organization and functioning of the National Command Center (NCC), which links the conventional force military operations, naval operations, and air force operations into an integrated system (CC3). After SPD was formed, its C2I2 SR Directorate evolved a dedicated nuclear (strategic) communication system (NC3). At NCC, a common operational picture (COP) is available that merges all national surveillance and reconnaissance capabilities, integrating satellite, drones, and other information means from all three services. The communication system is backed with several redundancies and is a secure, dedicated communication system with procedures that are updated as the information age evolves and new innovations in cyber, space, and information technology domains are introduced.[41]

However, the actual physical infrastructure of command centers, communication nodes and networks, and early warning systems has not been described in open sources in recent history. Shaun Gregory provides the best—albeit very dated—description of the communication system that supports Pakistani NC2:

[41] Feroz Hassan Khan, "Nuclear Command, Control and Communications (NC3): The Case of Pakistan", NAPSNet Special Reports, September 26, 2019, https://nautilus.org/napsnet/napsnet-special-reports/nuclear-command-control-and-communications-nc3-the-case-of-pakistan/

> Pakistan relies on a variety of space and land-based communication systems to assure nuclear connectivity and the continuity of centralized control. Some of these systems are commercial and others dedicated military networks. System robustness is underpinned by redundancy, the simple idea that if one or more systems fail others will be available to take their place. Pakistan's PASCOM network provide peacetimes army-wide land-line and, for GHQ and corps HQ, mobile phone connectivity; the DEFCOM and PATCOM networks provide satellite, fibre-optic, microwave and switching system connectivity; while the SATCOM network enables corps connectivity through VHF vehicle radio sets, field exchanges and faxes. Pakistan has also been the recent beneficiary of US tactical communications system upgrades – most notably Falcon II, to enable better US–Pakistan interoperability in the war on terror. Despite these arrangements, connectivity through the stages of conflict escalation to the nuclear level is not assured. At least four factors undermine system robustness in Pakistan: (1) the high costs of ensuring full-network redundancy; (2) the technical fragility of communication systems; (3) the vulnerability of the nuclear communication networks and nodes to electronic counter-measures, physical assault, technical dependency; and (4) the particularly rigorous demands of mobile basing.[42]

Pakistan's satellite capacities are also feeble[43] and the entire network appears highly vulnerable to disruption, counter-measures, and physical attack. At least part of its commercial fiber-optic network traverses India although it has dedicated military fiber-optic cables to support conventional forces. Even with codes, radio is considered unsafe for strategic communications, so it is likely used only for routine communication for NC2 purposes, if at all.

Like India, Pakistan has deployed a missile firing submarine and built a VLF station at Hameed near Karachi to communicate with it at sea.[44] The vulnerability of this facility and the demanding

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[42] S. Gregory, "Nuclear Command and Control in Pakistan," *Defense & Security Analysis*, 23:3, 315-330, 2007, at: https://doi.org/10.1080/14751790701573907

[43] G. Mujaddid, "The Next Decade of Nuclear Unlearning: Command and Control and Management of Pakistan's Nuclear Weapons," in F. Khan et al, edited, *Nuclear Learning in South Asia: The Next Decade,* Naval Postgraduate School, Monterey, June 2014 at: https://calhoun.nps.edu/handle/10945/45142

[44] U. Ansari, "Pakistan Unveils VLF Submarine Communications Facility," Defense News, Nov 16, 2016, at: https://www.defensenews.com/naval/2016/11/16/pakistan-unveils-vlf-submarine-communications-facility/

communications requirements of mobile missiles and possible deployment of tactical, forward-deployed nuclear weapons near the border with India raises the troubling possibility of early delegation of use authority to forward commanders in a crisis.[45]

Likewise, Pakistan's early warning system has limited range and is fragile. It has access to commercial satellite photography but for military purposes, depends almost entirely on the United States and China for strategic satellite support in a crisis. Its air defense radars are short range and provide limited warning of incoming aircraft or cruise missiles aimed at disabling its NC3 nodes and networks.[46]

Key NC3 Issues

The preceding sections defined NC3 as a critical dimension of nuclear forces, and outlined the NC3 systems, including early warning systems, of the five nuclear-armed states in the Asia-Pacific region. This section introduces six key NC3 issues: (a) the contribution of NC3 to the risk of nuclear war; (b) NC3 modernization and disruptive technology; (c) nuclear decision-making and commander accountability under international law pertaining to NC3; (d) complexity and the global NC3 system; and (e) the pandemic-nuclear nexus and NC3.

NC3 and Nuclear Risk

In section 2, we noted that NC3 is a force multiplier that represents a threat to a targeted state due to its ability to enhance the lethality of nuclear forces and to fight nuclear wars that are less than all-out global paroxysms of nuclear violence that end human existence. NC3 missions in this limited nuclear war context include precision targeting of adversarial NC3 sites and systems to stun and degrade its ability to retaliate with nuclear attacks, retargeting weapons on new targets based on intra-war intelligence (reallocating weapons from already empty silos and already annihilated targets onto new targets such as missiles on the move), terminating nuclear war

[45] F.H. Khan, Going Tactical: Pakistan's Nuclear Posture and Implications for Stability, IFRI Security Studies Center, Proliferation Papers 53, Paris, 2015, at: https://www.ifri.org/sites/default/files/atoms/files/pp53khan_0.pdf
[46] J. Yogesh, F. O'Donnell, *India and Nuclear Asia, op cit,* p. 320.

operations, and reconstituting own forces to prepare for the next war. These NC3 attributes lead to two types of operational problems.

The first is the vulnerability of many parts of the NC3 system. Although nodes can be buried in mountains and network hardware can be hardened against nuclear effects such as electro-magnetic pulse frying of electrical circuits and electronics, nuclear detonations are so powerful that once nuclear war begins, no-one knows if and for how long nuclear command and control will continue, or if it will continue at all.

Nuclear-armed states responded to vulnerability with a combination of hardening and proliferation of transmitting and repeater sites and redundant networks to make it impossible for a rational adversary to entertain the idea that a disabling strike on NC3 was a practical option. All that a nuclear-armed state has to do is to create a sufficiently resilient system that it can get out some nuclear strike orders to forces to "rip off an arm," that is, cause sufficient damage to an adversary to deter it from ever attacking—even if it has already destroyed its enemy with a first strike. Nonetheless, the reality is that for all the billions of national treasures invested in NC3 hardening, the sheer explosive, thermal, and radiative power of nuclear detonations is likely to rapidly degrade even the best NC3 system.

For this reason, many NC3 practitioners argue that the primary concern for nuclear risk is not the vulnerability of NC3 systems, but their propensity to cause errors of two types.[47] The first is a false negative error, that is, the nuclear commanders are told by early warning systems that they are not under attack, when in fact they are, and they fail to launch in retaliation. The corrective for this type of error is to invest heavily in strategic and tactical surveillance and reconnaissance sensors and reporting systems, which nuclear-armed states have done in different and highly uneven ways. The failure to notice that the former Soviet Union had emplaced nuclear armed missiles in Cuba was a slow-motion version of this error as the Cuban Missile Crisis might have been avoided if this activity had been flagged before the missiles arrived or were installed.

[47] Ashton Carter, "Sources of Error and Uncertainty," in A. Carter, J. Steinbruner, and C. Zraket, ed, *Managing Nuclear Operations,* The Brookings Institution, 1987, pp. 611-640.

The second is a false positive error wherein nuclear commanders are told or come to believe that they are under attack when in fact they are not, but they go ahead and launch anyway against another state. There are many examples of this kind of error in the historical performance of US and Russian NC3 systems. Often these false positives are based on hardware or software failure, or human error.[48] In other cases, they are inadvertent due to organizational cybernetics and procedural flaws whereby even a perfectly performed sequence of actions still leads to failure due to the sequencing of the steps between different parts of the organization, or its interaction with the adversary in an unanticipated way.[49] An especially pernicious variant on the false positives that may afflict NC3 systems is the problem of third-party catalysts who set out to induce a nuclear war between two or more other nuclear-armed states in the hope that they will come out unscathed or on top after a nuclear war. (There is a non-state version of this problem, which is the apocalyptic terrorist entity that seeks to end the world for a religious or other reason[50]).

The final way that nuclear risk is affected by NC3 is by malevolent or disloyal elements that may disrupt nuclear operations. The former is exemplified by non-state actors such as terrorists seeking to wrest control of nuclear weapons or delivery platforms as has occurred multiple times in Pakistan already. The latter refers to the possibility of coups in which nuclear weapons are not centrally controlled as may have happened with the attempted coup during the Algerian war in which nuclear warheads were vulnerable to seizure at the French testing site in the Sahara[51] and during the attempted coup against former Soviet President Mikhail Gorbachev when it was not clear who controlled the nuclear codes.[52] These are examples of the Byzantine General problem

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[48] Scott Sagan, *The Limits of Safety, Organizations, Accidents, and Nuclear Weapons*, Princeton, New Jersey 1993
[49] P. Bracken, *The Command of Strategic Forces,* Dissertation, *Yale University,* 1982, p. 39.
[50] Gary A. Ackerman, "The Non-State Dimension of Nuclear Command, Control and Communications," NAPSNet Special Reports, August 29, 2019, https://nautilus.org/napsnet/napsnet-special-reports/the-non-state-dimension-of-nuclear-command-control-and-communications/
[51] See the account of the coup and disputes related thereto in Benoît Pelopidas, "France: Nuclear Command, Control, and Communications," NAPSNet Special Reports, June 10, 2019, https://nautilus.org/napsnet/napsnet-special-reports/france-nuclear-command-control-and-communications/
[52] M. Dobbs, "During the Soviet Coup, Who Held Nuclear Control? Gorbachev Lost Command, Probers Say," New York Times, August 23, 1992, at: https://www.washingtonpost.com/archive/politics/1992/08/23/during-the-soviet-coup-who-held-nuclear-control-gorbachev-lost-command-probers-say/a4732610-679e-4f6e-be69-f0cf3f9eba85/ and C. Bohlen, "Gorbachev Lost Nuclear Control, Russians Report," *New York Times*, August 23, 1992, at: https://www.nytimes.com/1992/08/23/world/gorbachev-lost-nuclear-control-russians-report.html

wherein network dynamics and individual components generate random control failures that cannot be anticipated in advance nor controlled in the moment. In the NC3 system, this problem is one in which one of the command elements controlling nuclear weapons is traitorous to the supreme command, but no-one knows which, making coordination dangerous. The most extreme version of this problem is when a supreme commander turns out to be an agent of a hostile state or becomes insane but retains formal command over nuclear forces. President Trump may have been the first example of this version of the Byzantine General problem turned on its head.

NC3 modernization and disruptive technology

All the nuclear-armed states in the region are modernizing their nuclear forces, whether they are recent arrivals or originate in the mid-twentieth century. The nuclear great powers, especially the United States, China, and Russia, combine old analog with digital computer and communications systems and an array of platforms for transponders and sensors on Earth and in Space. Onto this combination of modern digital-legacy analog, they are superimposing and grafting on rapidly emerging technologies including drones, cyberwarfare, and highly automated data processing now moving into artificial intelligence and early applications of quantum computing and communications.[53] These new technologies have the potential to disrupt existing NC3 systems.

By enhancing NC3 operations, these new technologies may reduce negative and positive errors, thereby reducing nuclear risk; but they can also potentially reduce confidence in the resilience and robustness of NC3, stimulating notions of early first use of nuclear weapons to limit damage in the face of apparent nuclear attack by an adversarial nuclear-armed state. To the extent that these new technologies are driven to enhance conventional military forces, they also create an increased risk of nuclear-conventional entanglement whereby an adversary sees conventional operations as nuclear and feels obliged to act first to avoid being pre-empted.

A new dimension of NC3 is the way that commanders, especially the supreme commander, is not only supported by the classified, vertically compartmentalized and official NC3 systems but is also

[53] Elsa B. Kania, "Emerging Technologies, Emerging Challenges—The Potential Employment of New Technologies in Future PLA NC3", NAPSNet Special Reports, September 05, 2019, https://nautilus.org/napsnet/napsnet-special-reports/emerging-technologies-in-future-pla-nuclear-command-control-and-communications/ and Peter Hayes, "Nuclear Command-and-Control in the Quantum Era", NAPSNet Blue Peter, March 29, 2018, https://nautilus.org/napsnet/nuclear-command-and-control-in-the-quantum-era/

embedded in social media, which may be used for official signaling of nuclear threat and is linked to early warning systems that monitor social media for indicators of nuclear threat such as mobile unit movements, etc., with obvious potential to enhance false positive errors in the interpretation of nuclear attacks.[54]

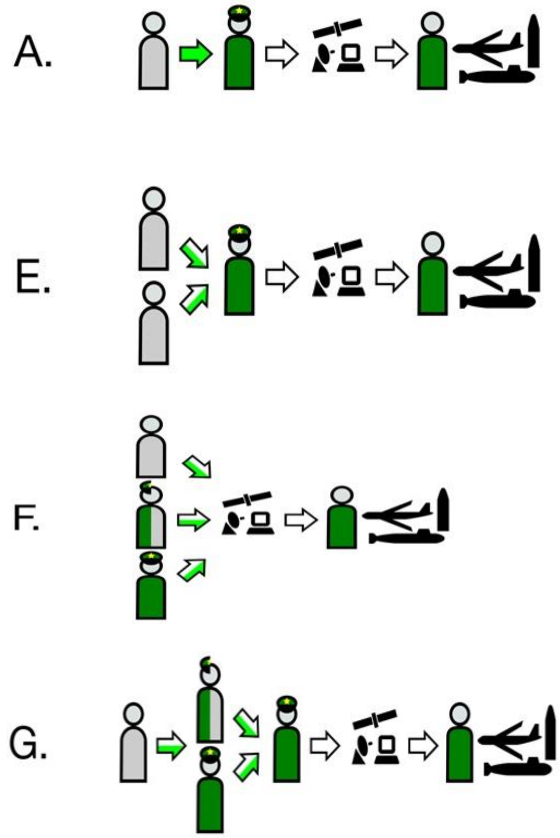
Nuclear Decision-Making and Commander Accountability

All organizations, including militaries armed with nuclear weapons, are made up of individuals interacting in patterned behaviors that becomes routines, standard operating procedures, and often guided by historical lessons such as how the last war was fought. They all have commanders at the top that make the ultimate decision on whether to use nuclear weapons—or not. Apart from different cultural orientations and historical trajectories, however, the individuals that rise to the top implement very different versions of what may be called the “n-person” rule, that is, how many people must participate in the decision, how that final decision is made, and who, if anyone, has veto power.

Table 2 below shows representations of simplified decision-making agents produced by Alex Wellerstein. Each diagram portrays who makes the ultimate decision to fire nuclear weapons (see notes to Table for detailed explanation) Diagram A shows how the system works in the United States and likely also in the DPRK. In this absolute nuclear rule model, only the president and the DPRK’s Supreme Leader (currently Kim Jong Un) can order a nuclear strike, which then goes to the top military officials who send the order out to nuclear forces. There is no military or civilian authority or figure who must first sign off or who can countermand this order. A manifestly illegal order may be disobeyed under international law, but that may not stop a determined supreme commander from circumventing an official who says no.

[54] See Nautilus Institute, Technology for Global Security, Preventive Defense Project, "Social Media Storms and Nuclear Early Warning Systems: A Deep Dive and Speed Scenarios Workshop Report," NAPSNet Special Reports, January 08, 2019, https://nautilus.org/napsnet/napsnet-special-reports/social-media-storms-and-nuclear-early-warning-systems-a-deep-dive-and-speed-scenarios-workshop-report/ and H. Williams and A. Drew **Escalation by Tweet: Managing the New Nuclear Diplomacy**, Centre for Science & Security Studies, Kings College, London, July 15, 2020, at: https://www.kcl.ac.uk/csss/assets/10957%E2%80%A2twitterconflictreport-15july.pdf

Table 2: Nuclear Command Authority Decision Models



Notes: The diagrams in this text are meant to illustrate several real and hypothetical ways in which nuclear command authority might be transmitted and translated into action. The characters on the far left are civilian state authorities (in gray). The character with the star on their hat is a top-level military authority (in green). The satellite/radar/computer represents the human and technical complexities of the command, control, and communications systems that transmit orders to, finally, the lower-level military figure (in green, no hat) who represents the officers who actually carry out the order with regards to the "shooters" (bombers, submarines, missiles, etc.).

Green arrows represent the ability to give positive or negative authority, whereas white arrows, in principle, are meant to be implementations of orders. Half-green arrows indicate the order only contains part of the necessary authority (one full green arrow is necessary for an order to be authenticated, so two half-arrows). One can ask whether every white arrow will flow naturally or whether there is the possibility of "push back" of some sort (e.g., a "veto," whether sanctioned or as either deliberate disobedience or just failing to convey orders forward), but in principle the white arrows are not intended to be "vetoes."

Source: Alex Wellerstein, "NC3 Decision Making: Individual Versus Group Process", NAPSNet Special Reports, August 08, 2019, https://nautilus.org/napsnet/napsnet-special-reports/nc3-decision-making-individual-versus-group-process/

According to Wallerstein, this same one-person rule may also operate in India and Pakistan:

> In India, this authority resides in the Prime Minister as head of the Political Council of the Nuclear Command Authority. In Pakistan, the nuclear capability was initially vested in the President of Pakistan as head of the National Command Authority, but it transferred (first procedurally, then legislatively) to the Prime Minister in 2010. It is unclear if these systems look like the flow in diagram "A," but they may.[55]

In China (see Diagram E) the heads of two civilian committees are required to initiate nuclear use. As the same person (President Xi) is currently the head of both committees, this system of checks reduces to a variant of A, absolute nuclear authority.

In Russia, paraphrasing Alex Wellerstein, three people (the president, the minister of defense, and the chief of general staff) carry the codes that enable them to authorize a nuclear strike. And at least two "votes" are necessary, portrayed by one full green arrow). States Wellerstein:

> Whether any one of these votes is privileged (e.g., is the President always required?), is unknown. Note that the Minister of Defense frequently has military rank, but this is not required (and several have not been military personnel), hence their ambiguous representation here. The Chief of General Staff has always been a high-ranking military officer. The activation of the "chegets" [nuclear codes] appears to go directly into the communication systems without an intervening officer.

It's possible that the Russian president may have special voting powers in this schema such that only that figure can initiate the order, but at least one of the others must concur, in which case some form of veto exists over the absolute power to fire nuclear weapons. (See Diagram D).

President Trump's turbulent and uneven use of nuclear threat has raised the issue of whether absolute power to start nuclear war should lie with only one person. As is evident from this

[55] A. Wellerstein, "NC3 Decision Making," *op cit.*

overview, however, the n-person question is universal, and some international consensus to generate a new norm on this score is badly needed. Moreover, the laws of armed conflict and other international law that define commander accountability on when and if use of nuclear weapons is ever legal demand that procedures that are universally agreed to should be implemented in all NC3 systems. This will ensure a minimum of accountability in the form of checks and balances to block manifestly illegal and insane strike orders from being implemented, ever. It is for this reason that the Treaty for the Prohibition of Nuclear Weapons includes NC3 systems in its scope, although it has yet to develop a practical set of recommendations that would allow NC3 systems to align with the core values of this treaty, even during the disarmament period when NC3 becomes more important than ever due to the vulnerability associated with holding small nuclear forces that reduces the assured ability of a nuclear-armed state to retaliate against a pre-emptive strike.

Complexity and the Global NC3 System

None of these NC3 systems, including their early warning and decision-making structures, exist in splendid isolation. Each is part of at least one nuclear-prone relationship constituted in part by the projection of mutual nuclear threat.

During the Cold War, this global threat and NC3 system was relatively simple, being either two or three way, depending on when China entered the picture (and subsuming the UK and France into the anti-Soviet bloc). At the time, Paul Bracken argued that the two NC3 systems were inextricably linked and tightly coupled, and the activities of one could generate spastic or pathological responses in the other, in a series of spiraling, interdependent effects whereby NC3 could be both cause and effect of the risk of nuclear war (see Figure 6). Nuclear weapons have become integral to Russia's reclamation of its major power role after the collapse of the former Soviet Union. It began a nuclear modernization program in the late 1990s, which is still ongoing. According to President Vladimir Putin's report in late 2019, modernized equipment now accounts for eighty-two percent of Russia's nuclear triad.[56] Russia's declaratory policy is to develop and

[56] Russian Federation Defence Ministry, "Supreme commander-in-chief of the Russian Federation Attends Extended Session of the Russian Defence Ministry Board Session." *Press Release*, December 18. 2018, http://eng.mil.ru/en/news_page/country/more.htm?id=12208613@egNews

deploy nuclear weapons to deter and, if necessary, prevail in a regional war—a strategy known as "escalate to de-escalate."

Russia's strategic modernization program has three elements. First, it is routinely replacing aging warheads and delivery systems with new, more advanced ones. Russia's nuclear triad consists of land-based international ballistic missiles (ICBMs), submarine-launched ballistic missiles (SLBMs), and strategic bombers. The land-based component of the strategic triad includes two versions of the SS-27: Mods 1 and 2. The focus of the current and larger phase of Russia's modernization is the SS-27 Mod 2 ICBM (known in Russia as RS-24 Yars), which is equipped with four multiple independently targetable reentry vehicles (MIRVs). Russia is also developing the heavy multiple-warhead ICBM (SS-X-29), known as Sarmat, which will replace the SS-18 in 2021.57 As for the sea-based component of its nuclear triad, Russia has already announced a plan to build five and purchase two more new Borei class submarines (Project 955A) to replace the older Delta IV SSBNs (Project 667BDRM) after 2023.[58] Russia has also resumed production of the Tu-160 aircraft in 2019 and is expected to field the first ten Tu-160M2s before 2027.

Second, Russia has begun to modernize its tactical nuclear weapons. As of early 2020, Russia is estimated to have a stockpile of about 4,310 nuclear warheads that are assigned to long-range strategic launchers and shorter-range tactical nuclear forces.[59] Of these, about 1,870 are nonstrategic warheads.

Third, Russia has begun to develop, test, and produce new "exotic" types of nuclear weapons. In March 2018, President Putin listed five new nuclear-capable weapons systems:

6. a nuclear-armed, maneuvering hypersonic glide vehicle (the Avangard), currently carried by a modified SS-19, and soon to be carried by an SS-29
7. a nuclear-powered, nuclear-armed cruise missile of "unlimited" range (the Burevestnik) to penetrate an adversary's missile defense systems
8. an air-launched ballistic missile purportedly intended to target ships (the Kinzhal)

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[57] RIA Novosti, *Russia to Develop New Heavy ICBM by 2020,* December 20, 2010, https://sputniknews.com/russia/20101220161856876/

[58] Hans M. Kristensen & Matt Korda, "Russian nuclear forces 2020," *Bulletin of the Atomic Scientists*, 2020, Vol.76, No.2, pp.102-117.

[59] Hans M. Kristensen & Matt Korda, "Russian nuclear forces, 2020," *Bulletin of the Atomic Scientists*, Vol.76, No.2, pp.102-117.

9. an SS-18 follow-on ICBM with modern features to penetrate missile defenses (the Sarmat)
10. a deep-diving, unmanned, nuclear-powered and nuclear-armed underwater delivery vehicle (the Poseidon) that is scheduled for delivery in 2027[60]

In February 2019, President Putin announced an additional nuclear-powered anti-ship hypersonic cruise missile (the Tsirkon) to the Russian nuclear weapons inventory. All these programs illustrate that Russia is determined to continue its reliance on nuclear weapons as a key element of its national security strategy. The new and "exotic" nuclear weapons provide means to augment existing nuclear forces with systems that are not counted under the New Strategic Arms Control Treaty (New START), now extended by the United States and Russia for five years by Presidents Biden and Putin.

These dynamics of Russian nuclear arms replacement, modernization, doctrine, and deployment—along with those of the United States—converge to suggest the new nuclear arms race between the United States and Russia will be different from that of the Cold War. In the late 1960s and early 1970s, the Soviet Union and the United States had approximate parity in the number of deliverable weapons in their nuclear arsenals. Their key strategic nuclear objectives were to obtain sufficient capacity to inflict a certain level of assured damage to the other one in a retaliatory strike. Driven by the reality of assured retaliation and near certainty of mutual annihilation in a nuclear war, the two nuclear superpowers had little incentive to pre-emptively strike the other's strategic nuclear forces. During the second half of the Cold War, Soviet leaders became uncertain of being able to indefinitely maintain a posture of guaranteed retaliation and mutual annihilation.[61] Three decades after the Cold War ended, we find the principles which guide the numbers or size of nuclear weapons have changed. On the one hand, the United States re-emphasized nuclear deterrence, boosted its nuclear modernization, and acted skeptically towards arms control measures. Thus, the guiding principles that shape the size and type of US nuclear forces have shifted from preserving strategic stability between the nuclear great powers to countering strategic threats from nuclear adversaries, whether they be small, medium, or great powers. Conversely, Russia's nuclear

[60] President of Russia, *Presidential Address to Federal Assembly*, March 1, 2018, http://en.kremlin.ru/events/president/news/56957
[61] Brendan R. Green and Austin Long, "The MAD Who Wasn't There: Soviet Reactions to the Late Cold War Nuclear Balance," *Security Studies*, 2017, Vol.26, No.4, pp.606-641.

modernization is still motivated in part by Moscow's strong desire to maintain overall numerical parity with the United States. For the Russian leadership the US ballistic missile defense system constitutes a real future risk to the credibility of Russia's retaliatory capability. Consequently, Russia began to research and develop new nuclear systems to counter deployment of US missile defenses. This unrestrained nuclear competition between the United States and Russia may complicate future bilateral arms control negotiation and potentially affect China's cognition of its own nuclear retaliatory capabilities.[62]

Apart from the major powers, more regional states have undermined efforts to restrain missile-proliferation by acquiring the scientific, technological, and industrial capabilities to produce both ballistic and cruise missiles.[63] The DPRK, India, and Pakistan have declared their possession of nuclear weapons and demonstrated their ability to use ballistic missiles. The DPRK test-fired an inter-continental range ballistic missile, which can reach at least the US West Coast, some 8,000 kilometers distant. India flight-tested a system with a range of 3,500 to 5,000 kilometers. Pakistan also has intermediate-range ballistic missiles able to carry nuclear warheads over 2,750 kilometers.[64] Evidently, states will continue developing or acquiring missiles and related technologies, despite interdiction, international condemnation, sanctions, and asymmetric efforts to limit them.

The "Post-INF" Capabilities and Major Powers' Strategic Interactions

The Intermediate-Range Nuclear Forces Treaty (INF) ended in 2019, but the issue of INF-range missiles remains. Russia's alleged treaty violations and China's increasing conventional and nuclear armed missile capabilities drove the United States to withdraw from the treaty. The former Trump Administration held that if the United States remained bound by the INF treaty limits, then it would be increasingly at a disadvantage with respect to Russia and China. American analysts argued that China has deployed thousands of land-based intermediate-range ballistic and cruise

[62] Charles L. Glaser, C. L., and Steve Fetter. 2016. "Should the United States Reject MAD? Damage Limitation and US Nuclear Strategy toward China," *International Security* 41 (1), pp.49–98.
[63] Nuclear Threat Initiative, "The Delivery Systems Threat," *Nuclear Threat Initiative*, December 30, 2015, http://www.nti.org/learn/delivery-systems/
[64]Missile Threat, Missile Defense Project. Lasted updated July 31, 2021, https://missilethreat.csis.org/missile/shaheen-3/

missiles, and ninety-five percent of them would violate the INF if China was party to it—which, of course, it is not.[65] After the US INF withdrawal, Russia decided to suspend its obligations under the INF treaty as a countermeasure. The current Biden Administration remains greatly concerned with Russia and China's potential employment of nuclear and conventional armed intermediate-range ballistic and cruise missiles and may try to seek negotiations on a global treaty to ban them.[66] The termination of the treaty means that the Asia-Pacific has entered into a "post-INF" era in which, as explained below, "post-ballistic" capabilities become a priority in military planning of these states and tripolar great power strategic interactions become more complex.

The "post-ballistic" capabilities arise from emerging technologies such as advanced guidance and stealth technology. Enhanced by these new technologies, a new generation of cruise missiles and tactical (shorter-range) ballistic missiles gained greater accuracy, reliability, and affordability than the long-range ballistic missiles. Modern cruise missiles can fly at low altitudes, which make them less visible to radars coverage and more difficult to detect and defend against. Shorter-range ballistic missiles, with their accuracy measured in meters, have become effective tools for taking out high-value, well-defended targets inside an adversary's territory.

These attributes, however, leave target nations with very limited ability to counter the new generation of missiles in wartime. Hypersonic vehicles with speeds of Mach 5 and above, for example, can drastically reduce the timelines for attack and response. The further proliferation of hypersonic missiles and the related technologies may cause miscalculation and misperception. Hypersonic weapon systems are divided into hypersonic glide vehicles and hypersonic cruise missiles. The United States, Russia, France, Japan, China, and India are all pursuing these weapons. Russia has already deployed early versions. Furthermore, the growing popularity of dual-capable missiles, when equipped with either conventional or non-conventional warheads, are also destabilizing and could lead to devastating deterrence failures because the payload ambiguity increases uncertainty in a crisis and, thereby, the stakes of not striking first.

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[65] Jacob Stokes, "China's Missile Program and US Withdrawal from the Intermediate-Range Nuclear Forces (INF) Treaty," *US-China Economic and Security Review Commission Staff Research Report*, Feb.4,2019, p.2.
[66] Sharon Squassoni, "How the Biden Administration can Secure Real Gains in Nuclear Arms Control," *Bulletin of the Atomic Scientists*, March 30, 2021, https://thebulletin.org/2021/03/how-the-biden-administration-can-secure-real-gains-in-nuclear-arms-control/

Russia has tested and fielded a new ground launched cruise missile system (9M729) that the United States claimed violated the INF treaty since May 2013.[67] Over the last two decades, China has deployed several new models of land-attack and anti-ship conventional cruise missiles, which are viewed by the United States as providing what it calls "Anti-access/Area-denial" (A2/AD) capability. On 3 August 2019, the day after the United States withdrew from the INF Treaty, then US Secretary of Defense Mark Esper revealed that the United States aims to deploy INF-range missiles in the Asia-Pacific to counter China's "A2/AD" capabilities.[68] At the same time, the Pentagon initiated a study to evaluate whether the United States needed new military capabilities to offset any advantage Russia and China might acquire by deploying a ground-launched cruise missile of INF range (between 500 and 5,500 kilometers). The potential US Army and/or Marine Corps options to deploy land-based intermediate-range missiles in this region include the intermediate-range ballistic missile (IRBM) with hypersonic glide vehicle, with a range of 4,000 km; the Tomahawk ground-launched cruise missile (GLCM), with a range of less than 2,500 km; the Improved Army Tactical Missile System (ATACMS), with a range of less than 700 km; and the Precision Strike Missile (PrSM), with a range of 499 km.[69]

The potential deployment of the previously prohibited ground-based INF-range missiles by the United States in the Asia-Pacific region, especially in the western Pacific, may increase the complexity of trilateral great power strategic interactions. In response, some Chinese scholars have suggested that China should increase the survivability of its nuclear forces by deploying multiple warheads on missiles and experiment with hypersonic boost-glide vehicles.[70] Some analysis outside China even speculated that Beijing might change its longstanding no-first-use (NFU) commitment and the minimum nuclear deterrence posture.[71] Yet to date, China has upheld its NFU

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[67] US Congressional Research Service, Russian Compliance with the Intermediate Range Nuclear Forces (INF) Treaty: Background and Issues for Congress, 8 February 2019.
[68] Robert Kobza, "Another Tool in the Toolbox: Using Intermediate-Range Missiles to Counter A2/AD in the Pacific," *Georgetown Security Studies Review*, 2 December 2019: 11.
69 Tanya Ogilvie-White, "Post-INF Arms Control in the Asia-Pacific: Political Viability and Implementation Challenges," *The International Institute for Strategic Studies,* 30 June 2020: 3.
70 Tong Zhao, "China in a world with No US-Russia Treaty-Based Arms Control," *Carnegie-Tsinghua Center for Global Policy*, 1 April 2019.
[71] Andrey Baklitskiy, "What the End of the INF Treaty Means for China," *Carnegie Moscow Center Commentary*, 2 December 2019, https://carnegie.ru/commentary/80462

commitment to non-nuclear states, in spite of the speculation of some in Washington that it would amend its NFU policy in the near future.

As for Russia, President Putin announced Russia will deploy new missile systems and augment its missile defenses in its eastern regions.[72] Russia also took other countermeasures that enhance Sino-Russian military ties and help China to boost its own missile defensive systems.[73] The Sino-Russian military cooperation between their respective missile defense systems can be traced back to US withdrawal from the Anti-Ballistic Missile Treaty (ABM) in 2002. Driven by the potential development of the aforementioned missiles by the United States, Sino-Russian relations gained a new momentum recently, which was named a "comprehensive strategic partnership" by China[74] and "an allied relationship" by Russia.

Will China Join the Trilateral Arms Control Negotiation?

In early 2019, the Trump Administration began to push for a trilateral arms control that would include the United States, Russia, and China. Then-president Trump noted that "Russia and China and us are all making hundreds of billions of dollars' worth of weapons which are costly and ridiculous."[75] In April 2020, the US State Department released a report titled, "US Priorities for Next-Generation Arms Control," which outlined US priorities for "next-generation arms control" involving both Moscow and Beijing.[76] The United States tended to cite China's participation as a pre-condition of the extension of the New START. The treaty limits deployed US and Russian strategic nuclear forces. Additionally, it facilitates inspections and exchanges of information on the status and movements of their intercontinental ballistic missiles and heavy bombers.

[72] Stephen Blank, "After the INF: Russia's Propaganda and Real Threats," *Eurasia Daily Monitor*, 6 September 2019, https://Jamestown.org/program/after-the-inf-russias-propaganda-and-real-threats/

[73] "Russia is Helping China Build a Missile Defence System, Putin Says," *Guardian*, 4 October 2019.

[74] "China and Russia," Ministry of Foreign Affairs of the People's Republic of China, online, https://www.fmprc.gov.cn/mfa_eng/wjb_663304/zzjg_663340/dozys_664276/gjlb_664280/3220_664352/

[75] Sonne P. and J. Hudson, "Trump Orders Staff to Prepare Arms-control Push with Russia and China," *The Washington Post*, April 25, 2019, https://www.washingtonpost.com/world/national-security/trump-orders-staff-to-prepare-arms-control-push-with-russia-and-china/2019/04/25/c7f05e04-6076-11e9-9412-daf3d2e67c6d_story.html

[76] Christopher A. Ford, "US Priorities for Next-Generation Arms Control," *Arms Control and International Security Papers*, Volume 1, Number1, April 06, 2020.

At the time, US proposals to trilateralize New START appeared disingenuous given that the relatively small Chinese nuclear forces are not equivalent to those of the United States and Russia.[77] Leaving aside the quantitative and qualitative differences of China's nuclear force, its warheads and relevant delivery systems are stored at separated locations, which means the existing counting rules in New START are not suitable to China.[78] Several Chinese spokespersons rejected the Trump administration's calls officially, arguing that the two nuclear superpowers should bear the main responsibility of reducing their arsenals to lower levels.[79] From Beijing's perspective, any request for a trilateral arms control dialogue from the United States is more a litmus test of its campaign of maximum pressure towards China on a range of policy issues and an excuse for its withdrawal from the treaty for non-substantive reasons. China is also worried that verification of its forces under a trilateral treaty could help to detect and weaken Beijing's limited nuclear retaliatory capabilities, which rely in part on opacity and ambiguity to compensate for its limited nuclear force.

China's negative attitude towards trilateral strategic arms control negotiation doesn't mean that China does not support the international disarmament and non-proliferation process. As a permanent member of the U.N. Security Council and a nuclear-weapon state, China has played constructive roles in other multilateral nuclear-related negotiations. In the 1990s, China actively led negotiations on military-to-military confidence building and risk reduction. It signed the multilateral 1996 Comprehensive Nuclear-Test-Ban Treaty and participated in the international monitoring systems being set up to detect nuclear explosions around the world. China pushed for a treaty preventing an arms race in outer space.[80] China also played a supportive role in negotiations leading to the 2015 multilateral Iran nuclear deal aimed at limiting that country's pathways to developing nuclear weapons. In the non-proliferation of missiles and their technologies, although it has not participated in any of the world's major export control

[77] According to Kristensen's assessment, Russia and the United States each maintain approximately 4,000 operational nuclear weapons, while China has around 300, cited from Kristensen H. M. and M. Korda, "Status of World Nuclear Forces", *Federation of American Scientists*, April, 2020, https://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/

[78] Leanne Quinn, "China's Stance on Nuclear Arms Control and New START," *Arms Control Now*, 23 August 2019, https://www.armscontrol.org/blog/2019-08-23/chinas-stance-nuclear-arms-control-new-start

[79] Director-General FU Cong's Interview with Kommersant, Ministry of Foreign Affairs of the People's Republic of China, Oct.16, 2020, https://www.fmprc.gov.cn/mfa_eng/wjbxw/t1824545.shtml

[80] Nancy Gallagher, "China on Arms Control, Nonproliferation, and Strategic Stability," *CISSM Working Paper*, August 2019: 2.

mechanisms except for joining the Nuclear Suppliers Group in 2004, China joined the Hague International Code of Conduct against Ballistic Missile Proliferation (HCOC) and pledged to halt missile exports in 1992, 1994, 1998, and 2000. In August 2002, China promulgated its own missile export control regulations and lists that corresponded closely to the Missile Technology Control Regime (MTCR) guidelines.[81] In 2003, China applied to join in the MTCR but was blocked by the United States.

When the United States shifted its China policy from engagement to containment under the Trump Administration—a posture likely to be maintained under the Biden administration—China became even more sensitive to the United States' trilateral arms control initiative. Nonetheless, China embraces dialogue underpinned by fair, equitable, and concrete principles. China will participate in negotiations when involved in a broader set of negotiating partners such as France and the United Kingdom with similar levels of nuclear forces rather than being singled out. All five officially recognized nuclear weapon states (the so-called "P5") have convened and collaborated successfully on the Iran negotiations. From Beijing's perspective, the P5 format might be more appealing than the prospect of negotiating alone with only the two nuclear superpowers. The P5 will be a good place for Beijing to negotiate confidence building measures such as the No First Use (NFU) principle. Some Chinese scholars even support the notion that China should enter into nuclear arms control dialogues rather than nuclear arms reduction negotiations because the concept of arms control is more comprehensive than arms reduction.[82]

Reducing the Risks of Dangerous Strategic Arms Races

The rapidly worsening global security environment now exacerbated by the global pandemic has led to several missile control treaties or agreements being abandoned or facing an uncertain future. The ABM Treaty and the Conventional Forces in Europe (CFE) Treaty collapsed. The termination of the INF Treaty highlights that bilateral arms control ultimately would not curb the geographical spread and technological advancement of missiles. The former Trump administration announced

[81] Robert J. Einhorn and Gary Samore, "Ending Russian Assistance to Iran's Nuclear Bomb," *Survival*, Vol. 44, No. 2 2002: 12.
[82] Wu 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

its withdrawal from the Open Sky Treaty. The 2010 New START, the only remaining treaty on limiting strategic ballistic missiles and strategic bombers, was going to expire in February 2021 and was saved only at the last moment by its extension by the Biden administration. Under Trump, even nuclear testing was put back on the agenda with unfounded American claims of the resumption of Chinese nuclear testing—which would have contravened the Comprehensive Nuclear Test Ban's "zero-yield" standard.[83] This reinforces just how far the negative trend went in the United States. Although many observers hope the Biden administration will reverse this trend, structural trends at the global level involving the nine nuclear-armed states, and the chaotic state of American domestic politics and nature of its foreign policy, mean that no-one can predict its stance on these issues for longer than a few years.

China opposes arms racing outright due to its cost and potential strategic risks. From the Chinese perspective, the situation could be improved by the following measures. First, states should strengthen and enlarge the existing institutions of missile control. A combination of deteriorating great-power relations, uncertainties about the impact of emerging technologies, and the fact that some "post-INF" missiles are inherently attractive to states, with low political and legal barriers to acquisition and use, has undermined controls on missile proliferation. There is no universal norm, treaty, or agreement which governs the development, testing, production, acquisition, possession, transfer, deployment, or use of missiles. Apart from the bilateral missile control treaties, the relevant mechanisms include unilateral (export controls), coordinated among exporting states as the MTCR, or multilateral but not legally binding and far from universal measures such as the HCOC. Despite its imperfections, the MTCR—the only existing multilateral arrangement covering the transfer of missiles and missile-related equipment, material, and technology relevant to weapons of mass destruction (WMD)—has brought a significant degree of order to containing the spread of ballistic missiles. The HCOC, an offspring of the MTCR and a useful set of voluntary confidence building measures, refers only to one category of missiles.

The existing regulations covering missiles fall far short of those that would avoid a costly and potentially deadly arms competition. For those concerned and responsible states in this region, it

[83] US State Department, "Executive Summary of Findings on Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments," *Bureau of Arms Control, Verification and Compliance*, April. 2020, https://www.state.gov/wp-content/uploads/2020/04/Tab-1-EXECUTIVE-SUMMARY-OF-2020-CR-FINDINGS-04.14.2020-003-003.PDF

is time to act now, or we will find ourselves bested by a destabilizing missile arms race. These existing instruments should give proper priority to cruise missiles and hypersonic missiles and even missile defense. The scope and number of their participants should be enlarged. A regional missile-limitation regime that provides prior notice of missile and satellite launches to enhance transparency and predictability would also offer great strategic benefits to all states in the region.[84]

Second, all states—but especially the great power nuclear armed states—must do everything possible to avoid the risk of war and nuclear war. States that possess nuclear-armed missiles must ensure that no accident or incident ever happens. All the nuclear-armed states should take the famous saying "a nuclear war cannot be won and must never be fought" as a common understanding and restrain their development and employment of any nuclear ballistic or cruise missiles. Nuclear-armed states should be divided into three levels according to the quantity or quality of their nuclear weapons. Each level should have different responsibilities.

The first level is Russia and the United States which, as nuclear superpowers, have more than ninety percent of the world's nuclear warheads. The deterioration of great power relationships has increased the possibility of a nuclear arms race. Their negative attitudes toward arms control have become a major barrier to the progress of international non-proliferation. The nuclear superpowers should reduce the role of nuclear weapons in their military doctrines by rejecting preemptive nuclear strikes or declaring that the sole use of nuclear weapons is as "the last resort" to defend their national security.

The second layer includes France, Great Britain, and China, the other three permanent members of the U.N. security council. It is imperative to encourage these states to make more contributions to the international arms control process.

The third layer involves the four *de facto* nuclear states, India, Pakistan, the DPRK, and Israel, who are neither members of the P5 nor parties to the NPT. Their rights to exploit nuclear energy peacefully should be respected. Meanwhile, every effort should be made to limit and reduce the

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[84] Kurosaki Akira, "Moving Beyond Deterrence and Missile Defense," *INESAP Briefing Paper,* No.13, November 2004, http://www.inesap.org/sites/default/files/Briefing13_04_0.pdf

risk of a nuclear war or conflict between India and Pakistan to boost the denuclearization process of the DPRK, while guaranteeing their national security.

Last, but not the least, the new arms control and disarmament dialogue must directly address the new factors that could increase the risk of accidental or inadvertent nuclear conflict, most important, the potential destabilizing effects of new non-nuclear weapon technologies such as ballistic missile defense, anti-satellite weapons, and precision-strike missile technology. The emerging advanced technologies supplement and even enhance nuclear weapons while offering non-nuclear states capabilities with which to offset the projection of conventional and nuclear forces by the great powers. With the widespread applications of emerging technologies, non-nuclear military facilities and platforms may degrade nuclear decision-making and increase the risk of an accidental nuclear war. Thus, Track 2 dialogues on emerging technologies and some non-nuclear weapon systems might develop workable proposals to reduce the resulting risks.

The continued high alert levels of American, Russian, British, and French warheads to support "launch on warning" is another risk that deserves urgent attention. Moreover, Russia and the United States each possess huge counterforce capabilities, which threatens not only each other but lesser nuclear adversaries with a decapitating and disarming first-strike. In contrast, China, India, and Pakistan reportedly keep their nuclear weapons un-deployed at central storage facilities on low alert levels. Their retaliatory strike capabilities are based on the principle of "launch under attack," not "under warning." Already in 1994, China proposed that the P5 should agree to adopt NFU, which could lay the foundation of developing codes of conduct to decrease the risks.[85] Recognizing the NFU principle could lessen the risk arising from misperception and misunderstanding of the preemptive strike posture on the one hand and sustain the taboo against nuclear employment on the other.

[85] Zhengqiang Pan, "A Study of China's No-First-Use Policy on Nuclear Weapons," *Journal for Peace and Nuclear Disarmament*, 1, No.1, 2018: 115-136.

6. Status of Existing and Emerging Asia-Pacific Space Powers Capabilities

Namrata Goswami

Introduction

The Asia-Pacific is a key region in international relations today. Host to major powers like China, India, Japan, South Korea, Indonesia and Singapore, the combined Gross Domestic Product (GDP) purchasing power parity (PPP) of the region was estimated to be the largest in the world in 2020, pre-pandemic assessments.[1] Interestingly, despite the COVID 19 pandemic, China has seen positive growth rates as the largest contributer to Asian economic vibrancy.[2] By 2030, the region is forecasted to contribute 60 per cent of global growth.[3] Among the major space faring nations in the Asia-Pacific, China will become the world's largest economy by 2050, according to PricewaterhouseCoopers, followed by India at number two and the United States (US) at number three.[4] Indonesia is forecasted to be the fourth largest economy; South Korea will be 14th in overall world ranking.[5] Among those forecasted to lead, China and India are Great Powers, followed by major powers like Japan, South Korea, and Indonesia. China, India, and Japan are major space faring nations with independent capacity to launch into space, with ambitions for space settlement

[1] Wang Huiyao, "In 2020, Asian Economies will become larger than the rest of the world combined-here's how," World Economic Forum, July 25, 2019, https://www.weforum.org/agenda/2019/07/the-dawn-of-the-asian-century/ (accessed July 26, 2021).
[2] Jonathan Cheng, "China is the only major economy to report economic growth for 2020," The Wall Street Journal, January 18, 2021, https://www.wsj.com/articles/china-is-the-only-major-economy-to-report-economic-growth-for-2020-11610936187 (accessed July 26, 2021).
[3] Praneeth Yandamuri and Zara Ingilizian, "In 2020, Asia will have the World's Largest GDP. Here's What that Means," *World Economic Forum*, December 20, 2019. https://www.weforum.org/agenda/2019/12/asia-economic-growth/ (accessed September 21, 2020).
[4] PricewaterhouseCoopers, "The World in 2050," https://www.pwc.com/gx/en/issues/economy/the-world-in-2050.html (accessed September 28, 2020).
[5] Will Martin, 'RANKED: This will be the 32 most powerful economies in the world by 2050," *Business Insider*, February 17, 2017. https://www.businessinsider.com/pwc-ranking-of-biggest-economies-ppp-2050-2017-2 (accessed September 21, 2020).

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and space resource utilization. South Korea has had its own space agency since 1992: the Korea Aerospace Research Institute.[6] The context within which the current space activities of space faring nations are occurring has changed as well. Unlike during the Cold War, when the focus was on 'Great Power Competition' for prestige and ideological reputation, with 'flags and footprints' missions, today, the focus is on space utilization and development, of which prestige is but a minor part. One can gauge this in the articulated space ambitions of the United States,[7] China,[8] India,[9] Japan,[10] and South Korea.[11]

Given the emergent space power focus in the Asia-Pacific, this report highlights the space power capabilities of the two Great Powers in space in Asia (China and India). This is followed by a section on horizontal and vertical proliferation of space warfare capabilities.[12] The report discusses the institutional and legal regimes and constraints on space weaponization, explains certain worst-case militarization scenarios, and presents alternative space demilitarization pathways.

Defining Space Power

Power is the ability that Country A wields over Country B to get Country B to do something, which Country B would not otherwise do. It is the ability to influence others to do what you want them to do.[13] It also implies an ability to prevent others from doing what they want, especially if it is not in your interest. Sometimes, such power is wielded to prevent others from including agendas in

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[6] Korea Aerospace Research Institute. https://www.kari.re.kr/eng/sub01_01.do (accessed September 21, 2020).
[7] The White House, National Space Council, "A New Era for Deep Space Exploration and Development," July 23, 2020. https://www.whitehouse.gov/wp-content/uploads/2020/07/A-New-Era-for-Space-Exploration-and-Development-07-23-2020.pdf (accessed September 21, 2020).
[8] Statement of Dr. Namrata Goswami Independent Senior Analyst and Author 2016-2017 Minerva Grantee Before the U.S.-China Economic and Security Review Commission Hearing on "China in Space: A Strategic Competition?" April 25, 2019. https://www.uscc.gov/sites/default/files/Namrata%20Goswami%20USCC%2025%20April.pdf (accessed September 28, 2020).
[9] Raghu Krishnan, "ISRO's Big Space Plans: Take a Look at the Missions the Space Agency has Lined up in the Coming Years," *The Economic Times*, September 8, 2019 (Accessed September 21, 2020).
[10] "Moon Shot Japan's Era of New Space," CNBC, n.d. https://cnb.cx/36kfA5q (accessed September 21, 2020).
[11] An, Hyoung Joon, "South Korea's Space Program: Activities and Ambitions," *Asia Policy*, April 24, 2020. https://www.nbr.org/publication/asia-in-space-the-race-to-the-final-frontier/ (accessed September 21, 2020).
[12] Peter Garretson, "What War in Space Might Look Like Circa 2030-2040?" Nonproliferation Policy Education Center, August 28, 2020. http://www.npolicy.org/article_file/What_War_In_Space_Might_Look_Like_In_The_Next_One_To_Two_Decades.pdf (accessed September 28, 2020).
[13] Robert Dahl, "The Concept of Power," *Behavioral Science*, 2:3 (December 1957), pp. 201-15.

discussions that may not be in your interest.[14] An example of this is the ability of the permanent members of the United Nations Security Council (UNSC) to pressurize and prevent other countries from discussing issues that are detrimental to their or their allies' interest. Therefore, power, in international relations, is the capability to influence, persuade or coerce others to do what is in one's own interest. By extension, spacepower is an extension of comprehensive power: the ability of Country A to persuade or coerce Country B to behave in a manner in space that is beneficial to Country A's interests. It includes the ability to deter harmful behavior, either by denial or by punishment. Brent Ziarnick in *Developing National Power in Space A Theoretical Model* defines spacepower as "the ability to do something in space."[15] Ziarnick develops his definition from Brigadier General "Billy" Mitchell's 1925 definition of airpower "as the ability to do something in the air."[16] Ziarnick quotes Colonel David Lupton, who defines spacepower as "the ability of a nation to exploit the space environment in pursuit of national goals and purposes and includes the entire astronautical capabilities of a nation."[17] The US Space Force's Capstone Doctrine, published in 2020, states that "national spacepower is the totality of a nation's ability to exploit the space domain in pursuit of prosperity and security."[18] The Capstone Doctrine identifies four instruments of national power: diplomatic, informational, military, and economic (DIME). "Military spacepower enables a nation to protect and defend space-based sources of economic power. Military operations exist in space to preserve and advance all equities of national spacepower."[19] It is critical to realize that while there are generalizable definitions of spacepower, when operationalized within the context of a particular country, the concept of strategic culture has an impact on how states behave/will behave in outer space. Strategic culture can be defined as a sum of a *nation's assumptions about its reality* (threats, opportunities) based on which policy choices are preferred over others. These policy choices are informed by the state's political culture

[14] Peter Bachrach and Morton S. Baratz, "Two Faces of Power," *The American Political Science Review,* 56/4 (Dec., 1962), pp. 947-952

[15] Brent Ziarnick, Developing National Power in Space A Theoretical Model (Jefferson, NC: McFarland & Company Inc, 2015), p. 12.

[16] Ziarnick, Ibid.

[17] Ziarnick, p. 12.

[18] Space Capstone Publication, "SpacePower Doctrine for Space Forces" United States Space Force, June 2020. https://www.spaceforce.mil/Portals/1/Space%20Capstone%20Publication_10%20Aug%202020.pdf (accessed September 28, 2020).

[19] Ibid.

reflecting both continuity and change over time.[20] Political Culture is "a short-hand expression for a 'mindset' that has the effect of *limiting attention to less than the full range of alternative behaviors, problems* [emphasis added], and solutions which are logically possible."[21] For instance, from a strategic culture perspective, China's aim is to win the competition for influence and power projection, especially with the help of outer space, and without bloodshed so that its value system (especially that guided by President Xi Jinping's thought), is established and legitimized.[22] Given that space has such deep consequences for how society is run today, including via the civilian, commercial, and military uses of space, "the purpose of space strategy is to ensure access to and use of space."[23] To maintain access requires space capacity. It is therefore important to examine the profile of the space powers' capabilities.

Profile of Each Space Power's Capabilities

This section offers an assessment of the Great Powers in space (China and India) and their space capacities.

China

China has one of the most ambitious space programs in the world. Funded annually with a budget of approximately $8 billion, China has ambitions to establish a permanent space station by 2022, a lunar research outpost by 2036, a Solar Power Satellite (SPS) transmission capacity from geostationary orbit (GEO) by 2050, and to establish itself as the world leader in space by 2050.[24] China has invested in developing its military space capacity to augment its information warfare capacity for military command and control (CnC), precision navigation, and timing (PNT) for

[20] Namrata Goswami, "Explaining China's Grand Strategy through the Lens of Strategic Culture," *The Space Review*, May 18, 2020. https://www.thespacereview.com/article/3944/1 (accessed September 28, 2020).
[21] Stephen Peter Rosen, "Military Effectiveness: Why Society Matters," International Security, 19/4 (Spring 1995), pp. 5-31.
[22] Robert Lawrence Kuhn, "Discerning the Essence of Xi Jinping Thought," *China Daily*, March 26, 2018. http://www.chinadaily.com.cn/a/201803/26/WS5ab8a6aaa3105cdcf651457f.html (accessed September 28, 2020).
[23] John J. Klein, *Understanding Space Strategy The Art of War in Space* (London and New York: Routledge, 2019), p. 21.
[24] Namrata Goswami, "The Economic and Military Impact of China's BeiDou Navigation System," *The Diplomat*, July 01, 2020, https://thediplomat.com/2020/07/the-economic-and-military-impact-of-chinas-beidou-navigation-system/ (accessed July 26, 2021).

independent missile launch and tracking as well as sea-based launch for avoiding detection. In the commercial sphere, Chinese private companies like OneSpace have already launched to space in 2019 and have plans for developing reusable rockets. Within the last two years (2018 onwards), China has seen investments of up to $2 billion in its private space sector.

Civilian Capability

China has an independent space launch capability and has a demonstrated human presence in Low Earth Orbit (LEO) via its Tiangong space station. China has achieved humanity's first landing on the lunar far side, and it has also launched its second independently conceived Mars mission. As of April 1, 2020, China has 363 satellites, the US has 1,327, Russia 169, and India 118.[25] On June 23, 2020, China launched the 55th satellite of its BeiDou Navigation System (BDS) according itself a fully independent, self-reliant Global Navigation Satellite System (GNSS) as an alternative to the US Space Force-maintained Global Positioning System (GPS). With this launch, "China is now able to extend influence in a multidomain environment (land, sea, and space) via its BeiDou space system, which provides navigation to aircraft, submarines, missiles, as well as commercial services dependent on such navigation."[26] This Chinese information infrastructure consists of undersea cables, (in which China is dominant), space-supported links, and other Earth-based links. China's National Development and Reform Commission (NDRC) determined in April 2020 that services like space information, and associated incorporated services like 5G, satellite broadband, artificial intelligence (AI), blockchain, and the Internet of Things (IoT) are part of its "New Infrastructures" list.[27] BeiDou offers an alternative to GPS, enabling China to further consolidate its hold on global infrastructure and rulemaking, form partnerships and alliances and to control the standards for information technology, mobile devices, 5G, self-driving cars and drones, and the broader IoT. It offers China an influence mechanism whereby countries dependent on BeiDou would hesitate to criticize China on political issues such as Tibet, the South China Sea (SCS), or Taiwan. This increases China's ability to coerce and compel. Wang Jingang, the chief deputy

[25] Union of Concerned Scientists, "UCS Satellite Database", November 30, 2018. https://www.ucsusa.org/nuclear-weapons/space-weapons/satellite-database (accessed on September 28, 2020).
[26] Namrata Goswami, "The Economic and Military Impact of China's BeiDou Navigation System", *The Diplomat*, July 1, 2020. https://thediplomat.com/2020/07/the-economic-and-military-impact-of-chinas-beidou-navigation-system/#:~:text=By%20Namrata%20Goswami&text=On%20June%2023%2C%202020%2C%20China,for%20its%20BDS3%20navigation%20constellation (accessed September 23, 2020).
[27] Ibid.

designer of the BDS-3 satellites, has described his work as a "rare chance to devote my intelligence to a symbolic national project." He points out that "people still mainly depend on navigation by GPS, supplemented by BDS," but hopes that "in a few years, people can be navigated mainly by BDS."[28] In January 2019, China established its first state-funded Space-Based Solar Power (SBSP) plant in Chongqing, a concept supported by Li Ming, the vice president of the China Academy of Space Technology (CAST).[29] The base plant is being constructed under the guidance of the Chongqing Collaborative Innovation Research Institute for Civil-Military Integration (CCIRICMI) in Southwestern China in partnership with researchers from Chongqing University, CAST's Xi'an Branch in Shaanxi province, and Xidian University. An initial investment of $15 million has been made by the Bishan district government for the SBSP plant. Technologies being tested include SBSP satellites in GEO using automated assembly and wireless power transmission.[30] Xie Gengxin, Deputy Head of CCIRICMI, has stated that:

> We plan to launch four to six tethered balloons from the testing base and connect them with each other to set up a network at an altitude of around 1,000 meters… these balloons will collect sunlight and convert solar energy to microwave before beaming it back to Earth. Receiving stations on the ground will convert such microwaves to electricity and distribute it to a grid… if everything goes well, a Chinese solar power station will be put into orbit about 36,000 kilometers above Earth and start generating power before 2040.[31]

China is also investing in its space launch capacity. Its latest rocket, the *Long March 5* (which is capable of launching 14 metric tons to geostationary orbit (GEO), 25 tons to low earth orbit (LEO), and 8.2 tons to trans lunar injection) successfully launched in December 2019. The success of this launch was critical given the China Mars Mission (Tianwen) was launched on the Long March 5 on July 23, 2020. Also, the Long March 5 launched China's *Chang'e 5* lunar sample return mission in November 2020 and sunsequently will launch China's eleven planned missions to construct its

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[28] "From Compass to BeiDou: Chinese Wisdom Help Navigate Belt & Road", *China Daily*, November 19, 2018. https://global.chinadaily.com.cn/a/201811/19/WS5bf25cb3a310eff303289946.html aAccessed September 28, 2020).
[29] "China Starts to Build World's First Space-Based Solar Power Plant", CGTN, February 18, 2019. http://www.ecns.cn/news/economy/2019-02-18/detail-ifzeratr8870758.shtml (accessed on April 18, 2019).
[30] Pan Zhaoyi, "China Starts to Build World's First Space-based Solar Power Plant", CGTN, February 18, 2019. https://news.cgtn.com/news/3d3d514f34597a4e32457a6333566d54/index.html (accessed on April 17, 2019).
[31] Ibid.

permanent space station (Tiangong) by 2022. In addition, China is developing the *Long March 9*, which is designed to carry a payload of 140 metric tons to LEO, a 50-ton spacecraft to a lunar transfer orbit, and a 44-ton payload to Mars transfer orbit.[32] Importantly, in its justifications for the *Long March 9*, China listed three goals: to launch a Mars robotic exploration mission requiring 41 tonne payloads; to launch manned Mars and deep space missions; and to construct an "orbital solar power plant with 10,000 MW capacity, massing some 50,000 tonnes, requiring 620+ launches."[33]

One of the core missions for China in civil space is its China Lunar Exploration Program (CLEP). Following the successful landing of the *Chang'e 4* on the far side of the moon on January 3, 2019, Wu Yanhua, deputy head of the China National Space Administration (CNSA) announced that by 2019 year-end, China will launch *Chang'e-5*, to bring lunar samples back to Earth (accomplished December 2020). This would be followed by *Chang'e-6*, aimed at bringing samples from the South Pole; *Chang'e-7*, which will survey the South Pole for evaluating its composition; and *Chang'e-8,* which will test key technologies, like 3D printing, to lay the groundwork for the construction of a scientific base on the moon.[34] Critically, scientists at the Technology and Engineering Center for Space Utilization of the Chinese Academy of Sciences (CAS) have tested 3D printing technology in micro-gravity by successfully completing a ceramic testing technology in 2018.[35] According to Wang Gong, Director of the CAS Key Laboratory of Space Manufacturing Technology, this will build a Chinese capability to construct bases on the moon and Mars, as well as in-situ resource utilization and space manufacturing with space-based resources.[36] Using ceramics is instructive as it is similar in composition to lunar silicate particles. China tested growing life organisms like cotton seeds, Arabidopsis, and potatoes on the lunar surface with its 3kg bioregenerative life support system aboard the *Chang'e 4*, with only the cotton seed sprouting. This is in pursuance of

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32 Zhao Lei, "Super Powerful Long March 9 Said to Begin Missions around 2030," *China Daily*, March 11, 2019. http://www.chinadaily.com.cn/a/201903/11/WS5c859b62a3106c65c34edcc0.html

33 As quoted from Journal of Rocket Propulsion, January 2011, in https://www.globalsecurity.org/space/world/china/cz-x.htm (accessed July 26, 2021).

34 "China unveils Follow-Up Lunar Exploration Missions", *Xinhua*, January 14, 2019 at http://www.xinhuanet.com/english/2019-01/14/c_137743015.htm (accessed on April 18, 2019).

35 "China Focus: China Pioneers Ceramic 3D Printing in Micro-Gravity", Xinhua, June 19, 2018 at http://www.xinhuanet.com/english/2018-06/19/c_137265536.htm (accessed on April 17, 2019). Richard P. Appelbaum, et.al., *Innovation in China: Challenging the Global Science and Technology System* (Polity, 2018). George S. Yip and Bruce McKern, *China's Next Strategic Advantage:* From Imitation to Innovation (MIT Press, 2017).

36 "China Focus: China pioneers Ceramic 3D Printing in Microgravity", n. 34.

building human capacity to settle and survive on the lunar surface. China's CLEP is not only aimed at lunar scientific missions, but it is also a long-term space presence development strategy to incrementally build capacity for lunar and asteroid mining. The Moon offers the best chance of building space-faring capacities on a planetary body because it is not difficult to reach from Earth. This aspect is recognized by Wu Weiren, the chief scientist at CLEP. He states that, "our short-term goal is to orbit the Moon, and land on the Moon, and take samples back from the Moon…our long-term goal is explore, land and settle. We want our manned lunar landing to stay for longer periods and establish a research base."[37] China also developed its relay satellite in May 2018, with the *Queqiao*, or Magpie Bridge, being placed in the L2 Halo orbit to serve as a communication relay satellite from the *Chang'e 4*.[38] *Queqiao* can peer into the Lunar polar craters, enabling future landing zones for China's probes in the shadowed regions. Lieutenant General Zhang Yulin, former deputy commander of China's Manned Space Program and former Deputy Chief of the Armament Development Department of the Central Military Commission (CMC), now with the Strategic Support Force (SSF), specified the significance of the Moon in 2016 when he stated that, "the earth-moon space will be strategically important for the great rejuvenation of the Chinese nation."[39] Yulin indicated in that same interview that China will be investing in building capacity to generate solar power in space. He was clear on what China's space program's focus should be in the long term, "The future of China's manned space program, is not a moon landing, which is quite simple, or even the manned Mars program which remains difficult, but continual exploration of the earth-moon space with ever developing technology."[40]

Military Space Capacities

China is developing its military space capacity. China's space program is directed by the State Administration on Science, Technology and Industry for National Defense (SASTIND), which

[37] "What does China want to do in Space", BBC, April 20, 2016 at https://www.bbc.com/news/av/36089689/what-does-china-want-to-do-in-space (accessed on September 17, 2020). Marina Koren, "China's Growing Ambitions in Space", *The Atlantic*, January 23, 2017 at https://www.theatlantic.com/science/archive/2017/01/china-space/497846/ (accessed on April 18, 2019).

[38] Luyuan Xu, " How China's Lunar Relay Satellite Arrived in its Final Orbit", Planetary Society, June 15, 2018 at http://www.planetary.org/blogs/guest-blogs/2018/20180615-queqiao-orbit-explainer.html (accessed on September 17, 2020).

[39] "Exploiting Earth-Moon Space: Chinese Ambitions after Space Station", Xinhua, March 08, 2016 at http://m.chinadaily.com.cn/en//2016-03/08/content_23775949.htm (accessed on September 17, 2020).

[40] Ibid.

functions under the direction of the Ministry of Industry and Information Technology (MIIT).[41] Consequently, China appreciates the vital role that space plays for CnC, PNT, informationized warfare, space access and presence, space-based communications systems, and developing counter-space capabilities via-a-vis the adversary. In 2007, China tested its anti-satellite (ASAT) capability. Such ASAT technologies have been further refined in 2010, 2013, and 2014, enhancing their capabilities (without generating space debris as did its 2007 test). Open sources report that the SSF is training with ASAT missiles aimed at US satellites. These ASAT systems include a variant of the HQ-19 surface-to-air missile (utilized in tests in 2007 and 2010), the DN-2 (2013), and the DN-3 (in the tests of 2015, 2016, and 2017). According to the National Space and Air Intelligence Center (NASIC) report, *Competing in Space*:

> China has military units that have begun training with anti-satellite missiles. Russia is probably also developing an anti-satellite missile. These missiles can destroy US and allied space systems in low Earth orbit, making intelligence, surveillance, reconnaissance, and communications satellites vulnerable.[42]

In 2015, China institutionalized a separate space service with the establishment of the People's Liberation Army Space Force (PLASSF). The PLASSF, for the first time, brings together China's growing military space assets into a single unit, aimed at dominance across the spectrum of air, space, and cyber. An independent BDS adds to China's military CnC as well. China can now independently guide missiles and bombs onto fixed targets without fear that the United States would turn off navigation services. China can now also guide its missiles very close to the target, after which a terminal seeker can provide active guidance for precise targeting. BeiDou augments independent military CnC by allowing precise knowledge of the location of one's own forces, and the ability to precisely target and provide navigation for military forces and strikes. This capability strengthens China's ability to coerce or compel others within its sphere of interest, such as on issues like the South China Sea, Taiwan, or Hong Kong. An independent BDS coupled with 5G

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[41] "Ministry of Industry and Information Technology", The State Council, The People's Republic of China, at http://english.gov.cn/state_council/2014/08/23/content_281474983035940.htm (accessed on September 17, 2020).

[42] National Air and Space Intelligence Center, "Competing in Space", December 2018 at https://media.defense.gov/2019/Jan/16/2002080386/-1/-1/1/190115-F-NV711-0002.PDF, p.21 (accessed on September 20, 2019).

means real-time military CnC and devastatingly accurate automated weapons systems.[43] China's military space capacity is geared towards building an independent capability to build into a system of comprehensive power with ASAT capability, informationized warfare, orbital presence, deep space missions, and lunar missions. It encompasses both military and civilian assets into one ideological mooring.

Commercial Space

In the past few years, China has been developing its commercial space capacity. Under the direction of President Xi Jinping, China has been enabling the development of its private space sector. This was made a priority in 2014 when the State Council of the Communist Party of China (CPC) released Document 60 to encourage China's private space sector. [44] Since then, there have been larger investments in China's private space sector as well as a focus on civil-military integration.[45] Since 2016, China's private funding has seen an increase to about $2 billion annually.[46] Private space companies have already achieved orbital launch and are investing in developing critical technologies like reusable space launch capacity. Amongst the known private space companies, Onespace is one of the first companies to successfully launch to sub-orbit,[47] followed by attempts made by Linkspace and Landspace. In August 2019, Linkspace experimented with the first Chinese reusable launch vehicle, when its rocket reached a height of 300 meters above ground and then landed back intact.[48] Beijing Interstellar Glory Space Technology Ltd or iSpace launched its rocket *Hyperbola 1* into orbit in July 2019, marking the first such

[43] Namrata Goswami, "The Economic and Military Impact of China's BeiDou Navigation System". n. 25.
[44] State Council Information Office of the People's Republic of China, "Guiding Opinions of the State Council on Encouraging Social Investment in Investment and Financing Mechanisms in Key Innovation Areas Document 60." November 16, 2014. http://www.gov.cn/zhengce/content/2014-11/26/content_9260.htm (accessed September 28, 2020).
[45] Zhao Lei, "Civil-Military Integration will Deepen," *China Daily*, March 3, 2018 http://www.chinadaily.com.cn/a/201803/03/WS5a99d67ca3106e7dcc13f437.html (accessed August 3, 2020).
[46] Michael Sheetz, "China Increases Investment in Emerging Private Space Industry," CNBC, October 10, 2018, , https://www.cnbc.com/2018/10/10/china-increases-investment-in-emerging-private-space-industry.html (accessed August 3, 2020)
[47] Reuters, "China Launches First Rocket Designed by a Private Company," May 17, 2018. https://www.reuters.com/article/us-space-launch-china-onespace/china-launches-first-rocket-designed-by-a-private-company-idUSKCN1II0FK (accessed August 3, 2020).
[48] "China Successfully Launches Largest Reusable Rocket," *Global Times*, August 10, 2019. https://www.globaltimes.cn/content/1160951.shtml (accessed August 3, 2020)

successful orbital launch by a Chinese private company.[49] In January 2021, iSpace attempted (and apparently failed) to launch into orbit China's first reusable rocket, the *Hyperbola-2*.[50]

India

India, like China, views space as part of its grand strategy and as a tool to defend and expand its power. Like China, India has an independent space launch capacity, has launched missions to the Moon and Mars, and tested an ASAT capability. India has also established a separate space service with the establishment of the Defense Space Agency in 2019. Some of India's civilian, military, and commercial space capacities are detailed in the next section.

Civilian Space Capacities

India possesses civilian space launch capacities, which are cost effective, not due to reusability but to lower manufacturing costs. This includes the Polar Satellite Launch Vehicle (PSLV) and the Geosynchronous Satellite Launch Vehicle (GSLV). India has the capacity to launch multiple payloads, including a record breaking 104 satellites, which were launched on a single mission in 2017,[51] a record since broken by SpaceX in January 2021 with the launch of 143 satellites on a single rocket.[52] In another record for India, 29 satellites were launched to three different orbits in 2019.[53] India launched its first Moon mission in 2008 with its *Chandrayaan 1* lunar orbiter mission. This mission included NASA's Moon Mineralogy Mapper (M^3),which helped confirm the presence of water ice on the lunar surface.[54] In 2014, India successfully sent a Mars orbiter,

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[49] Reuters, "Chinese Rocket Startup Puts Satellites into Orbit for First Time," Reuters, July 25, 2019. https://www.reuters.com/article/us-china-space/chinese-rocket-startup-puts-satellites-into-orbit-for-first-time-idUSKCN1UK0KY (accessed August 3, 2020).

[50] China's iSpace suffers failure with second orbital launch attempt - SpaceNews, February 04, 2021, https://www.space.com/chinese-startup-ispace-rocket-launch-failure (accessed July 26, 2021).

[51] Barry Ellen, "India Launches 104 Satellites From a Single Rocket, Ramping Up a Space Race," *The New York Times*, accessed June 13, 2019. https://www.nytimes.com/2017/02/15/world/asia/india-satellites-rocket.html

[52] Jonathan O' Callaghan, "SpaceX Launches Rocket with 143 Rockets The Most Ever Flown on a Single Mission," Forbes, January 24, 2021, https://www.forbes.com/sites/jonathanocallaghan/2021/01/24/spacex-launches-rocket-with-143-satellites--the-most-ever-flown-on-a-single-mission/?sh=4d89933027fd (accessed July 26, 2021).

[53] Indian Express, "Explained: What makes PSLV-C45 special," April 2, 2019. https://indianexpress.com/article/explained/pslv-c45-rocket-launch-indian-space-research-organisation-isroc-5653610/ (accessed September 28, 2020).

[54] NASA, "Chandrayaan-1 Moon Impact Probe," n.d.. https://solarsystem.nasa.gov/missions/chandrayaan-1/in-depth/ (accessed March 9, 2020).

Mangalyaan, at a low cost of US $74 million.[55] In September 2019, while India failed with its lunar lander, it did succeed with its *Chandrayaan 2* lunar orbiter entering lunar orbit in August 2019 to map the lunar poles.[56] India's ambition to scale higher in outer space was evidenced in 2018 when Prime Minister Modi announced that India would send a man or woman into LEO by 2022, in a mission called *Gaganyaan*.[57] Subsequently, four Indian astronauts began a year-long training exercise in Russia's Gagarin Cosmonaut Training Center (GCTC), but the mission has been delayed by the Covid-19 pandemic.[58] India's civilian space capacity is utilized in other sectors as well, like the geospatial information system, Prospective Fishing Zones (PFZs), accurate weather forecasts, financial and telecommunication services, as well as tele-education services.[59]

Military Space Capacities

India's military space sector took off after India had to reckon with 'intelligence failure' during the Kargil War of 1999 against Pakistan, when Indian agencies failed to pick up intelligence on infiltrators crossing the Himalayan border. Consequently, India developed its first Technology Control Satellite (TES) in 2001. In 2004, in order to collate intelligence within a single body, India established the National Technical Research Organisation (NTRO). In 2008, as a response to China's ASAT test in 2007, India established a separate Integrated Space Cell within the Integrated Defence Services Headquarters, followed by the Space Security Coordination Group (SSCG) under the National Security Adviser. RISAT-2, which was launched in 2008, was India's first dedicated military satellite,[60] followed by the GISAT-7 in 2013.[61] India's NavIC (Navigation

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[55] Ipsita Agrawal, "These Scientists Sent a Rocket to Mars for less than it cost to make 'the Martian," *Wired*, March 17, 2017,. https://www.wired.com/2017/03/these-scientists-sent-a-rocket-to-mars-for-less-than-it-cost-to-make-the-martian/ (accessed March 10, 2020); Sanjay Kumar, "India Joins Elite MARS Club," *NATURE*, September 24, 2014, *https://www.nature.com/news/india-joins-elite-mars-club-1.15997* (accessed September 17, 2019).
[56] Jason Davis, "Chandrayaan-2 Enters Lunar Orbit," *The Planetary Society*, August 20, 2019, *http://www.planetary.org/blogs/jason-davis/chandrayaan-2-successful-loi.html* (accessed March 9, 2020).
[57] Press Trust of India, "Gaganyaan, India's first manned mission, set to be a reality by 2022," Live Mint, August 15, 2018,. https://www.livemint.com/Politics/glFe56EP0V2EkF25mQshXO/Narendra-Modi-announces-Gaganyaan-in-Independence-Day-speech.html (accessed June 13, 2019).
[58] "Star City adventure: Take a sneak peek into India's first space crew training in Russia," Russia Today, February 17, 2020, https://www.rt.com/news/480892-india-first-space-crew-russia/ (accessed February 18, 2020).
[59] Government of India, Department of Space, Indian Space Research Organisation, "Vision and Mission Statements,". https://www.isro.gov.in/about-isro/vision-and-mission-statements (accessed March 10, 2020).
[60] EO Portal Directory, "RISAT-2 (Radar Imaging Satellite-2)." https://earth.esa.int/web/eoportal/satellite-missions/r/risat-2 (accessed June 12, 2020).
[61] Rajat Pandit, "India's first military satellite successfully launched," *Times of India*, August 30, 2013. https://timesofindia.indiatimes.com/india/Indias-first-military-satellite-successfully-launched/articleshow/22168268.cms; (accessed June 12, 2020).

Indian Constellation), which is part of global navigation satellite system (GNSS) and has been identified as an 'allied system' by the 2020 US National Defense Authorization Act (NDAA) under section 1601, subtitled, Space Activities.[62] In March 2019, India launched its *Mission Shakti* ASAT test against its own target satellite Microsat-R.[63] The ASAT test demonstrated India's capability to hit adversary objects (interdict and intercept) in space. The test was described by the Indian Prime Minister Narendra Modi as a deterrent asset against attack on India's space infrastructure.[64] In a tweet on March 27, 2019, the Prime Minister stated, "#MissionShakti is special for 2 reasons: (1) India is only the 4th country to acquire such a specialized & modern capacity. (2) Entire effort is indigenous. India stands tall as a space power! It will make India stronger, even more secure and will further peace and harmony."[65] Following the test, Prime Minister Modi directed National Security Adviser Ajit Doval to work on a space power doctrin and to set up the contours of a Defense Space Agency and a Defense Space Research Organisation.

Commercial Space

As in China, India's commercial space sector has taken off, with companies like Bellatrix[66] working on rocket propulsion, R-beam working on wireless transmission, Blue Sky Analytics[67] working on space-based Intelligence, Surveillance and Reconnaissance (ISR) for pollution monitoring, Dhruva Space[68] building small SATS, Satsure[69] mapping supply chain infrastructure, and TeamIndus[70] focusing on building spacecraft and lunar landers. Another company, Exseed Space, is the first private Indian space start-up to succeed in building and launching its own satellite

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[62] "National Defense Authorization Act for Fiscal Year 2020," Congress.gov. December 20, 2019. https://www.congress.gov/bill/116th-congress/senate-bill/1790 (accessed March 16, 2020)

[63] Loren Grush, "India Shows it Can Destroy Satellites in Space, Worrying Experts about Space Debris," *The Verge*, March 27, 2019. https://www.theverge.com/2019/3/27/18283730/india-anti-satellite-demonstration-asat-test-microsat-r-space-debris (accessed March 11, 2020)

[64] "India's A-SAT Not Against Any Country: PM Modi," *The Times of India*, March 27, 2019. https://timesofindia.indiatimes.com/india/pm-narendra-modi-address-to-nation-highlights/articleshow/68592668.cms (accessed on September 25, 2020).

[65] Narendra Modi @narendramodi, Twitter, March 27, 2019. https://twitter.com/narendramodi?ref_src=twsrc%5Etfw%7Ctwcamp%5Etweetembed%7Ctwterm%5E1110801488559759360%7Ctwgr%5Eshare_3&ref_url=https%3A%2F%2Ftimesofindia.indiatimes.com%2Findia%2Fpm-narendra-modi-address-to-nation-highlights%2Farticleshow%2F68592668.cms (accessed September 25, 2020).

[66] Bellatrix Aerospace Website. http://www.bellatrixaerospace.com/ (accessed June 14, 2019).

[67] Blue Sky Analytics Website. https://blueskyhq.in/about (accessed October 13, 2019).

[68] Dhruva Space Website. https://www.dhruvaspace.com/ (accessed February 18, 2020).

[69] Satsure Website. http://www.satsure.in/ (accessed June 14, 2019).

[70] TeamIndus Website. https://medium.com/teamindus (accessed June 14, 2019).

on a *SpaceX* Falcon 9 international commercial launch.[71] In light of this, the Indian Department of Space has established NewSpace India Limited (NSIL) – a state funded and controlled enterprise – to further commercialize and privatize India's space capacities.[72] It remains to be seen if, like China, India's new space companies are able to build their own space launch systems and develop reusability as a key feature.

The next section highlights trends in horizontal and vertical proliferation of space warfare capacities with plausible probes to include countries like Japan, Iran, Pakistan, the United States, Russia, and Australia.

Trends in Horizontal and Vertical Proliferation of Space Warfare Capabilities

Given the increase in space power projection capacities for Asian Great Powers, China and India, what can we anticipate in terms of horizontal and vertical proliferation in space warfare capacities? To clarify, the concepts of horizontal and vertical proliferation have been drawn from the literature on nuclear weapons proliferation and generalized into the literature on space weapons systems. "Horizontal" proliferation refers to nation-states or nonstate entities that do not have, but are acquiring, nuclear weapons or developing the capability and materials for producing them.[73] To extend this explanation to space weapons, horizontal proliferation would mean the acquisition of space capabilities by nation states and non-state entities that do not have them and that "are acquiring…or developing the capability and materials for producing them." "Vertical" proliferation refers to nation-states that possess nuclear weapons and are increasing their stockpiles of these weapons, improving the technical sophistication or reliability of their weapons, or

[71] Surendra Singh, & Srinivas Laxman, "India's first private satellite launched," *Times of India*, December 4, 2018. https://timesofindia.indiatimes.com/india/space-x-launches-indias-first-privately-built-satellite-exceedsat-1/articleshow/66937238.cms (accessed June 14, 2019).

[72] Press Information Bureau, Government of India, Department of Space, "New Space India Ltd," July 24, 2019. https://pib.gov.in/newsite/PrintRelease.aspx?relid=192201 (accessed March 9, 2020)
News18, "Sitharaman Launches New Space India Limited, ISRO's Commercial Arm to Market, Sell Products," July 5, 2019. https://www.news18.com/news/business/sitharaman-launches-new-space-india-limited-isros-commercial-arm-to-market-sell-products-2219263.html (accessed July 7, 2019)

[73]Victor W. Sidel, MD and Levy, "Proliferation of Nuclear Weapons: Opportunities for Control and Abolition," Am J Public Health. 2007 September; 97(9): 1589–1594.doi: 10.2105/AJPH.2006.100602; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1963312/ (accessed September 27, 2020).

developing new weapons."[74] By extension, space weapons-related vertical proliferation would mean proliferation of space weapons and additive missiles by nation-states that already possess space warfare capacities and are "increasing their stockpiles of these weapons, improving the technical sophistication or reliability of their weapons, or developing new weapons."[75]

Horizontal Proliferation of Space Warfare Capabilities in Asia

Is there an increase in horizontal proliferation of space warfare capacities in Asia? That is, are more nation states and non-state entities that do not have space capacities planning on acquiring these space capacities to include warfare capacities? Given the growing economic dependence of societies on space-based assets, it is more or less likely that states will be increasingly looking to harden their space assets and to create mechanisms of both deterrence and compellence if an adversary nation or entity threatens its space assets.

Japan, which has historically (1969) mandated its space assets for purely civilian purposes, is waking up to the defensive and military implications of space. In 2018, Japan's then Prime Minister, Shinzo Abe, highlighted the priority of space to modern military systems and the added requirement to develop Japan's military space capacities. Since 2008, under Japan's basic space law, the use of space for military purposes was allowed under strict guidance. Creating a robust Space Situational Awareness (SSA) in partnership with the United States, Australia, and Europe was highlighted as a critical need.[76] In April 2020, the Japanese Diet passed a bill that established the Space Domain Mission Unit (SDMU) within the Japan Air Self-Defense Force (JASDF). The SDMU is aimed to be fully functional by 2023. Yuka Koshino relates:

> In 2017, the JSDF began operating its first X-band communication satellite as part of the modernisation of its command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) infrastructure. In 2019, its naval ships began to use precision timing signals from Japan's Quasi-Zenith Satellite System (QZSS)—satellite

[74] Ibid.
[75] Ibid.
[76] Suzuki Kazuto, "Space: A New Battleground for Space," Nippon.com, December 5, 2018. https://www.nippon.com/en/in-depth/a06101/ (Accessed September 27, 2020).

navigation constellation—as a back-up for the US Global Positioning System. Japan is also developing a space-based ballistic-missile early-warning system.[77]

Japan is developing a ground-based deep space radar that can monitor satellites in Geostationary Orbit (GEO). With China testing its first Anti-Satellite (ASAT) weapon in 2007 and further improvement of such a capacity, Japan is now developing a SSA satellite with a fitted optical telescope that can carry out the dual activities of watching for space debris and conducting ASAT missions. Japan is also working on developing a satellite interceptor, primarily to counter satellite threats from China, with a final decision still pending as of the date of this writing. Japan's National Defense Guidelines of 2019 and Medium-Term Defense Program (2019-2023) highlight the importance of space for Japan's strategic thinking and deterrence capabilities. Japan's Self-Defence Forces (JSDF) are tasked with carrying forward the country's space capacities.[78] The linkage between ASATs and ballistic missiles underscores the ability of such systems for both offense and defense. Japan has its "own multi-tier defense system against ballistic missile attacks, by such means as installing ballistic missile defense capability to the Aegis-equipped destroyers and deploying the Patriot Advanced Capability-3 (PAC-3)."[79] Japan is building radars at a cost of $1 billion by Lockeed Martin, while at the same time focusing on developing an integrated air and missile defense (IAMD), and not limited to Aegis Ashore, two sites of which it cancelled in June 2020 due to costs.[80] Japan's sense of urgency is driven by geo-political factors, including tensions over the disputed islands in the East China Sea. Japan's 2019 White paper on defense identified China as a threat for the first time, based on China's fast military modernization.[81]

Japan is a maritime nation that has approximately 6,800 remote islands as part of its territory and the sixth largest territorial waters/exclusive economic zone (EEZ). In order to respond to various contingencies in the seas and airspace around Japan promptly and seamlessly, the MOD/SDF

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[77] Yuka Koshino, "Japan's new Space Domain Mission Unit and security in the Indo-Pacific region," IISS, May 1, 2020. https://www.iiss.org/blogs/military-balance/2020/05/japan-space-domain-mission-unit-security (Accessed September 27, 2020).

[78] Daniel Darling, "Japanese Government Consider Launching a Satellite Interceptor," Defense & Security Monitor, August 26, 2019, https://dsm.forecastinternational.com/wordpress/2019/08/26/japanese-government-considers-launching-a-satellite-interceptor/ (accessed September 27, 2020).

[79] Ibid.

[80] Tim Kelly, "Exclusive: Japan may still build Aegis Ashore despite reports of cancellation, sources say" Reuters, July 10, 2020, https://www.reuters.com/article/us-japan-defence-aegis-exclusive/exclusive-japan-may-still-build-aegis-ashore-despite-reports-of-cancellation-source-says-idUSKBN24B0W4 (accessed July 26, 2021).

[81] Ibid.

vessels and aircraft habitually engage in warning and surveillance activities. Particularly in the East China Sea, there have been an increasing number of cases in which foreign vessels conduct activities by unilaterally asserting the rights of their country based on claims that are incompatible with the existing order of international law. Thus, the necessity for constant and continuous monitoring and surveillance by destroyers and other vessels is increasing.[82]

Consequently, interceptor missiles like the SM-3 are under development in collaboration with the United States as a new feature of Japan's Ballistic Missile Defense (BMD) system.[83] This is being built with the DPRK's missile capabilities in mind. Of note, Japan has an advanced space program with independent space launch capacities spearheaded by the Japan Aerospace Exploration Agency (JAXA).[84]

The Democratic People's Republic of Korea (DPRK) is another country to watch for the horizontal proliferation of space capable weapons systems. While the DPRK has not yet demonstrated anti-satellite capabilities, it has developed jamming capacities within a particular geographic area. That said, ballistic missiles can evolve into a counter space capacity, so missile developments need to be closely monitored. In 2017, DPRK tested its first intercontinental ballistic missiles (ICBM), Hwasong 14 (8, 500 -13, 000 km and the Hwasong 15 (13, 000 km). More critically, these ICBMs were developed by its space launch program, Unha (Taepo-Dong 2). Some of the other DPRK operational missiles are the Pukguksong-3 (KN-26)-1900 km-Submarine Launch Ballistic Missiles (SLBM), Pukguksong-2 (KN-15)-1, 200-2,000 km Medium Range Ballistic Missile (MRBM), No-Dong, MRBM-1, 200 km-1, 500 km, and Taepodong-2 (SLV)-4,000 km-10, 000 km.[85] In 2016, the DPRK claimed that it had successfully put an Earth observation satellite, *Kwangmyongsong-4*, into orbit with a lift off from the Sohae launch facility in western DPRK.[86] In July 2019, the DPRK also demonstrated a "newly-developed large-caliber

[82] Ministry of Defense, Japan, "Effective Deterrence and Response," 2017. https://www.mod.go.jp/e/publ/w_paper/pdf/2017/DOJ2017_3-1-2_web.pdf (accessed September 28, 2020).
[83] Ibid.
[84] "Japan Aerospace Exploration Agency", https://global.jaxa.jp/ (accessed September 27, 2020).
[85] "Missiles of North Korea," CSIS Missile Defense Project, https://missilethreat.csis.org/country/dprk/ (accessed September 27, 2020).
[86] Mike Wall, "North Korea Launches Satellite into Space," Space.com, February 08, 2016, https://www.space.com/31860-north-korea-satellite-launch.html (accessed September 27, 2020).

multiple launch guided rocket system," with a range of about 250 km.[87] All these developments point to horizontal proliferation with potential for space weapons systems.

Iran has been attempting to launch its satellite into space for some time now. In February 2020, it failed to launch its Zafar 1 communications satellite into orbit. On April 22, 2020, the Aerospace Forces of the Islamic Revolutionary Guards Corps (IRGC) successfully launched its first military satellite, *Noor* (light) into LEO, on its rocket *Qased* (messenger), from the secretive Guard Base near Shahroud, 400 km from Tehran. General Hossein Salami, the Head of the IRGC stated, "today, the world's powerful armies do not have a comprehensive defense plan without being in space, and achieving this superior technology that takes us into space and expands the realm of our abilities is a strategic achievement."[88] The IRGC claimed the satellite reached an orbit of 425 km above Earth. Again, this can be directly linked to space launch and counter-space capacities. Iran has a ballistic missile program, with the Shabab-3, having a range of 1,000-1,300 km. According to Steven Hildreth:

> Longer range versions of the Shahab-3, variously referred to as Shahab-3 variants, the Shahab-3A, Shahab-3B, and Shahab-4, and a BM-25, may have range capabilities of 1,500-2,500 kilometers. These missiles potentially could reach targets throughout the Middle East, Turkey, and into southeastern Europe. Some have reported that perhaps several dozen or more of these missile types may be deployed and operational. Some Chinese, DPRK, or Russian involvement is suspected. In 2006, Iran announced the successful test of a Fajr-3 MRBM comparable to the Shahab-3, although US and Israeli intelligence analysts reportedly expressed skepticism.[89]

The Shahab-3-MRBM-1, 300 km, Ghadr-1-MRBM-1, 950 km, Soumar-cruise missile-2,000 km-3,000 km, and Sejill-MRBM-2,000 km are some of the operational missiles.[90] There are reports that Iran may also possess Short Range Ballistic Missiles (SRBMs)-ranges less than 1000 km

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[87] Vann H Van Diepen, "North Korea Unveils New "Multiple Launch Guided Rocket System," August 6, 2019, https://www.38north.org/2019/08/vvandiepen080619/ (accessed September 27, 2020).
[88] Amir Vahdat and Jon Gambrell, " Iran Guard Reveals Secret Space Program in satellite launch," Associated Press, April 22, 2020, https://apnews.com/article/0b45baa8a846f55e058e98905e290ce5 (accessed September 27, 2020).
[89] Steven A. Hildreth, "Iran's Ballistic Missile Program: An Overview", Congressional Research Service, February 4, 2009. https://fas.org/sgp/crs/nuke/RS22758.pdf (accessed September 27, 2020), p.3.
[90] "Missiles of Iran," CSIS Missile Defense Project. https://missilethreat.csis.org/country/iran/ (Accessed September 27, 2020).

developed with the help of China, DPRK, and Russia.[91] Iran is also known to have passed on missiles to non-state entities like Hezbollah and Yemen's Houthi rebels.[92] Waller says that:

> The type of ballistic missile technology used to launch this satellite could deliver nuclear, chemical, or even biological weapons to "wipe Israel off the map," attack US bases and allies in the region, and even US and NATO installations as far away as Western Europe. One particular concern about Iran having nuclear weapons and long-range ballistic missiles is the fact that it creates a deterrent umbrella under which the jihadist regime *would have a free hand to continue and even escalate their sponsorship and directsupport for terrorism around the world* [emphasis added]. Countries with such deterrent are less concerned about punitive or retaliatory strikes because of that capability.[93]

Australia is another country in the Asia-Pacific that has recently established a space program. The Australian Space Agency is focused on securing satellite communications, weather forecasting, and now has a roadmap till 2028 on securing Australian space assets.[94] Australian strategic thinker, Malcolm Davies, urges Australia to establish its own space command. Davies argues:

> Ideally, we need to reorganise Defence in a manner that recognises that space is an operational domain in its own right, just like air, sea, land and cyber. It's not merely an enabling adjunct…Does that mean Australia needs its own space force? Certainly, the ADF [Australian Defense Forces] needs a 'space command' within the RAAF in which space operations, doctrine and capability development are managed by a cadre of space professionals. Defence also needs an unclassified space strategy that informs those

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[91] Hildreth, n. 89 p.4

[92] Jonathan Saul, Parisa Hafezi, Michael Georgy, "Exclusive: Iran Steps up Support for Houthis in Yemen's War: Sources," *Reuters*, March 21, 2017. https://www.reuters.com/article/us-yemen-iran-houthis/exclusive-iran-steps-up-support-for-houthis-in-yemens-war-sources-idUSKBN16S22R (accessed September 27, 2020).

[93] Tommy Waller, "Did Iran just demonstrate they can take down the United States?", SecurityGrid, no date (n.d). https://securethegrid.com/did-iran-just-demonstrate-they-can-take-down-the-united-states/ (accessed September 28, 2020). Also see Peter Vincent Fry, "Nuclear EMP Attack Scenarios and Combined-Arms Cyber-Warfare," Report to The Commission to Assess The Threat To The United States From Electromagnetic Pulse (Emp) Attack, July 2017. http://www.firstempcommission.org/uploads/1/1/9/5/119571849/nuclear_emp_attack_scenarios_and_combined-arms_cyber_warfare_by_peter_pry_july_2017.pdf (accessed September 28, 2020).

[94] "Australian Space Agency," https://www.industry.gov.au/strategies-for-the-future/australian-space-agency (accessed September 27, 2020).

> functions in an accountable way. These would be good steps to formally embrace in the next defence white paper.[95]

Already ADF joint doctrine recognizes the critical importance of space, especially as a 'center of gravity' in information-based military systems. Given the expansion of China and Russia's counter-space capabilities, and Australia's dependence on space for reconnaissance, command and control, navigation, and precision guidance, analysts are urging Canberra to develop its own counter space capabilities..[96]

Pakistan is another country to watch with regard to horizontal proliferation. Pakistan is a nuclear weapons state with advanced missile capacity. Pakistan's Space & Upper Atmosphere Research Committee (SUPARCO) launched its first sounding rocket, Rehbar-1, in 1961. Badr-1 and Badr-B, two experimental satellites were launched in 1990 and 2001.[97] Given its rivalry with a Great Space Power like India, Pakistan is likely to utilize its relationship with China to develop its space capacity, as it has in its nuclear weapons program.[98] Given the connections between space capabilities and a country's missile development, some of Pakistan's missiles to watch are the Shaheen -3-MRBM of 2, 750 km range, Haft 6 (Shaheen) 2-MRBM-of 1,500-2,000 km range, and Haft 5 Ghauri-MRBM of1,250-1,500 km range.[99]

As a thought experiment, the following trajectories can be noted with regard to horizontal escalation in space:

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[95] Max Blenkin, "ADF Urged to Establish Aussie Space Command," SpaceConnect, January 30, 2020. https://www.spaceconnectonline.com.au/operations/4107-calls-for-adf-to-establish-space-command-to-manage-aussie-space-operations (accessed September 27, 2020).

[96] Malcolm Davies, "The Australian Defense Force and Contested Space," The Strategist, August 15, 2019. https://www.aspistrategist.org.au/the-australian-defence-force-and-contested-space/ (accessed September 27, 2020).

[97] "Pakistan's Space Programme," http://www.suparco.gov.pk/downloadables/03-Pakistans-Space-Programme.pdf (accessed September 27, 2020).

[98] Ali Ahsan & Ahmad Khan, "Pakistan's Journey into Space," *Astropolitics*, 17/1 (February 2019): 38-50. https://www.tandfonline.com/doi/abs/10.1080/14777622.2019.1578933?src=recsys&journalCode=fast20 (accessed September 27, 2020).

[99] "Missiles of Pakistan', CSIS Missile Defense Project, https://missilethreat.csis.org/country/pakistan/ (accessed September 27, 2020).

1. In warfare: Country A attacks Country B's aircraft carrier; Country A funds unconventional war in Country B; Country A attacks Country B's satellites—Country B attacks Country A's launch facilities.
2. In an arms race: Country A acquires hypersonic missiles; Country B acquires a space-based missile defense system.
3. In a crisis: Country A blockades Country B's port—Country B blockades Country B's Moon base.

Vertical Proliferation of Space Warfare Capabilities in Asia

"Vertical" proliferation refers to nation-states that do possess nuclear weapons and are increasing their stockpiles of these weapons, improving the technical sophistication or reliability of their weapons, or developing new weapons. By extension to space weapons proliferation, this would mean proliferation of space weapons, and missiles, by nation states that do possess space warfare capacities and are "increasing their stockpiles of these weapons, improving the technical sophistication or reliability of their weapons, or developing new weapons."[100]

China

China**,** as mentioned before, is acquiring new military space capabilities and improving its existing capacities. More importantly, China's military space capacities are directed by its civil-military fusion strategy. This space capacity is augmented by the establishment of the PLASSF, which is a theatre command-level enterprise. The PLA is also in control of China's space program. China's 2019 defense white paper described space as a "critical domain in international strategic competition" and stated the security of space provided strategic assurance to the country's national and social development.[101] Space forms an integral part of China's comprehensive national power and military strategy. Securing China's outer space assets is a key priority. While the aim is to bring informational warfare capacities together, President Xi Jinping has urged the PLASSF to

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[100] Victor W. Sidel, MD and Levy, "Proliferation of Nuclear Weapons: Opportunities for Control and Abolition," n.73.

[101] "China National Defense in a New Era," 2019 White paper on Defense, http://www.xinhuanet.com/english/2019-07/24/c_138253389.htm (accessed September 28, 2020).

prepare a doctrine for a future that sees China dominating the cislunar space[102] and beyond. Prioritizing the network-centric warfare approach, China is committed to developing its ASAT capacities in LEO and GEO.[103] Key bodies are the Space Systems Department, which is in charge of PLA space operations, from launch, surveillance, and missile tracking, to space warfare doctrine and concepts. The space capacities that China is developing for countering adversaries are kinetic kill, direct ascent, co-orbital inspection satellites, electronic warfare (satellite jammers), ground based lasers, space robotic capacities including a robotic arm, and reconnaissance and surveillance—all of which will help create space access for itself and deny access to adversaries in times of conflict. As stated earlier, the PLASSF is training with ASAT capabilities, and China's missile systems create added value. The SC-19, which is modeled on the DF-21C ballistic missile, is China's primary ASAT weapon, with a range of 2150 -2, 500 km.[104] Besides, China possesses the DF-26 IRBM, a land-attack and anti-ship missile, the DF-21A and DF 21E (nuclear tipped), and is predicted to possess 375 MRBM/IRBM missiles by 2025, up from 250 in 2020.[105] Most critically, about 75 of those missiles will be equipped with 'hypersonics,' especially the DF-17.[106] China has also increased their nuclear warheads, from 290 (2019) to 320 (2020).[107] From these developments, it is clear that China is increasing its stockpile and refining its military space capacities.

India

As mentioned earlier, India has invested in developing its military space capacities to include an ASAT test in March 2019, establishing a Defense Space Agency ,and calling for the establishment

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[102] Cislunar is the volume of space contained between the Earth's surface and the Moon's orbit.
[103] Office of the Secretary of Defense, "Military and Security Developments Involving the People's Republic of China," Annual Report to Congress, 2020, p.65. (accessed September 27,2020). https://media.defense.gov/2020/Sep/01/2002488689/-1/-1/1/2020-DOD-CHINA-MILITARY-POWER-REPORT-FINAL.PDF
[104] "SC 19 Anti-Ballistic Missile Interceptor," Global security.org. https://www.globalsecurity.org/space/world/china/sc-19-abm.htm (accessed September 27, 2020).
[105] Hans M. Kristensen, "The (Other) Red Storm Risings: INDOPACOM China Military Projection," Federation of American Scientists, September 15, 2020 (accessed September 27, 2020). https://fas.org/blogs/security/2020/09/pacom-china-military-projection/
[106] Hans M. Kristensen, "The (Other) Red Storm Risings: INDOPACOM China Military Projection," Federation of American Scientists, September 15, 2020 (accessed September 27, 2020). https://fas.org/blogs/security/2020/09/pacom-china-military-projection/
[107] "Nuclear Weapon Modernization Continues but the outlook for arms control is bleak," SIPRI, June 15, 2020. https://www.sipri.org/media/press-release/2020/nuclear-weapon-modernization-continues-outlook-arms-control-bleak-new-sipri-yearbook-out-now (accessed September 27, 2020).

of a Defense Space Research Organization aimed at developing counter space and counter value (attacking critical infrastructure) capacities. In June 2019 and September 2020, India conducted hypersonic tests with the launch of its hypersonic technology demonstrator vehicle (HSTDV), which reached a speed of Mach 6 (2 km per second). The HSTDV was launched on the Agni missile solid proponent rocket motor. The 2020 test utilized an indigenously built scramjet engine. The next step would be to develop long range hypersonic cruise missiles. The Brahmos supersonic cruise missile (which is being developed with Russian assistance) reaches a speed of 2.8 Mach with a range of 400 km.[108] India has 150 nuclear warheads (2020 estimate). It has an array of missiles, including the Prithvi II and Agni I- surface-to-air Short Range Ballistic Missiles (SRBM) with a range of 350-700 km.[109] The Agni III is an IRBM with a range of 3,000 km to 5000 km. The Agni V is an Intercontinental Ballistic Missile (ICBM) with a range of 5,500 km. The Dhanush submarine launch ballistic missile (SLBM) has a range of 300 km. The K-15 (Sagarika or B-05) was deployed in 2017 and has a range of 700 km.[110] India has launched an indigenously built long-range cruise missile, Nirbhay, a nuclear-capable, solid fuel missile that can reportedly reach top speeds of 0.6-0.7 Mach and can strike land targets at a distance of up to 1,000 kilometers. According to reports, it can be launched from multiple platforms, has loitering capability, and the first test of the air-launched variant is expected to take place in 2021.[111]

Some of the trajectories based on insights from the section above on vertical escalation could be as follows:

1. In warfare: Country A kills Country B’s PNT satellite; Country B kills two of Country A’s PNT satellites.

2. In an arms race: Country A acquires 1 ASAT, Country B acquires 5 ASATS.

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[108] Rajat Pandit, “India Successfully Tests Scramjet technology for Hypersonic Missiles,” *The Times of India*, September 8, 2020. https://timesofindia.indiatimes.com/india/india-successfully-test-scramjet-technology-for-hypersonic-missiles/articleshow/77973889.cms (accessed September 27, 2020).
[109] “Prithvi,” Federation of American Scientists. https://fas.org/nuke/guide/india/missile/prithvi.htm (accessed September 27, 2020).
[110] India Missile, November 2019. https://www.nti.org/learn/countries/india/delivery-systems/ (accessed September 27, 2020).
[111] Franz-Stefan Gady, “India Test Fires Nuclear-Capable Nirbhay Cruise Missile,” *The Diplomat*, April 15, 2019. https://thediplomat.com/2019/04/india-test-fires-nuclear-capable-nirbhay-cruise-missile/ (accessed September 27, 2020).

3. In a crisis: Country A puts its space forces on alert, Country B puts its space forces on alert.

Linked Conflict Systems; Linked Security Dilemmas

Proliferation and escalation in Asia are characterized by linked conflict systems and linked security dilemmas[112] between pre-existing competing dyads: China-Japan, China-India, Japan-South Korea, DPRK-South Korea, and India-Pakistan.

China seeks to secure itself from a US military intervention by acquiring an ASAT capability and a Strategic Support Force. India and Japan feel threatened by China's capabilities. In response, India develops an ASAT and defense space organization. Japan follows its ally, the United States, and begins developing a dedicated defense space organization and counter-space capabilities.

Similarly, because US conventional forces pose an existential threat to the DPRK and Iranian regimes, these regimes have strong incentives to develop missiles,[113] ASATs, and single-strike catastrophic deterrents such as High-Altitude Electro-Magnetic Pulse (HEMP) and High-Altitude Nuclear Detonation weapons.[114]

Because conflict systems are linked, we can expect horizontal proliferation specifically where competition is pre-existing in dyads.[115] Japan's counterspace capabilities will encourage development of counter-space capabilities by the DPRK. Already incentivized to create an ASAT to deter the United States, the DPRKwill accelerate to keep pace with any South Korean counter

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[112] Herbert Butterfield "The greatest war in history can be produced without the intervention of any great criminals who might be out to do deliberate harm in the world. It could be produced between two powers, both of which were desperately anxious to avoid a conflict of any sort." As quoted in Shiping Tang, "The Security Dilemma: A Conceptual Analysis," *Security Studies*, 18:3, 587-623. DOI: 10.1080/09636410903133050. (accessed September 28, 2020).

[113] Nuno P. Monteiro, "Unrest Assured Why Unipolarity is Not Peaceful," *International Security*, Vol. 36, No. 3 (Winter 2011/12), pp. 9–40. https://www.mitpressjournals.org/doi/pdf/10.1162/ISEC_a_00064 (accessed September 28, 2020).

[114] Clay Wilson, "High Altitude Electromagnetic Pulse (HEMP) and High Power Microwave (HPM) Devices: Threat Assessments," Congressional Research Service, Report for Congress, March 26, 2008. https://www.wired.com/images_blogs/dangerroom/files/Ebomb.pdf (accessed July 26, 2021).

[115] Daniel S. Geller, "Power Differentials and War in Rival Dyads," *International Studies Quarterly,* 37/2 (June 1993), pp. 173-193.

space developments. Pakistan, seeking parity and deterrence with India, and contesting leadership in the Islamic world, has incentives to develop ASAT capabilities.[116]

One could imagine initiation and escalation to space conflict in virtually any of the dyads. The DPRK and South Korea, both with relatively fewer satellites, might jam each other's satellites in a period of hostility, and one of them might take the step of escalating with a kinetic ASAT attack.[117] Similarly, a China-Japan skirmish over the Senkaku/Diaoyu islands could involve jamming or lasing each other's reconnaissance or communications satellites, or might result in dangerous practices of close approaches of co-orbital inspection satellites.

Were the DPRK to be suspected of orbiting a HEMP satellite, we could imagine Japan feeling forced to shoot it down or to attack it co-orbitally, as that might pose an existential threat to Japan.

Tensions between Pakistan and India would likely result in jamming, dazzling, or lasing of each other's reconnaissance and communication satellites with escalation incentivizing ever greater demonstrations of resolve, potentially including a limited kinetic exchange. The lead-up to such an event might see China siding with Pakistan and conducting close inspections of India's satellites to encourage a sense of vulnerability to a two-front war.[118] Alternately, India's fears of a two-front war with China over its eastern and western disputed borders could cause a heightened sense of alert, sending indications and warnings to China that India was postured for a pre-emptive strike in space, encouraging China to make similar moves.

Finally, Japan and South Korea are likely to participate in the US Artemis program, and thereby have national assets on or in the vicinity of the Moon. At some point India will also have a space station and likely operations on the Moon. China is likely to be able to project power over cislunar distances, and its history of imposing pressure on the geographic periphery suggests that China might hold these targets at risk directly or through plausibly-deniable grey forces to express

[116] Asad Hashim, "Pakistan Expresses 'Grave Concern' Over Indian Space Weapon Test," *Al Jazeera*, April 3, 2019. https://www.aljazeera.com/news/2019/04/03/pakistan-expresses-grave-concern-over-indian-space-weapons-test/?gb=true (accessed September 28, 2020).
[117] Peter Pry, "How one North Korean Nuclear- Armed Satellite Could Cripple the US Military," *The Hill*, December 5, 2017. https://thehill.com/opinion/national-security/363326-how-one-north-korean-nuclear-armed-satellite-could-cripple-the-us (accessed July 26, 2021).
[118] Ananya Das, "China carried out multiple attacks against Indian satellites: Report," *Zee News*, September 23, 2020. https://zeenews.india.com/india/china-carried-out-multiple-attacks-against-indian-satellites-report-2311905.html

displeasure, or to expose vulnerability, as happens with the harassment by fishing and coast-guard vessels.

Legal Implications and Concluding Thoughts

This section highlights some of the legal implications of horizontal and vertical space proliferation and offers some concluding thoughts. The foremost document that lays out the legal parameters for state behavior in outer space is the "Treaty On Principles Governing The Activities Of States In The Exploration And Use Of Outer Space, Including The Moon And Other Celestial Bodies," commonly referred to as the Outer Space Treaty (OST) signed in 1967. OST Article III stipulates that "States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding."[119]

More specifically, Article IV of the OST states:

> States Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.
>
> The moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the moon and other celestial bodies shall also not be prohibited.[120]

[119] Resolution adopted by the General Assembly 2222 (XXI). Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies. https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/outerspacetreaty.html (Accessed September 28, 2020).
[120] Ibid.

The OST in Article VII holds states liable for damages caused:

> Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air or in outer space, including the moon and other celestial bodies.[121]

The 1972 Convention on International Liability for Damage Caused by Space Objects builds upon OST Article VII specifying that "a launching State shall be absolutely liable to pay compensation for damage caused by its space objects on the surface of the Earth or to aircraft, and liable for damage due to its faults in space. The Convention also provides for procedures for the settlement of claims for damages."[122] There are other international mechanisms that limit and constrain the usage of nuclear weapons in space and/or transfer of missile technology. These are "Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water" signed between the US and the erstwhile U.S.S.R in 1963.[123] The Comprehensive Test Ban Treaty (CTBT)[124] signed by the US and China but not ratified by either (Russia has ratified it) and the Missile Technology Control Regime (MTCR).[125] There is also a stipulation of noninterference with national technical means (i.e. reconnaissance and commercial satellites).[126]

That said, if we are to tackle the challenges of horizontal and vertical proliferation of military space capacities, especially keeping in mind the escalation scenarios outlined above, how would these

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[121] Ibid

122 United Nations Office for Outer Space Affairs (UNOOSA), "Convention on International Liability for Damage Caused by Space Objects," https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introliability-convention.html (accessed September 28, 2020).

[123] U.S. Department of State, "Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water", 1963. https://2009-2017.state.gov/t/avc/trty/199116.htm (accessed September 28, 2020).

[124] United Nations Office for Disarmament Affairs, "Comprehensive Nuclear Test Ban Treaty," https://www.un.org/disarmament/wmd/nuclear/ctbt/ (accessed September 28, 2020).

[125] Missile Technology Control Regime, https://mtcr.info/ (accessed September 28, 2020).

[126] Sarah M. Mountin, "The Legality and Implications of Intentional Interference with Commercial Communication Satellite Signals," U.S. Naval War College, 90, 2014. https://digital-commons.usnwc.edu/cgi/viewcontent.cgi?article=1013&context=ils (accessed September 28, 2020).

treaties/regime help deescalate the conflict? On one hand, treaty obligations can be cited. On the other hand, states face no consequences for creating debris (for example, caused by ASAT tests by China, the United States, Russia, or India), where national security of critical infrastructure trumps international obligations with no enforcement mechanisms in place. International U.N. backed sanctions against either China or Russia for ASATS and other space militarization acts will be vetoed by China and Russia, using their permanent member privilege in the U.N. Security Council. The space future that we need to anticipate besides orbital presence and support for terrestrial military forces is countries developing military power projection capacities beyond GEO to cislunar space and the Moon. This is a realistic scenario given the United States, China, Russia, and Japan are aspiring to establish human presence on the lunar surface by 2040. This changes the dynamic of space. Already, the PLA SSF leadership highlights the significance of the Earth-Moon space for China's national rejuvenation. The United States has identified the Moon and extraction of resources as a vision. Japan has plans to establish a lunar settlement by 2040. Russia announced plans to establish a lunar presence by 2040 as well.[127] China and Russia signed a Memorandum of Understanding (MoU) in March 2021 to jointly establish a lunar base.[128] Given these changes in space discourse from purely tactical to strategic, we need to factor such scenarios into our assumptions of status and space behavior by space faring nations in the Asia-Pacific.

[127] Namrata Goswami, "Moon Race, National Space Legislation and Executive Orders on Ownership of Lunar Resources: Is it Enough to Regulate the Domain of Space?", Medium, June 12, 2020. https://medium.com/@namygoswami/moon-race-national-space-legislation-and-executive-orders-on-ownership-of-lunar-resources-is-it-b120e5d6fe5 (Accessed September 28, 2020).

[128] "China, Russia Ink Accord on Building Scientific Research Station on Moon," Xinhua, March 09, 2021, http://www.xinhuanet.com/english/2021-03/09/c_139797869.htm (accessed July 26, 2021).

7. The Nuclear Fuel Cycle and Horizontal Proliferation in the Asia-Pacific Region

John Carlson

Introduction

Horizontal proliferation refers to the acquisition of nuclear weapons by states additional to those already possessing such weapons. Nuclear weapons cannot be produced without fissile materials, namely, highly enriched uranium (HEU) or separated plutonium. Producing these materials requires respectively uranium enrichment and reprocessing capabilities. The difficulty of developing these capabilities remains a major obstacle to nuclear proliferation.

Historically, states pursuing nuclear weapons have usually sought to develop enrichment or reprocessing facilities in secret. An alternative approach, however, is to establish these openly, as part of the civilian nuclear fuel cycle. Enrichment and reprocessing are described as sensitive nuclear technologies because they are potentially dual purpose: they were developed originally for military purposes and a state that acquires these capabilities for peaceful use could decide to turn them to producing nuclear weapons. A state with such capabilities is described as having nuclear latency. This is not to say that a state pursuing enrichment or reprocessing intends to produce nuclear weapons, but such a state presents the international community with a dilemma: how to ensure the spread of fuel cycle capabilities does not increase the risk of nuclear weapons proliferation. This paper discusses this problem with particular reference to the Asia-Pacific context.

Asia-Pacific Region

This paper adopts the delineation of the Asia-Pacific region used by APLN (the Asia-Pacific Leadership Network for Nuclear Non-Proliferation and Disarmament): the area comprising North

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Asia, South Asia, Southeast Asia, and the Southwest Pacific. This is an extensive and diverse geographic area. States in the region include:

- Two of the five nuclear-weapon states recognized by the Non-Proliferation Treaty (NPT)—China and Russia;
- Three of the four nuclear-armed states not parties to the NPT—India, Pakistan, and the DPRK.

The United States, while outside the region, is deeply engaged in the region, including through defence alliances with several states.

Reflecting the competing interests of these various states, the Asia-Pacific is notable for containing a number of areas of tension and conflict, actual and potential, between nuclear-armed states. In this regard critical interactions include those between India and Pakistan, India and China, the DPRK and the United States and US allies; and China and the United States. As will be discussed, strategic threats, instabilities, and uncertainties contribute to proliferation pressures—as demonstrated by the actions of India, Pakistan, and the DPRK in developing nuclear weapons and by public debate about doing so in Japan, the ROK, and elsewhere. The region thus figures prominently in global proliferation concerns.

What is Meant by Horizontal Proliferation?

In the nuclear context, *horizontal proliferation* refers to an increase in the number of states with nuclear weapons. In the mid-1960s when the NPT was negotiated it was feared that the number of states with nuclear weapons would increase substantially, from the five that existed at that time to possibly twenty-five to thirty by 1990. Horizontal proliferation is distinct from *vertical proliferation*, which refers to an increase in the number of nuclear weapons held by nuclear-armed states, exemplified by the arms race between the United States and the Soviet Union in the 1950s and 60s. Unless a contrary intention is indicated, *proliferation* is generally taken to mean horizontal proliferation.

Horizontal proliferation can be thought of as having three phases. The first phase, the pre-NPT period, lasted from 1945 to the conclusion of the NPT in 1968. In this period the United States' monopoly over nuclear weapons was broken first by the Soviet Union. Subsequently, the United

Kingdom, France, and China also acquired nuclear weapons. When the NPT was negotiated these five became the recognized *nuclear-weapon states*. Over this period many other states were actively considering acquiring nuclear weapons, a situation which prompted the negotiation of the NPT.

The second phase lasted from the conclusion of the NPT until the treaty's indefinite extension in 1995. Over this period the NPT's membership gradually expanded and by 1995 was close to universal. During this period, however, nuclear weapons were developed by India, Israel, and Pakistan. These states never joined the NPT and remain outside it. Also, during this period South Africa developed nuclear weapons, while outside the NPT. Subsequently South Africa dismantled its nuclear weapons—so far the only nuclear-armed state to do so—and joined the NPT in 1991.

Towards the end of this period, as the NPT drew closer to universality, the term *proliferation* acquired its contemporary meaning: the pursuit of nuclear weapons in violation of the NPT. The most familiar example is Iraq, which established a secret nuclear program. Because this program had no obvious links to its declared program, it eluded detection for many years. The International Atomic Energy Agency (IAEA) found Iraq was in non-compliance with its safeguards agreement in 1991. As a consequence, Iraq's actions also constituted a violation of the NPT. In addition to Iraq, the IAEA has found five other states in non-compliance with their NPT safeguards agreements, two during this period: Romania (1992) and the DPRK (1993). The DPRK is notable for being the only case of NPT violation where the state concerned has succeeded in acquiring nuclear weapons.

The current phase dates from 1995. The NPT is now almost universal, with only India, Israel, and Pakistan remaining outside, together with the DPRK, which withdrew from the treaty in 2003.[1] During this period the IAEA found three further states in safeguards non-compliance: Libya (2004), Iran (2006), and Syria (2011). All six safeguards non-compliance cases included development or acquisition of enrichment or reprocessing technologies in secret, in violation of safeguards agreements and the NPT.

[1] The validity of the DPRK's withdrawal from the NPT has not been definitively determined. The IAEA sought guidance from NPT parties on the legal status of the withdrawal but such guidance has not been forthcoming. See IAEA Fact Sheet on DPRK Nuclear Safeguards, https://www.iaea.org/newscenter/focus/dprk/fact-sheet-on-dprk-nuclear-safeguards.

In contrast to these non-compliance cases, preparation for nuclear weapons does not necessarily have to proceed in secret. In the 1970s there were a number of cases where the transfer of enrichment or reprocessing capabilities was sought openly, for ostensibly peaceful purposes. These included supply by France of reprocessing plants to the ROK, Pakistan, and Taiwan, and supply by Germany of a reprocessing plant to Taiwan and enrichment and reprocessing plants to Brazil. These transfers were discontinued due to international concerns about their potential proliferation.

India's 1974 nuclear test, using plutonium in violation of peaceful use assurances given to Canada and the United States, alerted governments to the dangers of misuse of supplied technology, and these various proposals for supply of sensitive facilities added to these concerns. The outcome was the establishment of the Nuclear Suppliers Group (NSG) in 1974. The objective of the NSG was to prevent nuclear proliferation by controlling the export of materials, equipment, and technology that can be used to produce nuclear weapons.

Finally, it is noted that the term *horizontal proliferation* could also apply to the acquisition of nuclear weapons by non-state actors. This involves a different range of issues to proliferation by states and is beyond the scope of this paper.

The Non-proliferation Regime and Proliferation-sensitive Technology

The Non-Proliferation Treaty, concluded in 1968, is the centrepiece of the non-proliferation regime. The NPT's key provisions are summarized as follows:

- The states that had conducted a nuclear test prior to 1967 were categorized as *nuclear-weapon states*. There are five such states: the United States, Russia, the United Kingdom, France, and China. The nuclear-weapon states commit not to assist others in acquiring nuclear weapons (Article I).
- All other parties are categorized as *non-nuclear-weapon states*. These states commit not to seek nuclear weapons and to accept IAEA safeguards on all their nuclear material to verify that nuclear energy is not diverted to producing nuclear weapons (Article III).

- The NPT is expressed not to affect the right of the parties to research, production, and use of nuclear energy for peaceful purposes provided this is in conformity with the treaty. The parties undertake to cooperate in the peaceful uses of nuclear energy (Article IV).
- All parties undertake to pursue nuclear and general disarmament (Article VI).

The NPT is complemented and reinforced by a number of other treaties, arrangements, and mechanisms, including:

- IAEA safeguards: These are of crucial importance as the verification mechanism for the NPT's non-proliferation provisions. The key objectives of IAEA safeguards are the *timely detection* of diversion of nuclear material from peaceful nuclear activities to nuclear weapons and *deterrence* of such diversion by the risk of early detection.
- Bilateral agreements, particularly nuclear cooperation agreements applying peaceful use and safeguards conditions. Notable in this regard are agreements that require the supplier party's prior consent to enrichment and reprocessing, or expressly exclude these activities.
- Regional treaties, such as the Euratom Treaty and the various nuclear weapon-free zone treaties.[2]
- National export controls on nuclear and nuclear-related materials, items, equipment, and technologies, especially as coordinated through the NSG.
- Convention on the Physical Protection of Nuclear Material.
- Comprehensive Nuclear-Test-Ban Treaty.

As noted earlier, the impetus for negotiating the NPT was the concern that the number of states having nuclear weapons would increase substantially unless something was done. While the United States and the then Soviet Union were particularly concerned about the potential spread of enrichment and reprocessing capability, the NPT does not refer to specific technologies. When the treaty was negotiated it was believed proliferation risk would be limited because only the nuclear-weapon states and a small number of other advanced industrialized states would have enrichment

[2] The Asia-Pacific region has three nuclear weapon-free zones: the South Pacific Nuclear-Free Zone, the Southeast Asia Nuclear Weapon-Free Zone, and the Mongolian Nuclear Weapon-Free Zone. Neighboring the region is the Central Asian Nuclear Weapon-Free Zone.

and reprocessing capabilities. It was envisaged that technology holders would provide fuel cycle services to other states, removing any need for these other states to establish such capabilities themselves.

With the benefit of hindsight, it can be seen that the problem of the spread of enrichment and reprocessing was not well anticipated in the drafting of the NPT. There are two aspects to this problem: the ability of further states to obtain these technologies was underestimated, and too much reliance was placed on the ability of IAEA safeguards to provide timely warning in the event of misuse of these technologies.

It is now known that during the NPT negotiations UK officials warned their US counterparts that centrifuge enrichment presented a serious risk to the NPT's objectives. Unfortunately, this warning was not heeded, and the language in the treaty draft was not amended to address the problem. This warning proved prescient, as there has been a gradual spread of proliferation capabilities, particularly centrifuge enrichment technology, accelerated by black market activities, notably involving the Pakistan-based AQ Khan network. The relative ease of concealing centrifuge plants, and the potential speed of break-out, mean that in certain diversion scenarios, discussed below, adequate warning time cannot be assured.

Reprocessing raises timeliness issues that can be even more acute. Where stocks of separated plutonium are held, there is a real possibility that if a state diverts plutonium and has made the necessary preparations in advance, it could fabricate the plutonium into nuclear weapons well before effective international intervention is possible.

Today, as shown in Table 1, in addition to the five nuclear-weapon states and the other four nuclear-armed states, there are at least six non-nuclear-weapon states currently operating enrichment plants, and one (Japan) with reprocessing capability.

Table 1: States with Demonstrated Enrichment and/or Reprocessing Capability (Past or Current)[3]

Nuclear-weapon states	**Non-NPT nuclear-armed states**	**Non-nuclear-weapon states**	
These states have both enrichment and reprocessing capabilities		**Enrichment capability**	**Reprocessing capability**
United States Russia United Kingdom France China	India Pakistan DPRK Israel	Argentina Brazil Germany Iran Japan Netherlands	Japan
		Australia *South Africa*	*Belgium* *Germany* *Italy*

Note: For the non-nuclear-weapon states shown in italics the enrichment and/or reprocessing activity is no longer current. In some cases, these activities were only small-scale.

Factors Relating to Proliferation Risk

Broadly speaking the possibility of a state deciding to pursue nuclear weapons will be influenced by three factors: capability, motivation, and the barriers and disincentives to proliferation.

It can be debated whether motivation or capability comes first. They may be closely related and their sequencing can differ from case to case. The typical image of proliferation—exemplified by Iraq—involves a state deciding to pursue nuclear weapons and then setting out to develop the necessary technical capabilities. In this case motivation precedes capability. When a state develops enrichment or reprocessing capabilities in secret, it is a clear sign of proliferation intent.

The situation is not so clear, however, when a state develops such capabilities openly under IAEA safeguards. The state may be deliberately establishing a nuclear weapon option—in this case motivation still precedes capability, but the state's intention is not obvious. On the other hand, the state at that time may be genuinely committed against acquiring nuclear weapons. The problem is, once the state has the relevant capabilities it thereby has a nuclear weapon option if circumstances

[3] Iraq is not included because at the time its enrichment program was terminated, its output was small.

change—what is unthinkable today might be considered a necessity tomorrow. In such a case capability could influence motivation.

Nuclear weapon capability

The capability to develop nuclear weapons can be broken down into a number of key elements:

1. Production of fissile material
2. Nuclear weaponization
3. Deployment of nuclear weapons

1. Production of fissile material: First and foremost a state considering pursuit of nuclear weapons requires the capability to produce fissile materials[4]—HEU or separated plutonium. This requires the state to have enrichment or reprocessing facilities. Accordingly, when a state without enrichment or reprocessing seeks to establish these capabilities it is inevitable there will be international questioning, if not concern, about the state's intentions. Export controls applied by members of the NSG discourage, but do not exclude, such projects.

Enrichment: In the case of uranium enrichment, no state planning to produce HEU is going to admit to this. Globally, production of HEU for civilian use has ceased (with some very limited exceptions), so any production of HEU would immediately attract international attention. Accordingly, a state developing enrichment capability would claim to be doing so solely for producing low enriched uranium (LEU) reactor fuel.[5] However, there is no inherent technical barrier to using any of the currently established enrichment technologies to produce HEU.

Centrifuge facilities in particular can be readily adapted for producing HEU. Time would be required to reconfigure a facility to produce HEU, thus providing some warning of the state's intentions. However, this warning time could be fairly short, a matter of weeks or even days. If the state has the capability to manufacture centrifuges it is more likely to establish clandestine facilities for high enrichment, thus avoiding the warning that would result if it was seen modifying declared facilities.

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[4] For safeguards purposes the IAEA uses the term *unirradiated direct-use material* instead of *fissile material*.
[5] LEU is typically in the range three to five percent U-235.

While LEU cannot be used directly in weapons, LEU can be used as feed for higher enrichment, substantially shortening the time to produce HEU.[6] Hence stockpiling of LEU in bulk form (especially enriched uranium hexafluoride–UF_6) may have a proliferation significance.

Reprocessing: In terms of proliferation risk, reprocessing is more problematic than enrichment because in normal operation the product of a reprocessing plant is weapon-usable material.[7] Further, in the normal operation of reprocessing plants it is usual to have substantial quantities of separated plutonium on hand, providing the opportunity for rapid diversion to weapon production. Considering that the IAEA's *significant quantity*[8] for plutonium is only 8 kilograms, a plutonium inventory of just one tonne—modest by industry standards—is sufficient for well over 100 weapons.

Other means of acquisition: While the focus here is on states' establishing the capability to *produce* fissile material, it should not be overlooked that fissile material may also be acquired by *international transfer*: either by legitimate imports, e.g., research reactor fuel; critical assembly fuel or MOX[9] fuel; or by illicit procurement, e.g., purchase on the black market or by theft or seizure. While generally the quantity of fissile material that could be imported is relatively limited, in the case of plutonium in the form of MOX the quantity could be sufficient for a small nuclear arsenal.

2. Nuclear weaponization: *Weaponization* is a shorthand term for the range of activities, additional to acquisition of fissile material, necessary to produce a nuclear weapon. These include nuclear weapon design and associated modelling and calculations, high-explosive lenses and

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[6] Almost ninety percent of the enrichment effort to produce weapon grade HEU (ninety percent U-235) is expended in reaching five percent U-235 (the upper end of typical LEU). To reach ninety percent enrichment, starting with five percent enriched LEU, requires much less enrichment effort compared with starting with natural uranium; in other words, this can be achieved with a much smaller plant.

7 With some reprocessing processes the output is a plutonium/uranium mix, rather than pure plutonium, but the plutonium is not difficult to separate. Historically the states with nuclear weapons produced low burn-up plutonium (predominantly comprising the isotope Pu-239) for this purpose, but in principle almost all plutonium is considered to be weapon-usable.

[8] The significant quantity (SQ) is the quantity for which the possibility of manufacturing a nuclear explosive device cannot be excluded.

[9] MOX comprises a mixture of uranium and plutonium oxides.

implosion testing, specialised high-energy electrical components, high-flux neutron generators, and design and testing of warhead re-entry vehicles.

In contrast to nuclear materials and facilities—where IAEA safeguards provide a well-established system for verifying peaceful use—in the case of other items and materials of possible application to nuclear weaponization it is much more difficult to monitor states' activities,[10] and many of these could be pursued in secret. Further, many of these activities, items, and materials are *dual-use*, that is, taken in isolation they do not necessarily indicate an intention to manufacture a nuclear weapon. Some, but not all, involve items on the NSG dual-use list.[11] The purpose of a single dual-use activity may be ambiguous, but a combination of such activities may more clearly indicate the existence of a nuclear weapon program.

In assessing the significance of apparent weaponization activities, an essential question is whether the state is known to have fissile material or the capability to produce it. This in itself, however, is not necessarily conclusive. It is possible that detection of weaponization activities may be the first indicator that a state already has an undeclared (and so far undetected) program to produce fissile material or may indicate that a state intends to divert safeguarded fissile material in the future.

3. Deployment of nuclear weapons: The principal capability issue here relates to nuclear-capable delivery systems. While in theory nuclear weapons could be delivered by unconventional means, e.g., truck, fishing boat, or shipping container, in reality these would be of interest only to terrorists. A state requires credible nuclear deterrence based on a delivery system that will perform reliably and has a high probability of avoiding interception. In view of the vulnerability of aircraft, ballistic missiles are the preferred delivery method. Hence, discovery that a state has a ballistic missile program will be a warning sign. Given the substantial costs and accuracy limits of ballistic missiles, development of such missiles may well indicate an intention to deploy highly destructive (i.e., nuclear) warheads.

[10] Prohibitions and monitoring arrangements for certain weaponization-related activities were included in the Iran JCPOA (Joint Comprehensive Plan of Action) as Section T of Annex I.
[11] IAEA, "Communication Received from the Permanent Mission of Kazakhstan to the International Atomic Energy Agency regarding Certain Member States' Guidelines for Transfers of Nuclear-related Dual-use Equipment, Materials, Software and Related Technology," Information Circular INFCIRC/254/Rev.11/Part 2a, 18 October 2019, https://www.iaea.org/sites/default/files/publications/documents/infcircs/1978/infcirc254r11p2.pdf

An indication of relevant capabilities is given by the *Guidelines for Sensitive Missile-Relevant Transfers* under the Missile Technology Control Regime, that is, missiles with a range exceeding 300 kilometers and a payload exceeding 500 kilograms. A state developing missiles exceeding these parameters is not necessarily seeking a nuclear capability (for example, it may say it is engaged in space research), but such development will be grounds for suspicion, especially where other indicators are present, such as apparent weaponization activities, safeguards violations, and so on.

Other aspects of nuclear weapon deployment include organization and training of specialist military forces, development and promulgation of nuclear doctrine concerning the use of nuclear weapons, and establishment of command and control systems for nuclear weapons.

Nuclear weaponization and nuclear delivery and other deployment matters are beyond the scope of this paper, but these can give rise to indicators and observables which could have implications relevant to the fuel cycle, for example, indicating that a state's interest in the fuel cycle may be dual-purpose.

Motivation to acquire nuclear weapons

Motivation is the result of a stimulus or incentive that influences a government to act in a certain way. There are several reasons why a government might decide to pursue nuclear weapons, including its perception of threats and the need for a military deterrent, the desire to exert influence over other states, and notions of prestige and national pride. While these are political sentiments, they can be given tangible form discernible to other governments and observers through statements made and actions taken.

The principal indicator for a state's motivation is its *strategic environment*. Relevant questions include:

- Whether the state is located in a *region of tension*;
- Whether it is, or believes itself to be, under military, economic, cultural, or religious threat;
- Whether it is involved in military or political confrontation with other states.

The clearest example of a region of tension is the Middle East, and it is no coincidence that of the six safeguards non-compliance cases that have occurred to date, four have involved states in or closely associated with the Middle East.[12] The Asia-Pacific region contains two areas that can be considered regions of tension: South Asia and North Asia, particularly the Korean Peninsula.

Motivation can be seen at play in the Korean Peninsula. First there is the action of the DPRK in developing nuclear weapons. The DPRK maintains it did this in response to threats by the United States—hostile statements, sanctions, military exercises, and the ongoing armistice (that is, the absence of a peace settlement) have all been contributing factors. In response to the DPRK's actions, many people in the ROK and Japan have argued for these states to acquire their own nuclear deterrent. This situation illustrates two points:

- Acquiring nuclear arms does not improve a state's security, especially if it motivates neighbors to do the same.
- Military alliances can be an important factor affecting motivation to pursue nuclear weapons. As long as the ROK and Japan have confidence in their alliances with the United States their motivation to pursue nuclear weapons will be reduced, and *vice versa*—if confidence in the alliance is lacking, an independent nuclear deterrent might seem more necessary.

Not only can alliances reduce the motivation to pursue nuclear weapons, oversight by the alliance partner (the United States) will reduce the opportunity to do so, as was seen in US interventions against proposed transfers of proliferation-sensitive nuclear technologies in the 1970s.

Barriers and disincentives to proliferation

Proliferation barriers can take two forms, technical or political (or institutional).

***Technical barriers*:** These could include design features in nuclear facilities that can reduce or even eliminate the risk of proliferation. In the case of uranium enrichment this does not seem practicable—there is no technical barrier to using any of the currently established enrichment technologies to produce HEU.

[12] Iraq, Iran, Libya and Syria.

Technical barriers may be possible at the back-end of the fuel cycle. Here the fundamental question is, is it essential to recycle plutonium? In the case of *thermal reactors* (such as light water reactors) plutonium recycle is not necessary from a technical standpoint and cannot be justified economically (discussed further below). Proliferation risk can be avoided simply by not reprocessing.[13]

Plutonium recycle is required only if fast breeder reactors (FBRs) become economically viable. Where plutonium recycle technologies are developed, proliferation resistance and safeguards by design should be built in. This principle has been adopted by the Generation IV International Forum.[14] Consistent with this approach, recycle technologies that do not produce plutonium in readily accessible form are preferred to reduce the risk of proliferation and also sub-national theft. Concepts include liquid fuelled reactors (such as molten salt fast reactors) with online reprocessing (where the reprocessing unit is connected to the reactor, unwanted materials are removed and the plutonium-bearing stream is recycled directly back to the reactor). Another is pyro-processing, currently the subject of a joint study by the United States and the ROK.[15]

With pyro-processing, plutonium is not fully separated but remains in a highly radioactive mix with uranium, actinides, and fission products. Proponents maintain the process cannot produce pure plutonium and is therefore proliferation-resistant. US experts dispute this, and proliferation-resistance is a major aspect of the US–ROK joint study. Even if pyro-processing does not fully separate plutonium, it could still have proliferation significance by making the task of the proliferator easier. This is because the product of pyro-processing represents a very substantial quantitative reduction (by a factor of ten to twenty-five) compared with spent fuel at the start of the process, allowing the proliferator to use a much smaller scale plutonium separation facility than would otherwise be required.

Political and institutional barriers and disincentives**:** These take several forms. Considering that all states that currently do not have nuclear weapons are non-nuclear-weapon states parties to the

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[13] J. Carlson, L. Spector, M. Pomper, *The Other Fissile Material: Strengthening National and International Plutonium Management Approaches*, CNS, December 2018, https://nonproliferation.org/wp-content/uploads/2018/12/op42-the-other-fissile-material.pdf

[14] The Generation IV International Forum, https://www.gen-4.org/gif/

[15] The US-ROK Joint Fuel Cycle Study is outlined at page 52 of the 2015 US-ROK nuclear cooperation agreement, https://irp.fas.org/news/2015/06/123rok.pdf

NPT, and the development of nuclear weapons by such a state would violate the NPT, the principal deterrent to a would-be proliferator is the probability of detection by IAEA safeguards and the likely consequences of detection. These include Security Council sanctions and the risk of intervention, including military action, by states that consider themselves threatened. The proliferating state will be gambling that it can maintain secrecy long enough that by the time it is discovered it is too late for other states to intervene. If the state succeeds in acquiring nuclear weapons, however, it faces international sanctions that are likely to have a profound impact on its economy, and it will become an international pariah.

With regard to disincentives, one would hope the state is capable of a rigorous analysis of the dangers of proliferating. A state with nuclear weapons becomes a nuclear target. It is at risk of nuclear war, whether by deliberate actions or by mistake, miscalculation, or unauthorized actions, either by its own forces or by an adversary. Far from guaranteeing its security, possession of nuclear weapons will be an ongoing source of danger.

From a longer-term perspective, all states, even those outside the NPT, benefit from an effective non-proliferation regime that minimizes the number of states with nuclear weapons. There is no doubt that the more states have nuclear weapons, the more likely they will be used. The risk for a proliferator is that its actions will motivate others to do the same—so the “advantage” of acquiring nuclear weapons will be temporary. In due course the state’s adversaries will also be nuclear-armed, so its security situation will be much worse than before.

Institutional barriers to proliferation include export controls that aim to prevent access to sensitive technologies, equipment, and materials. On the positive side, incentives to maintain good non-proliferation standing include access to nuclear energy technology, fuel, and cooperation, as well as wider economical and technical benefits.

More intrusive safeguards, monitoring, and transparency measures could be introduced for states that have enrichment or reprocessing programs, but in case of misuse there can be no absolute assurance of timely warning, or that effective intervention will be possible. The most effective institutional barrier is to avoid national enrichment and reprocessing programs. National programs can be obviated by multilateral arrangements, such as fuel supply guarantees and multilateral control of proliferation-sensitive facilities. These matters are discussed in section six of this paper.

Nuclear Latency and Nuclear Hedging

Considerations of nuclear capability and motivation come together in the case of a state that has nuclear latency. Nuclear latency refers to the situation where a state has established, under a peaceful nuclear program, dual-use capabilities that could be used to produce nuclear weapons. The concept of nuclear latency applies to those non-nuclear-weapon states that have current capabilities in enrichment or reprocessing (there are six such states, see Table 1). It might also apply to those states that had such capability in the past, depending on how quickly the capability could be re-established. In addition, the concept is relevant to states seeking to develop enrichment or reprocessing capabilities as part of their nuclear power programs.

Nuclear latency might be inadvertent, e.g., while a state with uranium enrichment and/or reprocessing capabilities thereby has the basic capability to produce fissile material for nuclear weapons, it may well have (at least in foreseeable circumstances) no intention of doing so. On the other hand, nuclear latency could also be deliberate—a state could establish enrichment or reprocessing capabilities with an eye to having an essential component for a nuclear weapon option should its strategic circumstances change at some future time.

If nuclear latency might be an unintended consequence of having certain technologies, nuclear hedging refers to a deliberate national strategy of establishing the option of acquiring nuclear weapons within a relatively short time frame. Compared with latency, nuclear hedging has a much shorter time horizon, ranging from several weeks to at most a few years. The shorter time frame reflects the level of preparation—hedging implies the state not only has fissile material production capacity but is also undertaking at least some weaponization activities and developing or acquiring nuclear-capable delivery systems.

Some of the indicators which could point to an interest in nuclear weapons were outlined above. However, some of these indicators will be difficult to detect—so an apparent absence of indicators is not necessarily reassuring—and even if detected, the purpose could be ambiguous. The only visible indicator that a state is hedging may well be that it is pursuing an enrichment or reprocessing program that lacks a technically and economically convincing rationale.

Energy security is a justification for fuel cycle capabilities. States that pursue enrichment and reprocessing commonly cite energy security or energy independence as a rationale. Looking first at uranium enrichment, this is technologically demanding and is strongly affected by economies of scale. The commercial enrichment market is dominated by a small number of suppliers, principally Russia and Urenco (Germany, Netherlands, and the United Kingdom). The United States and France were major suppliers but the technology they used (gaseous diffusion) became uncompetitive, and today they both use Urenco technology (centrifuges). As Table 1 shows, a handful of states have developed national enrichment programs, but the great majority of states with nuclear power programs buy enrichment services on the international market.

For some years the international market has been in substantial over-supply, and enrichment prices are very low. Global annual enrichment capacity is 66.7 million SWU[16] compared to global annual demand of 57.5 million SWU. Russia's capacity is 28.7 million SWU and Urenco's is 14.9 million SWU. For some time, it is likely that growth in global demand will be offset by increases in China's capacity (currently 10.7 million SWU). In these circumstances there is no convincing economic case for additional states to develop uranium enrichment capacity. Concerns about security of supply, if any, can be addressed by appropriate fuel supply assurances or by buying into an established operation.

Historically, security of supply has also been cited as a rationale for reprocessing. In the early years of the nuclear industry, it was thought that uranium was scarce and would become increasingly expensive. In response, the concept of fast breeder reactors (FBRs) was developed. FBRs would maximise production of energy from uranium through separation and recycle of plutonium. Doing this necessitates reprocessing. Plutonium was seen as a national energy resource: recycling would reduce dependence on imported uranium and enrichment services.

The historic rationales for reprocessing and use of plutonium fuels no longer apply. It is clear that plutonium fuels are not required to ensure the sustainability or reliability of nuclear energy. Uranium is abundant and low-cost. Reprocessing is vastly uneconomic for light water reactors, the

[16] SWU refers to Separative Work Units, a metric of isotopic separation capacity. Given in full the metric is SWU per year (SWU/yr), but in this paper it is abbreviated to "SWU" for convenience.

predominant type in use today: plutonium is more expensive than use even of very high-cost uranium (including extraction of uranium from seawater).

The high cost of reprocessing is reflected in the massive surplus of plutonium. As at the end of 2018 (the most recent figures available) civilian stockpiles of separated plutonium (349 tonnes) greatly exceeded the quantities of plutonium in military programs (220 tonnes). Although the international Guidelines for the Management of Plutonium highlight the importance of balancing plutonium supply and demand, lack of demand has prevented this. The lack of a use for plutonium has led to the United Kingdom closing its reprocessing operations.

Currently only Russia and India are actively pursuing development and deployment of FBRs. Japan and France have terminated their FBR programs. France's Atomic and Alternative Energies Commission (CEA) has announced that in the current energy market the industrial development of fourth-generation reactors is not planned before the second half of this century.

Most states with nuclear power programs have either decided to proceed with the once-through fuel cycle, where spent fuel will be disposed of as a waste material or have adopted a wait-and-see attitude. From a technical perspective, most spent fuel can be stored for many decades, so there is no pressing reason to commit in the near term to final disposal or to recycle.

With regard to energy security, the main challenge for nuclear power is not security of fuel supply but public and political confidence, which is most impacted upon by safety concerns. Rather than pursuit of complex nuclear technologies in the name of energy independence, energy security is best served by pursuing energy diversity and, in the nuclear sector, by a total commitment to safety in all aspects—design and construction, facility upgrades, and operations.

A problem of scale

The fundamental issue is that the fissile material production capacity required for a nuclear weapon program is very small compared with commercial-scale operations. Even a modest industrial capacity can provide a substantial weapon capability and a short breakout time.

In the case of uranium enrichment, the capacity required to produce sufficient LEU for the annual fuel requirements of just one typical light water reactor is around 110,000 SWU. A "small" commercial plant is two or three million SWU. The capacity required to produce sufficient HEU for one nuclear weapon in one year is only 5,000 SWU (or less than 1,000 SWU if using LEU feed).

In the case of reprocessing, a modern reprocessing plant can have an annual throughput of 800 tonnes of spent fuel, separating about 8 tonnes of plutonium (this is the scale of Japan's Rokkasho plant and the French plant proposed for China). An output of 8 tonnes of plutonium is 1,000 times the IAEA significant quantity figure of 8 kilograms.

Because it is difficult to tell what the state's intentions are, or to predict what they may be at some future time, from a non-proliferation perspective the fewer national enrichment and reprocessing programs there are the better, and vice versa, the more widespread these capabilities become, the greater the risk of proliferation, now or in the future. If a number of states decided to pursue these capabilities there is the risk of virtual arms races, undermining international trust and destabilising the non-proliferation regime.

Prospective Fuel Cycle Developments in the Asia-Pacific Region

Leaving aside states with nuclear weapons (China, India, Pakistan, and the DPRK), currently Japan is the only state in the region that has enrichment and reprocessing activities. The ROK is undertaking research on a type of reprocessing, pyro-processing, and has shown interest in uranium enrichment. Australia has had uranium enrichment research and development projects but has no current or planned activity in this area.

Japan has both enrichment and reprocessing. Japan's enrichment capacity, based on centrifuge technology, is relatively small, 75,000 SWU, about two-thirds of what is required to meet the annual fuel requirements of a single typical light water reactor. Notwithstanding the global oversupply, there are plans to increase Japan's enrichment capacity twenty-fold, to 1.5 million SWU.

Japan has been engaged in reprocessing since the 1970s. The first reprocessing plant, at Tokai-mura, was closed in 2006, but Japan proceeded with a much larger plant at Rokkasho—annual capacity 800 tonnes of spent fuel, output around 8 tonnes of plutonium. Rokkasho is ready to commence operations but start-up has been deferred several times, currently until 2022. Meanwhile, Japan has accumulated almost 46 tonnes of separated plutonium, 9 tonnes in Japan and the balance held in the United Kingdom and France. It makes no sense to add to this very substantial stockpile.

It is hoped Japan will make the current moratorium on Rokkasho permanent, or at least extend it until such time, if ever, that there is a genuine need for the plutonium. Although Japan has a longstanding and strongly held commitment against nuclear weapons, the threat of DPRK nuclear weapons has prompted calls in Japan to maintain fuel cycle capabilities to ensure a nuclear weapon option.[17] This has led to some unease about the proliferation potential of the Rokkasho project.

In **the ROK** the nuclear research establishment also sees FBRs as important for the future and, to this end, has been researching pyro-processing for some time. Pyro-processing became an issue in the renewal of the US-ROK nuclear cooperation agreement in 2015. The ROK sought US consent to reprocessing and recognition of a right to enrich. In response to ROK concerns about fuel security, the renewed agreement provides US nuclear fuel supply assurances. The agreement refers to possible enrichment or reprocessing in the ROK, but this would require the further agreement of the parties. The ROK and the United States are conducting a Joint Fuel Cycle Study on spent fuel management, including assessment of the viability of pyro-processing and safeguards and proliferation aspects of this technology. This study is expected to be completed in 2021.

The possibility of enrichment and/or reprocessing in the ROK is viewed with concern in the region and in Washington, and in the ROK itself.[18] Such activities would be disruptive for efforts to negotiate a denuclearization process with the DPRK. Concerns are exacerbated by calls in the

[17] See for example, the remarks by Japan's former defense minister, Satoshi Morimoto, prior to his appointment,which was reported in the Japan Times on 6 September 2012: https://web.archive.org/web/20121013202153/www.japantimes.co.jp/text/nn20120906b4.html

[18] E. Lim, *South Korea's Nuclear Dilemmas*, Journal for Peace and Nuclear Disarmament, Volume 2, 2019, https://www.tandfonline.com/doi/full/10.1080/25751654.2019.1585585

ROK for an independent nuclear deterrent and the high levels of support for this (sixty percent or more) shown in public opinion polling.[19]

Overall, for both the ROK and Japan (and also China) there is a strong argument for deferring the development of plutonium-recycle technologies until it can be demonstrated that they are actually needed. If or when such development does proceed, it should be conducted under arrangements that fully address proliferation concerns.

Australia has had two R&D projects on uranium enrichment: a centrifuge project from the mid-1960s to the mid-1980s, and a laser-based project, SILEX, from the early 1990s to 2007 when the project was transferred to the United States for further development. In addition, there was a private sector study into the establishment of an enrichment industry in the 1970s. Initially this looked at the Australian centrifuge technology but finally settled on Urenco technology. Eventually the study was terminated for commercial reasons and also because of a change of government. The basis for these various projects was the possibility for Australia to value-add on its substantial uranium exports.

Reflecting anti-nuclear sentiment, in 1999 legislation was passed prohibiting the licensing of fuel cycle activities in Australia, including uranium enrichment. This prohibition remains in place today.

The possibility of Australia enriching uranium for export continues to be raised from time to time and was thoroughly examined by the South Australian Nuclear Fuel Cycle Royal Commission in 2015–16.[20] The Commission concluded that with an oversupplied and uncertain global market there was no opportunity for commercial development of uranium enrichment in Australia for the foreseeable future. If enrichment were pursued, the Commission recommended this should be on a multilateral basis with the participation of partner countries to address the issue of nuclear latency. In a submission to the Commission the national government expressed support for the principle of multilateral control of sensitive stages of the fuel cycle. The Commission

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[19] Rachel Oswald, 'Southern Discomfort', *Pulitzer Center*, 10 April 2018, https://pulitzercenter.org/stories/southern-discomfort

[20] Nuclear Fuel Cycle Royal Commission Consultation and Response Agency, 'Nuclear State-Wide Engagement' (Royal Commission, 2016), https://nuclear.yoursay.sa.gov.au/the-report The author was a member of the Commission's Expert Advisory Committee.

recommended that the South Australian government seek repeal of the national prohibition against fuel cycle activities so any proposals that arise could be considered further, but because of the poor economic prospects the government did not adopt this recommendation.

The Commission's principal recommendation was in favour of establishing an international spent fuel repository in South Australia. Bipartisan consensus was lacking for this to proceed. In the absence of bipartisan consensus, no nuclear developments are likely to proceed in Australia.[21]

Taiwan As noted earlier, Taiwan sought reprocessing capabilities in the 1970s. The 1974 nuclear cooperation agreement between the United States and the governing authorities on Taiwan contained the standard provision proscribing enrichment or reprocessing without US prior consent. When the agreement was renewed in 2014 Taiwan forswore enrichment and reprocessing, what is known in the United States as the "gold standard" for nuclear cooperation agreements.[22]

Vietnam had an ambitious plan to build up to ten nuclear power units by 2030 and negotiated project agreements with Russia and Japan. It concluded a nuclear cooperation agreement with the United States in 2014. The United States pressed Vietnam to forswear enrichment and reprocessing, but Vietnam declined to do this and instead expressed in the agreement its intent to rely on existing international markets for nuclear fuel services, rather than acquiring sensitive nuclear technologies. In 2016 Vietnam decided to postpone both the Russian and Japanese reactor projects indefinitely due to economic conditions, and the future of Vietnam's nuclear power program is uncertain.

Other Southeast Asian states that were planning nuclear power programs but deferred them for economic and other reasons include:

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[21] On 15 September 2021 Australia, the US and the UK announced a proposal to provide Australia with nuclear-powered submarines. This proposal does not involve Australia producing nuclear fuel. See the author's commentary, "AUKUS Nuclear-Powered Submarine Deal – Non-proliferation Aspects", https://www.apln.network/analysis/commentaries/aukus-nuclear-powered-submarine-deal-non-proliferation-aspects

[22] The "gold standard" first appeared in the 2009 US-United Arab Emirates agreement.

Indonesia The 2017 National Energy General Plan to 2050 excludes major nuclear capacity in favour of increases in oil, gas, and renewables and a focus on small-scale nuclear plants.[23]

Malaysia the year 2030 had been suggested as the earliest date for construction of a nuclear power plant, but more recently the Prime Minister has ruled out use of nuclear energy.[24]

Thailand The current Power Development Plan, for the period to 2037, has no provision for nuclear energy.[25]

In addition, the **Philippines**, which had a power reactor in the 1980s that was never started, is reported to be considering nuclear power again, but as yet no decisions have been taken.[26]

In South Asia, **Bangladesh** has two Russian-supplied power reactors under construction, scheduled for completion in 2023–2024 and 2024–2025. Russia will supply the fuel and take back spent fuel.[27]

None of these states has any plans for pursuing enrichment or reprocessing capabilities.

Finally, mention should be made of **Myanmar**. In the period 2000–2011 the military regime's links with the DPRK led to concerns about a possible nuclear weapon program. Following the establishment of a civilian government in 2011, Myanmar affirmed its commitment to non-proliferation. Myanmar signed a safeguards Additional Protocol in 2013, though this has not yet been ratified. Myanmar is engaging with the IAEA and participates in the Asia-Pacific Safeguards Network.

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[23] F. Todd, "Analysing the Development of Nuclear Power across Southeast Asia," Nuclear Engineering International, August 5, 2019, https://www.nsenergybusiness.com/features/development-nuclear-power-southeast-asia/

[24] Nor Ain Mohamed Radhi, "Malaysia Won't Use Nuclear Power, Says PM," *NST Online*, February 10, 2020, https://www.nst.com.my/news/government-public-policy/2020/02/564295/malaysia-wont-use-nuclear-power-says-pm

[25] "Power Plan Backed along wIth 2 Plants," *The Nation*, January 24, 2019, http://www.nationthailand.com/Economy/30362896

[26] Sustainability Times, "The Philippines Is Eyeing Nuclear Power as a Green Option," *Sustainability Times* (blog), March 13, 2020, https://www.sustainability-times.com/low-carbon-energy/the-philippines-is-eyeing-nuclear-power-as-a-green-option/.

[27] "Nuclear Power in Bangladesh - World Nuclear Association," Nuclear Power in Bangladesh, accessed October 27, 2021, https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/bangladesh.aspx, accessed 15 April 2020.

Conclusion - Minimising Proliferation Risk

Horizontal proliferation is usually thought of in terms of clandestine nuclear programs. Actions taken to counter such programs have included strengthening IAEA safeguards and export controls. The risks from nuclear latency—states developing proliferation capabilities openly as part of their safeguarded nuclear programs—are recognized, but avoiding latency has not attracted the same level of attention as clandestine programs.

The NSG Guidelines[28] ask suppliers of enrichment or reprocessing facilities, equipment, or technology to encourage recipients to accept, as an alternative to national plants, supplier involvement and/or other appropriate multinational participation in resulting facilities. The Guidelines also ask suppliers to promote multinational regional fuel cycle centres. These Guidelines, however, do not amount to a commitment against further national projects and, of course, they are applicable only where transfers are involved. They do not apply to wholly indigenous projects.

The pursuit of national enrichment and reprocessing programs highlights the latency/hedging dilemma. While every state wants energy security—to which nuclear energy could make an important contribution—this does not necessitate *every* state, or even *many* states, having national programs in proliferation-sensitive technologies. States need to see energy security, not in narrow technology terms (pursuit of fuel cycle capabilities), but in a much wider context. Paradoxically, having such programs could be counterproductive to a state's broader security interests, either directly, due to the threat perceptions and reactions of other states, or more generally through a weakening of the non-proliferation regime. A large part of addressing the latency/hedging problem will be to help states to understand and think constructively about this national security paradox.

The only sure way to address the issues of nuclear latency and hedging is to reach international acceptance that proliferation-sensitive stages of the fuel cycle should be under multilateral rather than national control. A new international framework for the nuclear fuel cycle is needed, emphasizing international collaboration in place of national programs. Key elements in the new

[28] NSG Guidelines, Part I, paragraph 6(e).

framework would include multinational fuel cycle centers, international fuel supply guarantees, and fuel leasing.

Multinational approaches are not an unrealistic aspiration. Already there are practical precedents with important characteristics that can be built upon in future models, including:

- Urenco, the European enrichment group, where there is a treaty providing for mutual oversight of facility operations by the treaty parties, as well as separation between facility operators and technology design/manufacture (in effect a *black box* arrangement).
- The International Uranium Enrichment Centre (IUEC), Russia, which provides enrichment customers with supply guarantees overseen by the IAEA, and also the opportunity for equity participation in the project.
- The IAEA LEU Bank, operated by Kazakhstan on the IAEA's behalf.
- A form of fuel leasing is provided by Rosatom (Russia), which supplies fuel assemblies and takes back spent fuel from a number of customers.

The key factor with sensitive facilities is multinational, rather than wholly national, control. Multinational participation provides transparency of facility operations and inhibits possible takeover by the host state, especially where this would violate treaties. An additional inhibitor is supply of technology under black box arrangements, where this is practicable. This precludes clandestine replication, and builds delays into any misuse scenario, providing greater opportunity for intervention.

If in the future the viability of plutonium recycle is established, an appropriate model might be nuclear "islands" in which fast reactors and associated recycle processing facilities are physically co-located under multinational control.

Fuel banks need not be physical, as with the IAEA LEU Bank in Kazakhstan, but could be *virtual*, as with the fuel supply guarantee provided by the IUEC. Under multinational arrangements virtual fallback supply could be provided by a number of suppliers.[29]

[29]. For more on multinational arrangements see *Multilateral Approaches to the Nuclear Fuel Cycle*, IAEA, 2005, http://www-pub.iaea.org/books/IAEABooks/7281/Multilateral-Approaches-to-the-Nuclear-Fuel-Cycle and J.

Multinational approaches should not be looked at in isolation but considered in the context of possible further complementary non-proliferation and confidence-building mechanisms, such as enhanced transparency, nuclear weapon-free zones, and regional safeguards arrangements.

In current circumstances there is no urgency to proceed with new or deferred enrichment or reprocessing projects. As discussed, the global enrichment market is substantially over-supplied, and there is no sound technical or economic rationale for reprocessing unless the viability of fast reactors is established, which is by no means assured and in any case is decades away. Accordingly, a constructive approach would be to defer any current plans and allow time to develop multinational, including regional, solutions. To this end, regional studies could be initiated on the concepts discussed here.

While multinational approaches are usually framed in the context of the risk of horizontal proliferation—the focus of this paper—this is also an issue for disarmament. In the future the potential for rapid break-out from arms control and disarmament commitments will be just as great a concern as the potential for break-out from non-proliferation commitments by nuclear weapons states using a residual surge capacity to reverse direction. The parties to arms control and disarmament negotiations can be expected to seek appropriate confidence-building measures to cover ongoing fuel cycle activities. Accordingly, there could be interest in adapting approaches developed for the ROK, Japan, and other non-nuclear-weapon states to also apply in the future to China, India, and Pakistan.[30]

Clearly gaining support for multinationalization of proliferation-sensitive stages of the fuel cycle will be challenging. However, achieving a future free from the danger of nuclear war requires a change in current mindsets, from an emphasis on national fuel cycle programs to new approaches based on the common interests of non-proliferation, nuclear disarmament, energy security, and strengthened international collaboration.

Carlson, *Multinational Approaches to the Nuclear Fuel Cycle*, in Routledge Handbook of Nuclear Proliferation and Policy, J. Pilat and N. Busch eds, Oxford, 2015.

[30] Of course the issue is equally applicable to the United States, Russia, the United Kingdom, France, and Israel.

8. Extended Deterrence and Extended Nuclear Deterrence in a Pandemic World

Allan Behm

Introduction

The global community is slowly coming to accept that it may be living not in a post-COVID-19 world but in a world of rolling outbreaks where waves of infection and death afflict populations unpredictably. Along with climate change and nuclear weapons, this is the new threat to human security and, like the other two threats, may constrain humanity's existence in the absence of an effective vaccine. Ian Dunlop has pointed out that the pandemic itself is related "to human-induced climate change, which stems from our use of fossil fuels, agriculture and land-clearing."[1] As we set about burning ever more fossil fuel, clearing ever more land, accelerating the decline of biodiversity, bringing human populations ever closer to wild animal populations, and forcing animal species to seek refuge in conurbations for their very survival, we expose human beings to unheralded forms of zoönotic disease. In recent decades, these have included HIV, bird flu, SARS, MERS, and the Hendra, Ebola, and Zika viruses.

Desertification and deforestation engender habitat loss that forces species that have never previously been in contact to migrate into shared refuges around new food resources.

Anthropogenic changes to the global landscape and atmospheric warming are not only affecting weather patterns but also creating new forms of health threat. Climate change is a risk multiplier. It affects the well-being of populations, the availability of food resources, the security of

[1] See Ian Dunlop, "The really big and tough issue is the environment says Ken Henry," *Pearls and Irritations*, 8 July 2020 https://johnmenadue.com/the-environment-the-really-tough-one/

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communities, and ultimately the stability of governments, all of which play into the causes of armed conflict and war.

Climate change and the coronavirus pandemic have both induced a potentially fatal paralysis in many world leaders and fatalistic inertia in many of the world's communities—and for the same basic reason. As a species, it appears that human beings are unable to accept the systemic interdependence between people, other animal species, and the natural world in general. In the most morbid of senses then, the global community is currently facing two catastrophes for the price of one. And, what is more, the inter-connectedness of planetary systems places the three most pressing threats to human existence—climate change, pandemics, and nuclear weapons—in the same decision space. Each of these threats constitutes a "wicked problem" where solutions are "messy," iterative, and constantly morphing.

The impact of the COVID-19 pandemic on global security is yet to be seen. But what is clear from the so-called first wave is the massive debilitation of human populations in the United States, India, Europe, and parts of Central and South America. Even China, Japan, and South Korea have been hard hit, though early controls reduced the relative levels of harm across the population. And at this stage of the pandemic's evolution, the global economic cost is unknown —but it will be massive. Taken together, the health and economic consequences of the pandemic constitute a substantial challenge to national security, making populations less resilient, more vulnerable to military threats, and less able to invest in and sustain significant military operations. And where some states may regard the emerging weakness of other states as an opportunity for saber-rattling and aggressive rhetoric (China and India have exchanged fire in the Galwan River valley, while then President Trump and members of his cabinet engaged in rhetorical exchanges with China), others may respond in similar fashion by engaging in political warfare to exploit social divisions generated by the pandemic. Australian and US concerns regarding alleged Chinese cyber and information attacks are emblematic of the insecurity that attends COVID-19.

It is already evident that the COVID-19 pandemic is affecting the readiness of military forces. The US aircraft carrier USS Theodore Roosevelt was an early casualty, as was its captain who drew attention to the plight of the crew and was promptly dismissed from his command.[2] Over 20

[2] See ABC report "Sailor from USS Theodore Roosevelt dies of coronavirus after captain fired for raising concerns about outbreak," ABC News, 14 April 2020 https://www.abc.net.au/news/2020-04-14/us-navy-sailor-from-uss-

percent of the carrier's crew tested positive for the virus, and at least one died. The captain, who also succumbed to the disease, was subsequently dismissed from the US Navy, and the US Navy Secretary who dismissed him was also fired. A US marine on exercises in the Northern Territory was also diagnosed with the coronavirus infection, re-introducing the virus to the Northern Territory following a sustained period of no cases.[3] The clear message is that military forces are as vulnerable to a pandemic as the civilian population, with unforeseeable consequences for operational readiness and effectiveness.

In view of the *Nuclear Posture Review 2018* and its lowering of the boundary between conventional and nuclear warfare, the threshold for nuclear use may well be reduced considerably if key elements of the US military were *hors de combat* due to the pandemic. For their part, China and Russia have exploited the uncertainties surrounding the coronavirus by stepping up their surveillance and associated military activities along their borders. The imperative to win, as distinct from survive, opens a pandora's box of terrifying scenarios in times of pandemic.

As some commentators have noted, including a former Australian Prime Minister,[4] the potential for the pandemic to provide a pathway to armed conflict has increased. And with the prospect of war, there is the possibility of nuclear exchange. The link between COVID-19 and Weapons of Mass Destruction (WMD) cannot be ignored, even if the relationship cannot be properly mapped. That is the nature of "wicked problems."

The COVID-19 pandemic is also changing the way nations think about the health security of their populations. Setting aside the defiant willfulness of the Trump administration's response to the pandemic, matching only that of the Bolsonaro government in Brazil for its cavalier incompetence, most governments have looked to internal solutions to their pandemic management problems. *Mutatis mutandis*, they have instituted quarantine controls by closing their borders to international

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theodore-roosevelt-dies-of-coronavirus/12147482 and Barbara Starr and Michael Nedelman, "US aircraft carrier hit by major coronavirus outbreak returns to sea," CNN Politics, 21 May 2020 https://edition.cnn.com/2020/05/19/politics/uss-roosevelt-return-to-sea/index.html

[3] See Steve Vivian, "US marine tests positive for coronavirus in the Northern Territory," ABC News, 10 July 2020 https://www.abc.net.au/news/2020-07-10/nt-coronavirus-update-new-case-confirmed-us-marine/12442232

[4] See, for instance, Andrew Tillett, "US-China tensions could lead to hot war: Rudd," *The Australian Financial Review*, 4 August 2020 https://www.afr.com/politics/federal/us-china-tensions-could-lead-to-a-hot-war-rudd-20200804-p55ib9 See also Kevin Rudd, "Beware the Guns of August – in Asia," *Foreign Affairs*, 3 August 2020 https://www.foreignaffairs.com/articles/united-states/2020-08-03/beware-guns-august-asia

travelers, imposing strict controls on the social intercourse of their populations, locking down districts and regions, expanding their medical services, constructing 'pop-up' hospitals, establishing mobile testing facilities, and generally imposing heavy costs on their economies as they try to maintain both services and incomes.

Apart from some formalized cooperative arrangements between individual laboratories and pharmaceutical companies that are otherwise competing to discover a vaccine, nations have not established international cooperative arrangements for the broader management of the pandemic. No nation has contracted out its coronavirus management to any international agency or organization (including the World Health Organization), far less to another state. This is less because the WHO has not discovered or manufactured a vaccine (that is not its role), but rather a reflection on the unwillingness of many governments to accept and follow WHO pandemic advice.

Rather than acting collaboratively, many national leaders have pursued a 'go it alone' policy towards both containing and managing the virus. Some might even describe it as a 'dog eat dog' approach. And Trump's attempt to corner the vaccine market by persuading Germany's CureVac company to move its research facilities to the United States, and to retain the Gilead company's Remdesivir production for sole US usage, highlights the triumph of national over internationally collaborative approaches to what is fundamentally an international problem affecting humanity as a whole.

It is curious that the 'go it alone' approach of so many of the US allies in managing their COVID-19 responses has been in sharp contradistinction to their longstanding preparedness to transfer ultimate responsibility for their security to another power, which is the consequence of extended deterrence.

So, this paper questions why states might contract out fundamental aspects of their national security to more powerful states ('extended deterrence') and how credible is the so-called protection they might receive in return.

The Problem of Trust

The COVID-19 world is one where trust is in retreat. Populations' trust in their leaders and governments, already in the doldrums for many years,[5] will continue to decline as citizens' hopes of 'a return to normal'—frequently promised by their governments—remain unfulfilled.[6] But trust is not only in decline within nations. It is in decline between nations. As The Lowy Institute has reported, "in 2020, Australians are less trusting of most countries around the world than in the past."[7] Trust in China has more than halved over a two-year period, while trust in the United States has declined from a high of 83 percent during President Obama's administration to just over 50 percent in 2020.[8]

In a world where trust—both between citizens and the state, and between states—is in decline, the barking of the dogs of war grows louder. That doesn't necessarily make war inevitable. But it does make it more likely, and it makes states feel more insecure, which in turn makes them look to their defenses. For Non-Nuclear Weapon States (NNWS) such as Australia, Japan, and South Korea, locked into alliances with the United States, the comfort of the nuclear guarantee looks even more attractive. But is the guarantee to be trusted? More to the point, is the United States to be trusted to deliver on that guarantee? And even more to the point, was Trump to be trusted to put Chicago at risk to protect Canberra, or Washington to protect Tokyo?

Reliance on the nuclear deterrent capabilities of a major power is much more a statement of necessity than one of trust. But if, ultimately, that reliance is insufficient though necessary for national security, what's the point? If it is not grounded in trust, then it is groundless. That is the dilemma on which extended nuclear deterrence rests for its credibility.

In important respects, the COVID-19 pandemic has revealed that trust, or its absence, is the global community's Achilles heel. Trust, and its absence, are pervasive qualities, affecting all aspects of

[5] See OECD, "Trust in Government," https://www.oecd.org/gov/trust-in-government.htm

[6] See Christopher Ingraham, "Coronavirus will undermine trust in government, 'scarring body and mind' for decades, research finds," *The Washington Post*, 5 July 2020 https://www.washingtonpost.com/business/2020/07/05/coronavirus-pandemic-trust-government/

[7] See Lowy Institute Poll 2020 at https://poll.lowyinstitute.org/tags/trust-in-global-powers/

[8] *Loc.cit.*

individual, communal, and national decision-making and behavior. This is a matter to which we shall return in due course.

Extended Deterrence and Extended Nuclear Deterrence

Ultimately, the doctrine of deterrence rests on fear: it is no accident that 'terror' is intrinsic to the very word.[9]

The theoretical principles underlying the doctrine of extended deterrence were well articulated by Paul Huth, writing in *The American Political Science Review* in 1988.[10] With estimable caution, Huth ended his analysis with the following observation:

> The defense of allies from external threats is an enduring feature of the competition between states for spheres of influence in the international system. Extended deterrence, however, can be a very difficult and demanding task for foreign policy leaders…The credible threat of military force is required to convince the potential attacker that the military costs of changing the status quo are high, but skillful diplomacy is also required to assure the potential attacker that the political costs of continued peace are acceptable.[11]

Therein one sees the fundamental problem with the doctrine of extended deterrence: what at one level appears to be a force-on-force solution to a force problem, dependent on the superior firepower and destructive forces of the deterring power, is at another level a political problem dependent on nimble management of the political and psychological uncertainties attendant upon Clausewitz's dictum "war is the continuation of policy by other means."

George Schultz, Secretary of State in US President Ronald Reagan's administration, has put the nuclear deterrence dilemma with characteristic precision.

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[9] For an excellent examination of the modern evolution of deterrence, see Andrew Brown and Lorna Arnold, "The Quirks of Nuclear Deterrence," *International Relations*, Vol. 24, No. 3, (2010), pp. 293-312 https://www.belfercenter.org/sites/default/files/legacy/files/The-Quirks-of-Nuclear-Deterrence.pdf

[10] See Paul Huth, "Extended Deterrence and the Outbreak of War," *The American Political Science Review*, vol. 82, No 2 (June, 1988), p. 424 https://www.jstor.org/stable/1957394?read-now=1&seq=2#page_scan_tab_contents

[11] Paul Huth, *art.cit.*, p. 439

> Nuclear weapons were, and are, the gravest threat to humanity's survival. Their effect in preventing wars has been overrated and reports of the damage they cause tend to be brushed aside. New studies show the major impact of their use on the climate and agriculture beyond all the other effects that we knew about previously. To depend on nuclear deterrence indefinitely into the future, especially when other means of deterrence are available, is foolhardy.[12]

The more populist architects of extended deterrence were rather like the medieval scholastics whose philosophical presuppositions and axioms enabled them to explore the relationship between materiality and immateriality—the *reductio ad absurdum* encapsulated by the question "how many angels can dance on the head of a pin?" How does one 'play with the mind' of a potential adversary contemplating the materiality of war by confronting them with the immateriality of uncertainty as to whether a third party might apply overwhelming force? Extended deterrence assumes a linearity between armed aggression and its resolution that ignores both the non-linear character of warfare (Clausewitz's 'fog' and 'friction') and the decision chaos that comes with uncertainty.[13] Yet history confirms repeatedly that the immateriality of policy eventually overwhelms the materiality of war.

The logical gymnastics of deterrence can be seen in the confected binary between counter-value (the adversary's cities and economic infrastructure) and counter-force (the adversary's military systems). To imagine that an adversary will refrain from a counter-value defense on the grounds that the attack is counter-force is to ignore both history and human psychology. The destruction of Rotterdam, Cologne, Dresden, Hiroshima, and Nagasaki—all counter-value targets—demonstrates that what might appeal to military planners in theory (destruction of industrial and military targets) does not conform to what happens in practice. Moreover, as Fred Kaplan points

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[12] See George Schultz, in George P. Schultz and James E. Goodby (eds), *The War That Must Never Be Fought: Dilemmas of Nuclear Deterrence* (Stanford: Hoover Institution Press, 2015), p. xv https://www.hoover.org/sites/default/files/research/docs/goodby_shultz_-_the_war_that_must_never_be_fought_-_scribd.pdf

[13] Uncertainty was embedded in Clausewitz's analysis of war. See Vladimir Rauta, "Clausewitz's Fog and Friction and the Military Transformation Fiction," Conflict and Security (University of Nottingham), 2 December 2013 http://nottspolitics.org/2013/12/02/clausewitzs-fog-and-friction-and-the-military-transformation-fiction/

out in his remarkable history *The Bomb*, the internal logic of counterforce drives the dynamics of an inevitable arms race.[14] Signal-giving and signal-reading are not the same thing.

Extended nuclear deterrence is an artefact of US alliance policy in the immediate post-WW2 years: the nations that 'enjoy' the extended nuclear deterrence that the US nuclear arsenal affords them are all joined to the US through a set of alliance arrangements that places the US at the center of their national defense. Consequently, extended nuclear deterrence is very much a security preoccupation of the United States and its allies. It is not something to which defense planners in Brazil or Indonesia, or China for that matter, turn their minds. The former Warsaw Pact members, for instance—the forced acolytes of the former Soviet Union that wasted no time in escaping the clutches of the Soviet Union following *glasnost*—did not enjoy a similar relationship with their dominant partner. They were not in any effective sense covered by a nuclear umbrella in the way that NATO members thought themselves to be. So in a strategically unbalanced world, only the allies of the United States live in the security bubble of extended nuclear deterrence.

It is a curious phenomenon that most deterrence theorists are also deterrence enthusiasts. Like theology, deterrence theory takes on the guise of a faith-based discipline masquerading as an evidence-based science. Yet its foundation principles are axiomatic rather than observable facts. Its practitioners are often the 'true believers' providing a kind of theoretical basis that legitimizes what military planners were probably intending to do anyway. The arguments for deterrence, especially nuclear deterrence, can be as ingenious and sophisticated as they are novel and specious. In a recent academic journal article, for instance, two Australian scholars argued that by signing on to the institutional arrangement that delivers US nuclear deterrence to safeguard Australia against an overwhelming aggressor—the ANZUS treaty—Australia acquires the ability to influence the direction of US nuclear policy, and defense policy more broadly.

> In general, maximizing influence over U.S. strategic policy has been an important motive for U.S. allies seeking to participate in nuclear cooperation. For instance, Australia only began to highlight U.S. extended nuclear deterrence in its 1993 Strategic Review, due to an underlying anxiety that the United States was considering detaching itself militarily from the Asia-Pacific after the Cold War…Moreover, Australia's White Papers contain an

[14] Fred Kaplan, *The Bomb: Presidents, Generals and the Secret History of Nuclear War* (New York: Simon and Schuster, 2020), p. 78.

> implicit "sole-purpose" declaration that relates U.S. extended nuclear deterrence (in the case of Australia) exclusively to *nuclear* threats.[15]

Whether the institutional frameworks that purportedly deliver deterrence are truly able to lend authority and credibility to a weaker party in their efforts to influence the policies of their major ally is moot—more an expression of hope than a reflection of experience.

A more agnostic approach to the place of deterrence in security planning was evidenced by Patrick Morgan in 2012.

> Much of the discussion, indeed worry, about deterrence now has to do with familiar concerns: credibility, target rationality, fitting deterrence carefully to the situation (tailoring), possible/actual first-strike capabilities, and so on. More analysis is needed stressing what became, over time, the most important dimension of Cold War deterrence—system security management. This is management for a world now trying to reorder international politics and security to make deterrence steadily less relevant, with that management resting much less on nuclear deterrence in particular, and with ordinary deterrence more prominent and often meant to help sharply improve international politics.[16]

But keen interest in and re-evaluation of deterrence theory does in part explain why, in recent decades, the two terms of art—'extended deterrence' and 'extended nuclear deterrence'—have tended to conflate.[17] 'Extended deterrence' relied on the willingness of a third-party ally with superior conventional forces to use those forces in the defense of the less militarily powerful ally against an aggressive third party. The proliferation of nuclear weapons encouraged the United States and its allies to bring nuclear forces into the deterrence equation: the potential aggressor had to calculate whether he would be prepared to employ nuclear weapons in armed conflict with a

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[15] See Stephan Frühling and Andrew O'Neil, "Nuclear weapons, the United States and alliances in Europe and Asia: Toward an institutional perspective," Contemporary Security Policy, vol 38 (2017), issue 1, https://www.tandfonline.com/doi/full/10.1080/13523260.2016.1257214

[16] See Patrick M. Morgan, "The State of Deterrence in International Politics Today," *Contemporary Security Policy,* vol. 33 (2012), issue 1, p. 98, https://www.tandfonline.com/doi/full/10.1080/13523260.2012.659589

[17] See, for instance, Steven Pifer, Richard Bush, Vanda Felbab-Brown, Martin Indyk, Michael O'Hanlon and Kenneth Pollack, "U.S. Nuclear and Extended Deterrence: Considerations and Challenges," Foreign Policy at Brookings, May 2010, where the terms are used more or less interchangeably, https://www.brookings.edu/wp-content/uploads/2016/06/06_nuclear_deterrence.pdf

Non-Nuclear Weapon State (NNWS) against the prospect of a nuclear sanction imposed by the United States.

But the progressive withdrawal of US ground forces from Germany and the Republic of Korea,[18] along with the re-drawing of nuclear-use thresholds in the *Nuclear Posture Review 2018*, has added considerable ambiguity to the use of nuclear forces to deter conventional attacks in Europe and Asia. Accordingly, 'extended nuclear deterrence' has come to dominate consideration of deterrence policy.

A surprising consequence of this conflation is that, for the United States, the effectiveness of extended nuclear deterrence is increasingly judged in terms of allies' expressions of reassurance rather than the absence or reduced likelihood of armed conflict.

Their conflation is due, in part, to the progressive legitimization of nuclear weapons and their use resulting from long-term weapons production and possession by the NWS (as identified by the Nuclear Non-Proliferation Treaty, or NPT) and their unwillingness and inability to embark on nuclear arms elimination as required by the NPT. It is due in part to the intellectual laziness that has begun to characterize much of what passes for strategic policy analysis and formulation. It is due in part to an intellectual sleight-of-hand whereby the presuppositions and axioms underpinning the simpler concept of 'extended deterrence' have been maneuvered into position as the conceptual foundations of the more complicated and elusive idea of 'extended nuclear deterrence.' And it is also an inevitable consequence of the Trump administration's *Nuclear Posture Review 2018*, which postulated a lowering of the nuclear-use bar by contemplating nuclear first-use in conventional warfare.

> . . . Deterring nuclear attack is **not the sole purpose** of nuclear weapons. Given the diverse threats and profound uncertainties of the current and future threat environment, U.S. nuclear forces play the following critical roles in U.S. national security strategy.
>
> - Deterrence of nuclear **and non-nuclear** attack;
> - Assurance of allies and partners;

[18] For a particularly insightful analysis of nuclear security issues on the Korean peninsula, see Paul K. Davis, Peter Wilson, Jeongeun Kim and Junho Park, "Deterrence and Stability for the Korean Peninsula," *The Korean Journal of Defense Analysis*, vol. 28 (1), March 2016, pp. 1-23, https://www.kida.re.kr/frt/board/frtBoardJatsxmlPop.do?idx=2

> - Achievement of U.S. objectives **if deterrence fails**;
> - Capacity to hedge against an uncertain future.
>
> These roles are complementary and interrelated, and we must assess the adequacy of U.S. nuclear forces against each role and the strategy designed to fulfill (sic) it.[19]

The review continues:

> 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.[20]

The credibility of extended deterrence rests on the supposition that the superior forces of a powerful state would come to the aid of the forces of a less powerful state (generally a NNWS) were it subject to armed aggression by an opposing powerful state. It is the basic assumption on which the North Atlantic (NATO) Treaty, the still contested Treaty of Mutual Cooperation and Security between the United States and Japan,[21] and the ANZUS Treaty rest—that the United States would come to its allies' assistance in the event of an armed attack by an opposing state, with or without the implied threat of nuclear weapons use.

There are, however, three intrinsic disjunctions in the extended deterrence formula: that the interests of the more powerful deterring state would necessarily align with those of the less powerful state, that the more powerful state would in any circumstance be prepared to expend blood and treasure on behalf of the less powerful state, and that the benefits of confronting an

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[19] Office of the Secretary of Defense, *Nuclear Posture Review February 2018*, p. 20 https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF (Emphasis is by the author).

[20] Office of the Secretary of Defense, *op. cit*., p.21. A curious reader might wonder how France and the United Kingdom regard their inclusion under the US extended nuclear deterrence umbrella. Emphasis by the author.

[21] While it is a major advocate of nuclear nonproliferation, Japan continues to pursue a hedging policy that retains the possibility of nuclear weapons development by preserving the ability both to enrich uranium and to reprocess plutonium. As is the case with other US allies, there remains a reservoir of doubt about the effectiveness and reliability of the extended nuclear deterrence provided by the US-Japan Treaty. See, for instance, Mark Fitzpatrick, "How Japan Could Go Nuclear," *Foreign Affairs*, 3 October 2019 https://www.foreignaffairs.com/articles/asia/2019-10-03/how-japan-could-go-nuclear

opposing powerful state would outweigh those costs. "My enemy's enemy is my friend" might resonate with some, but "my friend's enemy is my enemy" may not be true in most circumstances.[22]

There is a superficial attractiveness in rationalizing hope. The hopeful press for deals from the powerful, often without realizing the extent to which the powerful are driven by self-interest. Concessions come at a price. And the powerful deploy their policy sales agents who confect all kinds of sophistries to persuade the customer to buy their wares, particularly when the customer is gullible. In pressing Australia to accept a 'soft' treaty with Japan in the immediate post WW2 period, the United States was prepared to accept Australia's demand for a security guarantee against the possibility of Japan's eventual re-armament. So the ANZUS treaty, which is scarcely more than an agreement to consult, provided Australia with the 'extended deterrence' that an insecure and nervous Australia demanded.[23]

Yet, so far as this author has been able to determine, none of the contemporary negotiators envisaged the use of the US nuclear strike capability to defend Australia against any putative Japanese aggression. Australia's insecurity pathologies continued to infect its strategic concerns during the 1950s and 1960s—dominoes in South East Asia and deep worries about Indonesian aggression during *Konfrontasi* (1963-66). But the assistance provided to the United Kingdom to develop its nuclear weapons (the provision of the Monte Bello and Maralinga test sites) and its own ambitions to develop a nuclear capability notwithstanding, Australian planners seem not to have given serious contemplation to a nuclear defense of Australia by the United States.

Konfrontasi, of course, brought Australia a serious reality check on the real strategic utility of Australia's extended deterrence expectations provided by the ANZUS treaty. In 1963, Prime Minister Robert Menzies decided to test the waters. Australia's commitment of forces to the defense of Malaysia against Indonesian 'Confrontation' in 1963 was made on the assumption that, were Australian forces to come under direct attack by Indonesian forces, the United States would

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[22] The logical anomaly inherent in these two propositions was explored by Thomas Schwartz in "The friend of my enemy is my enemy, the enemy of my enemy is my friend: Axioms for structural balance and bi-polarity," *Mathematical Social Sciences*, vol. 60, Issue 1, July 2010, pp. 39-45. https://www.sciencedirect.com/journal/mathematical-social-sciences/vol/60/issue/1

[23] For an excellent and concise analysis of the negotiating history of the ANZUS Treaty, see Joseph M.Siracusa, "The ANZUS Treaty Revisited," *Security Challenges*, vol. 1, no. 1. Pp.89-104 https://www.regionalsecurity.org.au/Resources/Files/vol1no1Siracusa.pdf

commit forces to support Australia. Discussions between the US Under-Secretary of State for Political Affairs Averell Harriman and the Australian government in June 1963 skirted around US policy in South East Asia, with Harriman apparently taking a broader interpretation of the ANZUS treaty than President Kennedy subsequently adopted in his conversations with Prime Minister Menzies and Treasurer Holt, and the Australians apparently hearing what they wanted to hear.

So when Menzies met Kennedy in July 1963, the key topic of conversation was the applicability of the extended deterrence assumed by Australia's interpretation of the ANZUS treaty to an Australian force under attack in Malaysia. Menzies was confident that ANZUS applied in such a situation. Kennedy was equivocal.[24] In a subsequent conversation with Treasurer Harold Holt, Kennedy was more forthright: the United States was not going to be the backstop behind UK and Australian forces in Malaysia. Kennedy is recorded as saying, "We have not said 'if you [Indonesia] do so and so [attack British or Australian forces] the result will be war with the United States.'"[25]

As the record shows, there was no "blank check [sic]" extended to Australia. The limits of the ANZUS treaty, and consequently the limits of extended deterrence, were clearly established. Consultation did not mean contribution. The United States certainly had the military mass to deter Indonesia had it chosen so to do, but it was not prepared to encourage Australian reliance on Indonesia's possible uncertainty concerning US intentions.

The nail in the extended deterrence coffin was driven home by President Nixon with the enunciation of the Guam Doctrine in 1969. The United Staes sought to ensure that nations expecting US military support in times of tension or conflict at a minimum provided for their own self-defense.

Coming as it did during the Vietnam War, when the United States was both stretched and stressed, the Guam statement made it clear that the United States was not some kind of global savior. Speaking during a stopover in Guam, Nixon said that the United States "is going to encourage and has the right to expect" that "military defense . . . will be handled by, and responsibility for it taken

[24] See note 3 to the Memorandum of Conversation between US President Kennedy and Australian Treasurer Harold Holt, 2 October 1963 in *Foreign Relations of the United States, 1961-1963, Volume XXIII, Southeast Asia*, document 337 https://history.state.gov/historicaldocuments/frus1961-63v23/d337

[25] This statement is quoted in the document cited above.

by, the Asian nations themselves."[26] The message was not lost on either Australia or New Zealand.[27] And, for his part, President Trump drove the message home in his remarks at the NATO Headquarters in Brussels in May 2017, when he upbraided NATO members for not paying "their fair share," a situation he saw as being "not fair to the people and the taxpayers of the United States."[28] And not one to let a bone go without chewing on it a bit more, Trump reiterated his views in London in December 2019 when he said "[The NATO budget] was going down for close to 20 years . . . you wouldn't have had a NATO if you kept going that way."[29]

NATO members might want to consider the credibility of both extended deterrence and extended nuclear deterrence in the contemporary strategic circumstances of Europe, especially in the light of French President Macron's description of NATO as "brain dead."[30]

Bluff, Double Bluff, and Reverse Bluff

The origins of extended deterrence theory in modern times lie in the dominant and overwhelming military force of the post-WW2 United States. Try as it did, the Soviet Union was no match (witness the 1962 Cuban missile crisis, a near-run thing but ending in a Soviet back-down), and no other power, including China after its acquisition of a nuclear weapon, had any chance of staring down the United States. So the threat of an armed US intervention on behalf of its NATO, Japan, ANZUS or SEATO allies, and the certainty that the United States *could* use its military power with impunity (even when there was no certainty that the United States *would* actually use its military power) was enough to deliver effective deterrence, at least until the late 1950s.

[26] See Document 29 (editorial note), *Foreign Relations of the United states 1969-1976*, Vol. 1, "Foundations of Foreign Policy, 1969-1972" https://history.state.gov/historicaldocuments/frus1969-76v01/d29

[27] See Hugh White, "A very unreassuring bombshell: Richard Nixon and the Guam doctrine, July 1969," *The Strategist*, 25 July 2019 https://www.aspistrategist.org.au/a-very-unreassuring-bombshell-richard-nixon-and-the-guam-doctrine-july-1969/

[28] President Trump, remarks at the unveiling of the 9/11 and Article 5 Memorial and Berlin wall Memorial, 25 May 1017 https://nato.usmission.gov/may-25-2017-president-trumps-remarks-911-article-5-memorial-unveiling/

[29] President Trump after the 1:1 Meeting, London, 3 December 2019 https://www.whitehouse.gov/briefings-statements/remarks-president-trump-nato-secretary-general-stoltenberg-11-meeting-london-united-kingdom/

[30] See "A president on a mission," *The Economist,* 9 November 2019. Also, "Emmanuel Macron warns Europe: NATO is becoming brain-dead," *The Economist*, 7 November 2019 https://www.economist.com/europe/2019/11/07/emmanuel-macron-warns-europe-nato-is-becoming-brain-dead

More than that, it delivered comfort to the more apprehensive allies of the United States—the European NATO member with their concerns about the Soviet Union, and Australia and New Zealand with their generalized insecurity about China and potentially Indonesia—that their defense would be guaranteed by the United States.

Yet doubt has lain at the heart of deterrence theory from the beginning. It was elegantly summed up by Henry Kissinger in 1979. "…European allies should not keep asking us to multiply strategic assurances that we cannot possibly mean or if we do mean, we should not want to execute because if we execute we risk the destruction of civilization." He went on to say:

> If there is no theater nuclear establishment on the continent of Europe, we are writing the script for selective blackmail in which our allies will be threatened, and in which we will be forced into a decision whereby we can respond only with a strategy that has no military purpose but only the aim of destruction of populations. I ask any of you around this conference table: If you were Secretary of State or Security Adviser, what would you recommend to the President of the United States to do in such circumstances? How would he improve his relative military position? Of course, he could threaten a full-scale strategic response, but is it a realistic course? It is senseless to say that dilemma shows that Americans are weak and irresolute. This is not the problem of any particular administration, but it is a problem of the doctrine that has developed.[31]

Strategic change, however, has transformed the credibility of force-based 'extended deterrence,' Russia's changed force posture, and President Putin's confidence and assertiveness in the face of the decline of US influence in both Europe and the Middle East, have brought a revised capability and psychological alignment that challenges the United States (and Trump) directly, changing the calculation balance from the preponderance of US force to the credibility and reliability of US intent.

Moreover, China's rise as a strategic power in Asia and the relative decline in US dominance have begun to concern the treaty allies of the United States, particularly Japan and the Republic of Korea. Australia is not immune from this concern. The issue here is the automaticity of a US force

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[31] Henry Kissinger, "NATO – The Next Thirty Years," speech at the Palais d'Egmont, Brussels, 1 September 1979, pp. 11-13) http://findit.library.yale.edu/images_layout/fullviewnoocr?parentoid=11781220

response to the threat of armed aggression—a confidence that the treaty might be expected to provide—as distinct from the uncertainty (in the minds of both the aggressor and the threatened party, as it happens) generated by deterrence. The credibility of US commitment to the defense of its Asian (and antipodean) allies rested on US conventional dominance and the belief that China would not initiate the use of nuclear weapons. The change in the conventional balance has diminished the credibility of US extended deterrence.

So, for Australia, Japan, and the Republic of Korea, reliance on the US *preponderance of force* to guarantee deterrence of possible armed aggression by China has also given way to a reliance on the *intent* of the US to honor its treaty arrangements. In other words, in both Europe and North Asia, reliance on strategic bulk has been replaced by a reliance on strategic bluff. Just how reliable is that?

The answer to that, in contemporary circumstances, is probably not very. The tension between materiality and immateriality was well captured by Steve Fetter and Jon Wolfsthal in 2018.

> If we are fighting and likely to prevail in a conventional war on the Korean peninsula, using nuclear weapons could lead to a more devastating nuclear attack by the North on South Korea and stalemate any conventional conflict. Yet, failing to respond could expose past commitments to use nuclear weapons as a bluff and the call into question the credibility of the United States on all security and military matters. That is why President Obama and many past presidents have sought to limit the conditions under which the United States might use nuclear weapons so as to not create a commitment trap that may force it into an unnecessary use of nuclear weapons.[32]

It is curious that something as fundamental to the survival of humanity as the avoidance of nuclear war should now be premised on techniques employed by gamblers to enhance their chances of winning. It is important to note in this context that gamblers are usually not concerned with or interested in other players' losing. They are interested in winning, even when their position appears weak. They maximize their position by imposing psychological uncertainty on their opponents,

[32] Steve Fetter and Jon Wolfsthal, "No First Use and Credible Deterrence," Journal for Peace and Nuclear Disarmament, Vol. 1, Issues 1, 9 April 2018
https://www.tandfonline.com/doi/full/10.1080/25751654.2018.1454257

causing them to 'fold' or otherwise to lose. In games of chance, bluff can condition the choices and decision of opponents without materially changing the intrinsic odds.

Bluff is intrinsic to certain games of chance. But the randomness in a game of chance is known and predictable following the laws of probability, whereas armed conflict is characterized by ambiguity, discontinuity, and decision-making that, as in games of chance, cannot always be assumed to be rational. Accordingly, the threat calculus assumed by extended deterrence and extended nuclear deterrence is never stable, but rather exists in the world of Clausewitz's "fog" and "friction." So for the beneficiary of extended nuclear deterrence in particular, the assumption that any US president, especially President Trump, would trade New York for Tokyo, San Diego for Seoul, or Cleveland (Ohio) for Canberra is to pin a security hope on an improbability.

And the improbability, of course, cuts at least three ways: the aggressor's uncertainty that the United States will contemplate such a trade; the uncertainty of the state subject to attack that the United States will defend it; and the uncertainty that the United States would accept a nuclear attack on behalf of an allied state.

It might be suggested that the apparent fragility of both the extended deterrence and extended nuclear deterrence doctrines and their increasing reliance on bluff has been addressed by *The Nuclear Posture Review 2018*, cited above. By lowering the nuclear use threshold to contemplate nuclear strike in the circumstances of conventional war, it might be argued that the bluff has been replaced by the double bluff—the pretense to have less power (because of assumed constraints on possible use) than is actually the case, but the determination to use that power if and when necessary.

The Nuclear Posture Review 2018 depends, for its strategic foundations, on the *2018 National Defense Strategy*, which proposed both modernizing the nuclear triad and strengthening alliances.[33] It may be, of course, that *The Nuclear Posture Review 2018* envisages the possibility of a significant increase in defense spending by the allies and client states of the United States, as demanded by President Trump and as recommended by numerous national strategic commentators, thereby reducing the likelihood of a call on the extended (nuclear) deterrence

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[33] See "Summary of the 2018 National Defense Strategy," US Department of Defense, p. 6 and 8 https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf

capabilities of the United States. But in either scenario—a lower first-use bar or a lower likelihood of demand—the fact remains that extended deterrence continues to rest on a foundation of bluff and variations of bluff. That is no basis for national or population survival.

Survival depends on the ability of citizens and their governments to act in concert to mitigate and eliminate threats. Whether those threats arise from the inability of mankind to understand that it is as subject to the laws of nature as other beings are, or the preference of so many of the world's leaders for nationalism and ideology in place of vision and hope, their mitigation and elimination depends on common purpose and a shared moral compass based on the dignity and value of each human being by virtue of our shared humanity. Whether it is survival in the face of climate change, pandemics, or nuclear weapons, human agency is key.

In the immediate post WW2 years, the United States exercised some of that agency. But as America's moral and strategic superiority continue to erode, the United States runs a higher risk that it might simply be unable to make good on its military commitments. The relative erosion of the conventional military dominance of the United States exacerbates the declining confidence of allies, and perhaps of the United States itself, that the United States will win a conventional war. Its global strategy is increasingly likely to be exposed as an extended nuclear deterrence bluff masquerading as a certainty—that the preponderant nuclear forces of the United States will provide the reverse bluff that persuades the state contemplating a conventional attack to desist because of its certainty that nuclear weapons will overwhelm its superior conventional forces. But, as with the double bluff, the state of certainty rests not with the state providing extended nuclear deterrence, but with the 'aggressor' state contemplating the conventional attack, confident that the unwinnability of a nuclear exchange will prevent its occurrence. Here again, all forms of bluff fail, destroying the intrinsic credibility of deterrence. The intention of the deterring state remains ambiguous and uncertain, while the aggressor state will remain reasonably confident that a nuclear response to a conventional attack is too subject to escalation to be more than a bluff. The position of the dependent ally or client state is precarious at best.

This is a situation that Hal Brands and Eric Edelman contemplated, at least in passing, in their *Avoiding a Strategy of Bluff: The Crisis of American Military Primacy.* "As American superiority erodes . . . the United States runs a higher risk that it might simply be unable to make good on its military commitments; its global strategy is increasingly likely to be exposed as bluff'.[34]

While expressing their confidence in the continuing extended nuclear deterrence posture of the United States, they identified the fundamental flaw in the applicability of the doctrine.

> Yet like geopolitical retrenchment, the idea of substituting risk for cost contains serious liabilities. Simply hoping that exposed commitments will not be challenged might work—for a while. But this strategy carries an enormous risk that at some point those guarantees will, in fact, be tested and found wanting, with devastating effects on America's reputation and credibility. The United States could experience its version of the "Singapore moment"—an episode, as when the Japanese captured that supposedly formidable British redoubt and sank much of its Far Eastern battle fleet along the way, when a great power's strength and promises are revealed to be an empty shell, and its image as a strong and capable actor in a key part of the world never recovers. Along the way, a strategy of bluff would likely weaken deterrence and reassurance on the installment plan, as allies and adversaries perceive a shifting balance of power and understand that U.S. guarantees are increasingly chimerical. The United States could therefore end up with both the destabilizing consequences of retrenchment, along with the risk of conflict that comes from hanging on to preexisting obligations.[35]

This flaw has been exacerbated by the COVID-19 pandemic, where the United States has retreated further from global engagement, shredding and shedding its credibility along the way.

Consequently, both the putative adversary and the ultimate security guarantor, as well as its ally or client, are caught up in the same world of strategic uncertainty that renders extended deterrence (of any form) itself uncertain and ultimately inoperable.

Extended nuclear deterrence theory has gradually morphed into a kind of deterrence theology—a belief system founded on a codified set of indemonstrable doctrines. The validity of the system

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[34] Hal Brands and Eric Edelman, *Avoiding a Strategy of Bluff: The Crisis of American Military Primacy* (Washington: Center for Strategic and Budgetary Assessments, 2017), p. 12 https://csbaonline.org/uploads/documents/Strategic_Solvency_FINAL.pdf

[35] *Loc.cit.*, pp. 21-2.

rests on five implausible and ultimately unprovable propositions: that the guarantee is absolute and unconditional; that nuclear exchange escalation can and will be controlled; that the guarantor will accept the fact and consequences of a nuclear attack on behalf of the client state to which deterrence is extended; that the decision maker will make rational choices based on the logic of the guarantee; and that any possible aggressor will make its decisions based on the same strategic mindset as the guarantor. But each of these propositions is unsupportable.

- The guarantee can never be absolute and unconditional: war and the threat of war takes place in time and space, and is consequential upon political developments over which the guarantor may have no control or input. If, for instance, the guarantor considers that the client state has contributed to its own misfortune, it may sanction both the client state and the adversary, but may not commit to armed conflict itself.
- Escalation cannot be controlled because the decision space is essentially chaotic. The fact that tactical planners can think about and design control mechanisms does not mean that in the circumstances of war things go as planned. Discontinuities and the associated crises are intrinsic to the conduct of war.
- The guarantor will not write a blank check for the client whereby the guarantor takes total liability for the consequences of a nuclear exchange, including directs attacks upon and destruction of its people and property.
- The logic of the guarantee implies that the guarantor decision-maker will accept the consequences of a nuclear strike, which is not a rational thing to do.
- The stability that extended nuclear deterrence is intended to establish depends on all parties accepting the same nuclear use, response, and escalation rules, sharing the same strategic mindset, an impossibility when neither the strategic intent nor the strategic objectives can be the same or even converge.

Since none of these propositions is necessarily true, the validity of extended nuclear deterrence is ultimately dependent on irrationality—the irrationality of the guarantor decision maker accepting unimaginable consequences on behalf of a third party. The fact that the dynamics of war, which are instinctive and visceral, can be considered and analyzed rationally does not render them rational. And the obverse is true: while it may be comforting, it is irrational for the client state to regard extended nuclear deterrence as an ultimate guarantee of national security.

'The logic of nuclear war' is perhaps the most dangerous oxymoron ever devised. The ability to conceptualize the inconceivable and to construct analytical structures does not create reality or substantiate validity. Any decision, on whatever grounds, that may lead to the annihilation of humanity is tantamount to auto-anthropophagy: self-consumption that can be contemplated as a dystopian concept but cannot be executed sanely or rationally. Earlier in this paper, reference was made to Fred Kaplan's *The Bomb*. An enthralling, powerful, and ultimately shocking journey through the nuclear age, Kaplan sums up the insanity of nuclear deterrence and nuclear war.

> With the spread of the bomb came a logic—a stab at a strategy—on how to deter its use in warfare. The logic involved convincing adversaries that you really would use the bomb in response to aggression; part of that involved convincing yourself that you would use it, which required building certain types of missiles, and devising certain plans, that would enable you to use them—and before you knew it, a strategy to deter nuclear war became synonymous with a strategy to fight nuclear war. And when crises arose, the logic encouraged, almost required, escalating the cycle of threats and counterthreats, just up to the point where deterrence and war converged, in order to maintain credibility. The compelling, and frightening, thing about the logic was that, once you bought into its premises, you fell into the rabbit hole; there seemed no exit. The [US] presidents who fell into this hole, who faced the abyss where the logic led, avoided its end point—avoided war—by scrambling out of the hole, snapping out of the logic, like snapping out of a bad dream.[36]

The logic of deterrence, if there is one, ultimately depends on the use of force, whether conventional or nuclear, to sanction an adversary's actions when deterrence has failed. The logic of deterrence is self-annihilating.

Apart from the logical, policy, and systemic disfunction of deterrence theory, Kaplan also identifies a fundamental institutional flaw in the exercise of deterrence and the decision to initiate a nuclear strike. The decision and responsibility rests solely with the president of the United States. There are no checks and balances. At a time when US President Trump's handling of the coronavirus pandemic has displayed confusion, impulsiveness, indecision, panic and vacillation,

[36] Fred Kaplan, *op. cit.*, pp. 297-8.

there were no grounds for confidence that the president was capable of determining a strategically credible and morally appropriate course of action in the face of nuclear brinksmanship. To apply a moral calculus, or even a strategic calculus, one must understand what it is.

If there is a single lesson that the coronavirus pandemic might deliver to US citizens, the allies of the United States, and the global community at large, it is this: the US Congress must address this fundamental flaw in US decision-making by developing a robust protocol determining precisely the powers exercisable by the president, the mechanism by which key decisions are reviewed, and the limits on Executive authority. The issue here is not to cloud or distribute decision-making. Much has been written about the complexity and compression of crisis decision-making,[37] with group decision-making models appearing even more fraught than those where there is a single point of decision. But, following President Truman's instinct, the US president needs civilian counsellors that might at least include the vice president (as president of the US Senate), the Speaker of the House of Representatives and the chief justice.

While a "no first use" policy may serve to constrain a delusional or 'madman' president from initiating a first strike on an adversary, it does not assist a decision-maker acting to respond to an adversary's first strike, where early warning systems may or not be reliable, early warning signals may or may not reach the decision-maker in immediate real-time, and the decision-maker may or may not have time to deliberate on the consequences of decisions taken or not taken.

Morton Halperin has proposed a bold solution to this problem. The United States should adopt a firm policy of no strike based only on warning. Rather, it would contemplate nuclear weapons retaliation only after nuclear weapons have exploded on the US homeland, on US forces wherever they might be, or, perhaps, on allied forces.[38]

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[37] See, for instance, John R. Harvey, "US Nuclear Command and Control for the 21st Century," *NAPSNet Special Reports*, 24 May 2019 https://nautilus.org/napsnet/napsnet-special-reports/u-s-nuclear-command-and-control-for-the-21st-century/, Alex Wellerstein, "NC3 Decision Making: Individual versus Group Process," NAOSNet Special Reports, 8 August 2018 https://nautilus.org/napsnet/napsnet-special-reports/nc3-decision-making-individual-versus-group-process/ and Jeffrey G. Lewis and Bruno Tertrais, The Finger on the Button: The Authority to Use Nuclear Weapons in Nuclear-Armed States, James Martin Centre for Nonproliferation Studies, February 2019 https://www.nonproliferation.org/wp-content/uploads/2019/02/Finger-on-the-Nuclear-Button.pdf

[38] Morton H. Halperin in correspondence with the author of this paper.

While US nuclear war plans have contemplated response to unprovoked attack, there are in reality no ‘black swans’—unpremeditated nuclear attacks without indicators or warnings. Even nuclear terrorism would have indicators. Whether the indicators and warnings are detected and heeded is another matter. This is where gaming, scenario planning, and rehearsal come to the fore, allowing decision-makers to practice the doomsday art. But given that the decision to use or not to use nuclear weapons is the most politically and strategically consequential decision a president may ever make, and that the US democracy is what gives the president the authority and power to take such a decision, the counsel of the highest national office holders would seem appropriate.

Accidental nuclear war would be a total rejection of civility and rationality in the conduct of relations between states. The global community has a deep and abiding interest in ensuring that it never happens, and its survival depends on it. Is it too much to demand of the NWS, even those like Russia that appear willing to use nuclear weapons for coercion as well as deterrence, that they negotiate NC^3 protocols to ensure that they are bound by the same decision rules, and that they subsequently force the other states possessing nuclear weapons to follow the same protocols? If it was possible for the P5 plus Germany and the EU to negotiate a nuclear deal framework with Iran in 2015 (sadly abandoned by the Trump Administration) there may be hope that controls on the possible acquisition of a nuclear weapons capability by one state could inspire the negotiation of controls on nuclear weapon use by states that already possess them.

While this should have been done in 1968 when major powers signed the NPT, it is never too late to return to the negotiating table. Perhaps the Treaty on the Prohibition of Nuclear Weapons will provide the stimulus needed to that end.

The Alternative to Extended Deterrence and Extended Nuclear Deterrence: Nuclear Disarmament

The sudden appearance of the COVID-19 pandemic has been a stark reminder of humanity’s vulnerability to massive shocks. In a world of nuclear weapons, the existential threat to humanity deriving from their use far outweighs whatever benefit small states might seek to derive from hiding under the nuclear umbrellas of powerful states. The domains of pandemic management, climate change mitigation and adaptation, and nuclear arms control and disarmament are remarkably similar. In each case, the world is at risk because of the denialism of some world leaders, the intransigence of others, and the chronic inertia of the world's citizens. And again, in the case of nuclear disarmament and climate change, the major treaty that underpins global efforts towards disarmament and the mitigation of global warming has been undermined by the constant shift of the "middle ground" away from high aspiration towards the lowest common denominator as key players erode the substance of earlier agreements.

It might be argued that extended nuclear deterrence is a way of balancing the uncertainties attaching to the continued presence of nuclear weapons in the arsenals of the Nuclear Weapon States (NWS) and the security costs incurred by the Non-Nuclear Weapon States (NNWS) in the 'twilight zone' between a nuclear armed world and a nuclear disarmed world. This would be analogous, however, to aiming for a kind of 'nuclear herd immunity': let the pathogen proliferate until there is an immunity equilibrium. But 'extended nuclear deterrence' is not some kind of nuclear security vaccine. At best, it is a prophylaxis. At worst, it is delusory, the security equivalent of 'snake oil.'

The NPT is often described as "the cornerstone of the global non-proliferation regime."[39] The problem is that the non-proliferation edifice is essentially a façade resting on a single corner, and that corner is crumbling. The question that faces the parties to the NPT is whether they want to strengthen the edifice—and the cornerstone—or whether they are prepared to see the NPT go the way of the New-START—desuetude.

Either way, there is much at stake. Reinvigorating the NPT will take enormous diplomatic effort on the part of the NNWS and significant concessions (and diplomatic sensibility) on the part of the NWS, especially those states that implicitly provide protection to the break-out states like Iran, Israel, and North Korea. Would it be too much to ask the NWS—all of them—to revitalize the 1994 Budapest Memorandum on Security Assurances so as to provide greater confidence to each other and the NNWS that nuclear weapon use could be prohibited and the weapons themselves eliminated? Desuetude, on the other hand, is the easy way out where blame can be allocated, the

[39] See, for example, John Carlson, "Is the NPT Still Relevant? – How to Progress the NPT's Disarmament Provisions," *Journal for Peace and Nuclear Disarmament*, Vol. 2, 2019 Issue 1 https://www.tandfonline.com/doi/full/10.1080/25751654.2019.1611187

finger pointed at disarmament idealists and so-called nuclear weapon realists alike, and the global community left captive to a dangerous stalemate. The parallels with the UN Climate Change Commission's Conference of the Parties (COP) are uncanny.

Yet the abandonment of the NPT, like the abandonment of the Paris Accords and President Trump's abandonment of the WHO in a time of pandemic, would sound the death knell for both the legitimacy and the effectiveness of the measures that are already in place pursuant to the treaty. The nuclear proliferation restraints and the nuclear fuel cycle safeguards, along with the institutions that manage them, that have taken the global community half a century to construct would be in the gravest jeopardy. The danger here is less with the mavericks and pariahs of the kind that have broken away previously from the global consensus, dangerous though they be, than it is with the 'break out' of major economic and political powers that may feel that there is no strategic option in an unconstrained world but to be similarly unconstrained. Turkey and Saudi Arabia are two states that appear already to be reviewing their options.

The perceived and real failure of extended nuclear deterrence is exactly the kind of development that could encourage the so-called defense realists in Germany, Japan, the ROK, and Australia to follow the path chosen by Israel, India, Pakistan, the DPRK and potentially Iran—the development of a nuclear weapon capability.

We have already seen glimmerings of this malaise. Paul Dibb, one of Australia's best-known defense commentators, coyly raised the question in late 2018, neither advocating the development of a nuclear weapon nor dismissing it on either moral or strategic grounds. While the subliminal strategic concern was China's massive expansion of its conventional military capabilities to "threaten us seriously" (invoking a kind of antipodean *force de frappe*),[40] Dibb surprisingly puts the question in terms of our alliance with the United States.

> . . . We face a stark dilemma: increasing uncertainty about US extended nuclear deterrence versus the daunting alternative of acquiring our own nuclear deterrent. The other alternative is to simply accept (as we did in the Cold War) that we are a nuclear target and take our

[40] The French *force de frappe* doctrine is a policy based on dissuasion and retaliation in the event of a conventional war threat, as well as the threat of a nuclear war.

> chances. My view is that Australia should at least be looking at options and lead times. Doing so doesn't commit us to proliferating.[41]

Another leading Australian defense commentator, Hugh White, is no less adamant that the nuclear weapons question is one "we will not be able to avoid over the decades to come."[42] The fact that two of Australia's leading defense thinkers should revisit an issue that Australia's ratification of the NPT might have been thought to have resolved is noteworthy. And that their so doing caused barely a ripple, except for an elegant rebuttal by Ramesh Thakur, is also noteworthy.[43] But these developments are not simply a sign of the uncertainty that distinguishes the contemporary world. They are also a sign that the 'extended nuclear deterrence' has failed, and that the NPT has failed to deliver the confidence and security that it was intended to do. As Andrew Brown and Lorna Arnold noted a decade ago,

> The effectiveness, extravagance and risks of nuclear deterrence need to be carefully reassessed, because, unlike deterrence in the animal kingdom, it contains the seeds of species destruction rather than promoting individual preservation. Whenever a state decides to acquire or renew nuclear weapons in the name of deterrence, it feeds nuclear proliferation.[44]

The return to consideration of the acquisition of nuclear weapons by NNWS is also, of course, a sign that defense commentators are more inclined to view the nuclear weapons issue through the lens of military force rather than through the lens of securing and maintaining the peace. That, they might say, is their job. But whether contemplating nuclear war—a war that ultimately cannot be won—and building the systems to conduct such a war is a morally defensible way to maintain the peace is the core strategic question, because it contemplates annihilation as preferable to defeat.

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[41] See Paul Dibb, "Should Australia develop its own nuclear deterrent?" *The Strategist*, 4 October 2018 https://www.aspistrategist.org.au/should-australia-develop-its-own-nuclear-deterrent/

[42] See Hugh White, *How to Defend Australia* (Melbourne: Latrobe University Press in conjunction with Black Inc, 2019), p. 231.

[43] See Ramesh Thakur, "The bomb for Australia?" (Parts 1-3), *The Strategist*, 17 January 2018, 19 January 2018 and 22 January 2018 https://www.aspistrategist.org.au/bomb-australia-part-1/; https://www.aspistrategist.org.au/bomb-australia-part-2/; https://www.aspistrategist.org.au/bomb-australia-part-3/

[44] See Andrew Brown and Lorna Arnold, *art.cit.*, p. 308.

As President Reagan said, "A nuclear war cannot be won and must never be fought."[45] The peace, however, can be won, and that is the job of an engaged and sustained international diplomacy. Winning the peace is the task that the global community now confronts in more urgent terms than ever before, and a more active and focused diplomacy is the task that governments must now sign up to more than ever before.

Rebuilding Trust, Leadership, and Confidence

This essay began with the somber observation that, in the COVID-19 world, trust is in retreat. It is imperative that the western democracies embark on rebuilding global trust as a matter of urgency. Uncertainty can breed fatalism. Christopher Clark's magisterial *The Sleepwalkers* described how short-termism, unsubstantiated assumptions, carelessness and a measure of deviousness led the global community into the catastrophe of WW1. Europe's leaders may have been well-meaning, but they were incompetent. There was a trust deficit that matched both their leadership incompetence and their complacency.

Building trust is the business of diplomacy, and the COVID-19 world demands a significant reinvestment in diplomacy by all nations, but particularly by the world's leading economies (the G20).

And if trust is in short supply, so too is leadership. It is no longer adequate to look to the world's great powers to provide the leadership to which the global community has become accustomed since the end of WW2. The much-vaunted international rules-based order did not happen by accident: it was an artefact of post-WW2 leadership, not just by Presidents Truman and Eisenhower, but by the leaders of countries large and small who wanted to avert the possibility of the cataclysm that was WW2. Remarkable people like Dag Hammarskjöld and U Thant, from Sweden and Burma (Myanmar) respectively, were able to provide the leadership that the global community so needed.

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[45] President Ronald Reagan, *Address before a Joint Session of the Congress on the State of the Union*, 25 January 1984 https://www.reaganlibrary.gov/federal-records

And with that leadership came the confidence that marked the second half of the twentieth century, the Cold War notwithstanding. Through cooperation, the global community can manage the consequences of the COVID-19 pandemic, just as it can reduce the threat of nuclear war through disarmament negotiations and the effects of climate change by setting and meeting agreed targets. And that, as history shows, is easier and less costly than reconstruction and rehabilitation after catastrophic events.

So, quite simply, the nations represented at the COVID-19 Pandemic-WMD Conference have no alternative but to take up the challenge of a sustained disarmament campaign. As the evolutionary biologist and psychologist David Barash has written, "undoing the ideology—verging on theology—of deterrence won't be easy, but neither is living under the threat of worldwide annihilation."[46] None of the nations represented here have the power to recreate the past. But they can ride on its back to shape the future. They need to follow as five-point program:

- As a high priority, they must reinvest in their negotiating capacity—the people and the domain expertise necessary to push the disarmament agenda forward. Each nation represented at the COVID-19 Pandemic-WMD Conference has power. But they need to appreciate the force of Hans Morgenthau's observation that the quality of national diplomacy is the most important of the factors that make for the power of the nation.[47]
- They must re-engage with like-minded countries to create the community of nations necessary to give body and ballast to the constructive and convergent policies that must be at the center of a new set of rules to disarm the world effectively. This is not a recall to the 'usual suspects'—the well-intentioned Western countries—but the newly emerging powers like Indonesia and Vietnam, Nigeria and Kenya.
- They must militate to ensure that Russia and the United States rekindle the New-START negotiations and bring China into their dialogue.

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[46] David Barash, "Nuclear deterrence is a myth. And a lethal one at that," The Guardian, 14 January 2018 https://www.theguardian.com/world/2018/jan/14/nuclear-deterrence-myth-lethal-david-barash

[47] Hans J. Morgenthau with Kenneth Thompson, *Politics Among Nations: The Pursuit of Power and Peace*, 6th ed. (New York: Alfred A. Knopf, 1986): 105. See also Anthony Lang, "Phronesis, Morgenthau and Diplomacy," *E-International Relations*, 7 November 2013 https://www.e-ir.info/2013/11/07/phronesis-morgenthau-and-diplomacy/

- Those that are allies of the United States, particularly Australia and Japan, must leverage their historical defence relationships to persuade the United States that nuclear war is never in the interests of the United States or its allies.
- And it is of critical importance that the members of the Association of South East Asian Nations (ASEAN) and the other nations of Asia—the economic powerhouse of the 21st century—play their part in building a safer world. Indonesia, Vietnam, Thailand, Malaysia, and Singapore must be heard.

At this point, the prospects of advance and sustained progress may look bleak. That is precisely why collective action is needed. For the NNWS, there are three issues that need early resurrection: the proposed cut-off of the production of fissionable material; the proclamation of a 'no first use' by the NWS and the other states possessing nuclear weapons; and the further strengthening of the IAEA safeguards and inspections regime and their application to the NWS. It must be understood that the NWS are not special cases, but rather deviant cases that have failed to honor their obligations under the NPT.

This is the challenge facing all nations represented at the conference. Failure to meet this challenge is to fail the generations to come.

9. Chemical Weapons in the Asia-Pacific: History, Science, and Future Prospect

Jonathan Forman and Alexander Kelle

Introduction[1]

From ancient times through 20th century wars, chemicals as weapons have a long history, with development and use of chemical weapons by both state and non-state actors. Since 1997, with the entry-into-force of the Chemical Weapons Convention (CWC), the nations of world have agreed to eliminate chemical weapons and allow the verified destruction of stockpiles declared by possessor States. The Asia-Pacific region[2] includes three possessor states: Russia, the ROK, and the United States, as well as chemical munitions abandoned by other states in past wars, most notably by Japanese forces while retreating from China at the end of the Second World War. The DPRK, however, remains outside the CWC and is widely believed to maintain a chemical weapon stockpile. Alongside the efforts of states at chemical demilitarization, chemicals have continued to be used in harmful ways by terrorist groups and in targeted attacks that are linked to several Asia-Pacific States.

Science and technology have provided us with advancements well beyond the state-of-the-art that produced the chemical arsenals of 20th century militaries and is often called out as a challenge to

[1] The views expressed herein are those of the authors and do not necessarily reflect those of OPCW. Alexander Kelle's contribution to this report has benefitted from a grant of the German Foundation for Peace Research to the IFSH, grant number SP03/05/2020. This support is herewith gratefully acknowledged.
[2] In this narrative, we focus on the internationally recognized states of Asia-Pacific that make up the Pacific Rim, excluding Central and South America and New Zealand. These are: Australia, Canada, China, Democratic People's Republic of Korea (DPRK), Fiji, Indonesia, Japan, Kiribati, Marshall Islands, Malaysia, Micronesia, Nauru, Palau, Papua New Guinea, Philippines, Republic of Korea (ROK), Russia, Samoa, Singapore, Solomon Islands, Tonga, Tuvalu, United States, Vanuatu, and Vietnam.

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maintaining the norms of the CWC. Yet, we also see scientific research with potential to strengthen capabilities to control, prevent, and respond to chemical threats; and

recent examples of chemical attacks have not showcased the adoption of advanced technologies, as much as they have demonstrated unexpected approaches for deployment of previously known chemical weapons. The misuse of chemistry to harm people, the verification of destruction of chemical arsenals, and the effective mitigation and response to chemical threats requires a sound understanding of the underlying scientific basis of chemical weapons and associated technologies. These activities also require transdisciplinary technical capabilities. At the same time, disarmament and non-proliferation instruments like the CWC have set clear boundaries on what defines a chemical weapon and what chemical weapon related scientific research and development is allowed. This report will discuss the history of chemical weapons use and programs, progress in chemical disarmament, and aspects of the science and technology that informs these efforts. The chapter concludes with an assessment of the current state of affairs and provides an outlook on the future prospects for chemical weapons use and mitigation in the Asia-Pacific.

Chemicals in War and the Prohibition of Chemical Weapons

Chemicals have seen use in war throughout history from ancient to modern times,[3,4] with weaponized chemicals encompassing a broad range of substances and harmful effects. Familiar and historical examples include incendiary mixtures such as "Greek fire"[3] and napalm,[5,6] pyrophoric materials such as white phosphorus (commonly used for illumination and generation

[3] A. Mayor. *Greek Fire, Poison Arrows & Scorpion Bombs: Biological and Chemical Warfare in the Ancient World*; Overlook Press: New York, 2003.

[4] For a history of 20th century CBW use see (a) J. Tucker. *War of Nerves. Chemical Warfare from World War I to Al Qaeda*, New York: Pantheon, 2006. (b) *The Problem of Chemical and Biological Warfare, Volume 1: The Rise of CB Warfare*, SIPRI, Stockholm 1971, https://www.sipri.org/publications/2000/problem-chemical-and-biological-warfare.

[5] "Army Talks About Napalm Chemical Corps reveals some technical information on the chemistry and manufacture of incendiary gels". *Chem. Eng. News* 1954, 32, *27*, pp. 2690–2692. DOI: 10.1021/cen-v032n027.p2690.

[6] M. Lumsden. *Incendiary weapons*. Stockholm International Peace Research Institute, MIT Press, Cambridge, Mass., 1975, pp. 227-249.

of smoke),[6] poisons for coating the tips of weapons,[3,7] gun powder (invented in 10th century China[8]) and explosives,[9] toxic and asphyxiating gases (such as chlorine),[4,7,10] blistering agents (such as sulfur mustard),[11] nerve agents (such as sarin),[12] and herbicides (the most infamous being agent orange which was used in conflicts in Malaya and Vietnam).[13]

Asia-Pacific states began contributing to international efforts to restrict the use of chemical weapons in the 19th century. In 1874, an initiative was put forward by Czar Alexander II of Russia, which led to the Brussels Declaration Concerning Laws and Customs of War. The declaration included a ban on the use of poison and poisoned weapons within its prohibitions; however, it never entered into force.[14] The discussions that began in 1874 did lead to agreements on banning poisons and poisoned weapons, as well as the use of projectiles that diffuse asphyxiating or deleterious gases through provisions found within the Hague Conventions of 1899 and 1907.[15] Before the first-world war, Asia-Pacific states party to these Conventions included China, Fiji, Japan, Korea, Russia, and the United States, additionally territories and colonies in Asia-Pacific would have been obligated to these Conventions through colonial powers that were party to the Hague Conventions (which included the major world powers of the day).[16]

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[7] Kim Coleman, *A History of Chemical Warfare*. Palgrave Macmillan, United Kingdom, 2005. DOI 10.1057/9780230501836.

[8] J. Kelly. *Gunpowder: Alchemy, Bombards, And Pyrotechnics: The History of The Explosive That Changed The World*. Atlantic Press, 2004.

[9] G. I. Brown. *The Big Bang: A History of Explosives*. Sutton: Stroud, UK, 1998. ISBN 0-7509-2361-X.

[10] S. Everts. "When Chemicals Became Weapons of War." *Chem. Eng. News* 2015, *93(9)*, 21; https://chemicalweapons.cenmag.org/when-chemicals-became-weapons-of-war/#:~:text=The%20release%20of%20poison%20gas,Haber%2C%20the%20weapon's%20main%20advocate

[11] J. McManus, K. Huebner. "Vesicants." *Critical Care Clinics.* 2005, *21(4)*, pp. 707-18. DOI: 10.1016/j.ccc.2005.06.005.

[12] S. Costanzi, J. H. Machado, M. Mitchell. "Nerve Agents: What They Are, How They Work, How To Counter Them". *ACS Chem. Neurosci*. 2018, *9 (5)*, pp. 873– 885. DOI: 10.1021/acschemneuro.8b00148.

[13] J. Stellman, S. Stellman, R. Christian, T. Weber, C. Tomasallo. "The extent and patterns of usage of Agent Orange and other herbicides in Vietnam." *Nature* 2003, *422*, pp. 681–687. DOI: 10.1038/nature01537.

[14] International Declaration concerning the Laws and Customs of War. Brussels, 27 August 1874; available at: https://ihl-databases.icrc.org/ihl/INTRO/135

[15] (a) Convention (II) with Respect to the Laws and Customs of War on Land and its annex: Regulations concerning the Laws and Customs of War on Land. The Hague, 29 July 1899; available at: https://ihl-databases.icrc.org/ihl/INTRO/150. (b) Convention (IV) respecting the Laws and Customs of War on Land and its annex: Regulations concerning the Laws and Customs of War on Land. The Hague, 18 October 1907; available at: https://ihl-databases.icrc.org/ihl/INTRO/195

[16] The USA did not ratify the declaration on the use of projectiles for delivering asphyxiating or deleterious gases.

With the First World War giving rise to the use of toxic chemicals on a scale never before seen in the history of war,[3,7,10] the Hague Convention bans on poisons and gases were short lived. This war saw chemicals deployed on industrial scales, as well as research and development that led to the weaponization of new types of chemicals posing both breathing and skin contact hazards. The first recorded use of chemicals in World War I was the firing of tear gas by French forces in 1914,[17] and by the end of the conflict numerous other chemical substances, many with far greater lethality and hazardous properties, had been tested and/or deployed in battle.[4,7,10,17]

The use of chemicals in World War I gave rise to the Geneva Protocol of 1925. This agreement banned asphyxiating, poisonous or other gases and analogous liquids, materials, or devices in war, and also bacteriological methods of warfare.[18] The Protocol allowed states to ratify with reservations allowing the use of the banned weapons against states not party and in retaliation to an attack using banned weapons. By the mid-1930's, States Parties from Asia-Pacific included Australia, Canada, and Russia (as the Soviet Union). Chemical weapons were still used in the region in World War II by Japanese forces in China,[19] and tear gas was deployed against enemy combatants by the United States in the Vietnam war.[20] Both Japan and the United States had signed the Geneva Protocol in 1925, but these states did not ratify/accede to the protocol until 1970 (Japan) and 1975 (USA) respectively.[18] China became a State Party to the Geneva Protocol in 1952 and Vietnam in 1970, With the exception of Kiribati, Micronesia, Marshal Islands, Nauru, Palau, Samoa, Singapore, Tuvalu, and Vanuatu, which are not party to the protocol, the other States in the region joined after World War II.[18]

[17] S. Everts. A Brief History of Chemical War: For more than 2,000 years human ingenuity has turned natural and synthetic poisons into weapons of war. *Distillations* May 11, 2015; https://www.sciencehistory.org/distillations/a-brief-history-of-chemical-war#:~:text=Three%20substances%20were%20responsible%20for,%2C%20phosgene%2C%20and%20mustard%20gas

[18] Protocol for the Prohibition of the Use of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare. Geneva, 17 June 1925; available at: https://ihl-databases.icrc.org/applic/ihl/ihl.nsf/INTRO/280

[19] (a) Japanese Chemical Weapons Program, Federation of American Scientists; https://fas.org/nuke/guide/japan/cw/. (b) A detailed Japanese report on chemical weapon use in China recently became available: https://www.japantimes.co.jp/news/2019/07/08/national/history/detailed-report-documents-japans-use-nerve-agents-second-sino-japanese-war/

[20] M. Meselson. "Tear Gas in Vietnam and the Return of Poison Gas". *Bulletin of the Atomic Scientists* 2015*, 27(3)*, pp. 17-19. DOI: 10.1080/00963402.1971.11455334.

During the Cold War, the United States and the Soviet Union produced large stockpiles of chemical weapons, including highly toxic organophosphorus nerve agents,[12] and programs to develop new types of chemical weapons continued in a number of states.[12] Discussions to ban both chemical and biological weapons began again at the Disarmament Conference in Geneva in 1968. The Biological and Toxins Weapons Convention opened for signature in 1972,[21] but the negotiations that eventually led to the Chemical Weapons Convention (CWC),[22] which comprehensively prohibits chemical weapons, continued. It was not until 1993, that the CWC opened for signature, with its entry-into-force in 1997.

The CWC opened a new era in prohibiting chemical weapons. Unlike the multilateral treaties that preceded it, with exception of the Biological and Toxin Weapons Convention (BTWC), it was a complete ban on an entire class of weapons of mass destruction (WMD). In contrast to the BTWC, however, it created an implementing organization, the Organisation for the Prohibition of Chemical Weapons (OPCW),[23] and included a verification regime. Today there are 193 States Parties to the CWC.[24] Only four world states remain outside this Convention; only one of these states is in Asia-Pacific, the DPRK. The successes of the CWC were recognized by the award of the Nobel Peace Prize to OPCW in 2013 for its extensive efforts to eliminate chemical weapons.[25]

The CWC prohibits the development, production, acquisition, stockpiling, retention, transfer, or use of chemical weapons. State Parties must destroy chemical weapon stockpiles and chemical weapon production facilities in their possession. As of March 2022, 71,614 (99%) of the 72,304 metric tonnes of chemical warfare agents declared by States Parties have been destroyed under international verification.[26] Of the ninety-seven declared chemical weapons production facilities, seventy-four have been destroyed and twenty-three converted to other (allowed) uses, all under international verification.[26] States Parties must also participate in a verification regime that allows

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[21] *Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction*; http://disarmament.un.org/treaties/t/bwc
[22] *Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction*; Organisation for the Prohibition of Chemical Weapons; www.opcw.org/chemical-weapons-convention/
[23] Organisation for the Prohibition of Chemical Weapons; www.opcw.org
[24] Organisation for the Prohibition of Chemical Weapons Member States; www.opcw.org/about-us/member-states
[25] The Nobel Peace Prize 2013. https://www.nobelprize.org/prizes/peace/2013/summary/
[26] (a) Organisation for the Prohibition of Chemical Weapons by the Numbers; www.opcw.org/media-centre/opcw-numbers. (b) Further details on summary statistics of implementation of the CWC can be found in OPCW Annual Reports, available at: www.opcw.org/resources/documents/annual-reports

international inspectors access to their chemical facilities, including commercial production sites.[27] These states must also implement national laws that include provisions for the regulation of production and transfer of certain "Scheduled" chemicals.[28] Additionally, the CWC contains Articles for providing assistance and protection for States Parties in the event of a chemical incident,[29] promoting and supporting peaceful uses of chemistry, and scientific knowledge sharing and collaboration.[30] Furthermore, the CWC bans the use of riot control agents (e.g., tear gas) as a weapon of war,[31] but it does not provide for any restrictions on the use of riot control agents for law enforcement purposes[32] (national laws of the individual states govern such use).

The history of chemical weapons focused on chemicals typically described as poisons (toxic substances) and toxic gases, while the CWC introduced a more precise definition, where "chemical weapons" are defined by one or more of the following criteria:[33]

(a) Toxic chemicals and their precursors, except where intended for purposes not prohibited under this Convention [the CWC], as long as the types and quantities are consistent with such purposes.

(b) Munitions and devices, specifically designed to cause death or other harm through the toxic properties of those toxic chemicals specified in point (a) above, which would be released as a result of the employment of such munitions and devices.

[27] Fact Sheet 5: Three Types of Inspections; Organisation for the Prohibition of Chemical Weapons: The Hague, November 2017.
[28] Annex on Chemicals. *Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction; Organisation for the Prohibition of Chemical Weapons*. The Hague, 2020; www.opcw.org/chemical-weapons-convention/annexes/annex-chemicals/annex-chemicals
[29] Organisation for the Prohibition of Chemical Weapons Capacity Building (Assistance and Protection); www.opcw.org/resources/capacity-building. See also CWC Article X: Assistance and Protection Against Chemical Weapons; www.opcw.org/chemical-weapons-convention/articles/article-x-assistance-and-protection-against-chemical-weapons
[30] Organisation for the Prohibition of Chemical Weapons Capacity Building (International Cooperation); www.opcw.org/resources/capacity-building. See also CWC Article XI: Economic and Technological Development; www.opcw.org/chemical-weapons-convention/articles/article-xi-economic-and-technological-development
[31] See CWC Article I: General Obligations www.opcw.org/chemical-weapons-convention/articles/article-i
[32] For "Purposes Not Prohibited," see: Definitions and Criteria, paragraph 9; www.opcw.org/chemical-weapons-convention/articles/article-ii-definitions-and-criteria
[33] See CWC Article II: Definitions and Criteria, paragraph 1; www.opcw.org/chemical-weapons-convention/articles/article-ii-definitions-and-criteria

(c) Any equipment specifically designed for use directly in connection with the employment of munitions and devices specified in point b above.

Criterion (a) is a complete prohibition of “toxic” chemicals and their precursors, unless that chemical has a legitimate use (and any state possessing that toxic chemical can show that the amounts it possesses are consistent with that legitimate use). Criteria (b) and (c) are also important as they indicate a chemical weapon does not need to be a discrete chemical substance; it can also be equipment or munitions used in the weaponization of that chemical.

Applying criterion (a) required the drafters of the CWC to define the term “toxic chemical”:

“Any chemical which through its chemical action on life processes can cause death, temporary incapacitation or permanent harm to humans or animals. This includes all such chemicals, regardless of their origin or of their method of production, and regardless of whether they are produced in facilities, in munitions or elsewhere.” [34]

It follows that when referring to WMDs, under international law, chemical weapons are specifically chemicals whose toxic properties are used to harm humans and animals, which excludes incendiary chemicals, explosive chemicals, and herbicides from being considered “chemical weapons” (unless these chemicals are used in a manner that intentionally exploits their toxic properties against humans or animals).

The History of Chemical Weapons and their Prohibition in Asia-Pacific

The Asia-Pacific region has been exposed to the development and use of chemical weapons by both state and non-state actors over the past century. This section of the paper will discuss this history of chemical weapon usage and the participation of states from the region in the global chemical weapons prohibition regime codified in the 1993 CWC. It will focus on chemical weapons programs and use by Imperial Japan, the United States, the Former Soviet Union (FSU),

[34] IBID, paragraph 2.

the People's Republic of China, the ROK, and the DPRK. In addition, the most notorious case of non-state actor use of chemical weapons, by the Japanese Aum Shinrikyo cult, is briefly presented.

Of the eight states that have declared possession of chemical weapons to the OPCW,[35] three are regional states: the United States, Russia (declaring the stockpile of the FSU), and the ROK. However, the history of 20th century chemical warfare saw another regional power, Imperial Japan, use chemical weapons during the first half of the 20th century. The Japanese Imperial Forces had produced a number of chemical weapon agents, including phosgene, mustard, and lewisite. Before and during the Sino-Japanese war some of these were used in China. At the end of the war Japan's chemical weapons in China, estimated at about 700,000 munitions, were dumped into rivers or buried. "Most of the Abandoned Chemical Weapons (ACW) in China are buried in the Haerbaling District of the City of Dunhua, Jilin Province.[19] With the entry into force of the CWC in 1997, Japan has assumed responsibility for destroying the chemical weapons it abandoned on Chinese territory. This process began in 2010[36] and, given the large number of chemical munitions involved, is going to last for some more years to come.

Apart from the abandoned chemical weapons left behind on its territory, China only declared to the OPCW that it had destroyed all its past chemical weapon production facilities (CWPFs) and only conducts defensive Chemical Weapons (CW) research, which is permitted under the CWC. While China never declared that it transferred chemical weapons to another state in the past, during Albania's chemical weapon destruction process some chemical munitions were discovered with Chinese markings on them.[37] While this would be consistent with Albania not having declared a CWPF, the origin of some of its chemical munitions was never fully clarified.

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[35] The following states have declared chemical weapons to the OPCW: Albania, India, Iraq, Libya, Syria, Russia, ROK, and the United States. See P. Walker. "Three Decades of Chemical Weapons Elimination: More Challenges Ahead." *Arms Control Today* 2019; https://www.armscontrol.org/act/2019-12/features/three-decades-chemical-weapons-elimination-more-challenges-ahead. As of November 2020, all states except the United States have completed the destruction of the declared stockpiles. The United States estimates completion in 2023. Further information on the US chemical weapon destruction program is available from: Program Executive Office, Assembled Chemical Weapons Alternatives; https://www.peoacwa.army.mil/

[36] *Report of the OPCW on the Implementation of the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction in 2010,* C-16/4, OPCW: The Hague, 29 November 2011; www.opcw.org/sites/default/files/documents/CSP/C-16/en/c1604_e_.pdf

[37] M. V. Tompkins, Albania's Chemical Weapons Con, *The Nonproliferation Review*, 2009, Vol.16, No.1, pp. 65-77; Ivan Lebedev, "Allegedly Chinese-Made Chemical Weapons Found in Albania," *ITAR-TASS News Agency*, January 11, 2005.

The United States amassed the world's second largest declared chemical weapons stockpile with over 28,000 metric tonnes of CW produced and located in several different CW storage facilities (CWSF). Due to legislation passed by the US Congress, CW destruction facilities (CWDF) had to be built at each of the CWSFs. While the largest part of the US CW stockpile has been verifiably destroyed, protests against some of the planned destruction technologies led to delays in the destruction process at two CWDFs.[38] Currently, the completion of CW destruction in the last two remaining facilities – Pueblo, Colorado and Blue Grass, Kentucky - are scheduled for 2023.[39]

The FSU accumulated the world's largest declared chemical weapons stockpile of 40,000 metric tonnes of nerve and blister agents in bulk storage as well as munitions, these were spread over seven CWSFs. Like all other possessor states, Russia, as successor to the FSU was unable to meet the destruction deadline of April 2007, as contained in the CWC. With the assistance of the United States and other Western states the Russian Federation completed destruction of the declared FSU chemical weapon stockpile in September 2017.[40] However, Russia has been accused of being behind two assassination attempts involving the use of military-grade nerve agents in 2018[41] and 2020,[42] and some Western states believe that Russia has not fully declared or stopped its entire chemical weapons program.[43,44] While the Western states have expressed condemnation of Russia

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[38] See *Chemical Weapons: Destruction Schedule Delays and Cost Growth Continue to Challenge Program Management,*
GAO-04-634T, United States Government Accounting Office, 2004; https://www.gao.gov/products/gao-04-634t.

[39] See the US government implementing agency's vision statement at https://www.peoacwa.army.mil/about-peo-acwa/.

[40] "OPCW Marks Completion of Destruction of Russian Chemical Weapons Stockpile"; www.opcw.org/media-centre/news/2017/10/opcw-marks-completion-destruction-russian-chemical-weapons-stockpile

[41] M. Peplow. "Nerve agent attack on spy used 'Novichok' poison Chemical weapon used in U.K. assassination attempt was developed by Soviet Union during Cold War" *Chem. Eng. News* 2018, *96(12)*; https://cen.acs.org/articles/96/i12/Nerve-agent-attack-on-spy-used-Novichok-poison.html.

[42] R. Stone. "How German military scientists likely identified the nerve agent used to attack Alexei Navalny", *Science* 8, September 2020; DOI: 10.1126/science.abe6561.

[43] (a) S. Costanzi, G. D. Koblentz, "Controlling Novichoks after Salisbury: revising the Chemical Weapons Convention schedules." *The Nonproliferation Review*, 2019, *26(5-6)*, pp. 599-612. DOI: 10.1080/10736700.2019.1662618. (b) "EU imposes sanctions on Kremlin chiefs over Alexei Navalny poisoning", *The Guardian*, 15 October 2020; https://www.theguardian.com/world/2020/oct/15/eu-announces-sanctions-against-kremlin-chiefs-over-alexei-navalny-poisoning

[44] (a) US Department of State, *Compliance With the Convention of the Prohibition of the Development, Production, Stockpiling, and Use of Chemical Weapons and on Their Destruction. Condition (10)(C) Report*, Washington, D.C., June 2020; https://www.state.gov/wp-content/uploads/2020/06/2020-10C-Report-Unclassified-Version-for-H.pdf.
(b) US Department of State, *Compliance With the Convention of the Prohibition of the Development, Production, Stockpiling, and Use of Chemical Weapons and on Their Destruction. Condition (10)(C) Report*, Washington, D.C., April 2021; https://www.state.gov/wp-content/uploads/2021/04/2021-Condition-10-c-Report.pdf.

for these incidents, mechanisms within the CWC to address non-compliance have been invoked only to a limited extent.[45]

An officially unidentified chemical weapon possessor state known in OPCW publications as "A State Party" is widely understood to be ROK, which ratified the CWC in 1997 and declared its chemical weapon stockpile and a production facility.[46] According to one estimate the size of ROK's stockpile was 3,126 metric tonnes.[47] Following media reports, the ROK's military built and operated a CWDF to eliminate all chemical munitions at a site in Yeongdong Chungcheong.[48] The ROK completed destruction of its stockpile in July 2008 as the second possessor state to do so.[49]

The DPRK has neither signed nor ratified the CWC. However, in 1989 it acceded to the 1925 Geneva Protocol, which prohibits the use of chemical and biological weapons, but not their development, production, or storage. Estimates by the United States and ROK authorities of a DPRK chemical weapons stockpile have varied over time, but since the 1990's seem to have revolved around the figure of 5,000 metric tonnes of various chemical warfare agents stockpiled, including highly toxic nerve agents.[50] It has also been reported that the DPRK has assisted other states, such as Syria, in their chemical weapon acquisition efforts.[51] Any efforts, pursued either bilaterally, or by the OPCW, to draw the DPRK closer to the CW prohibition regime have so far gone unanswered.

The notion of DPRK possessing a well-developed chemical weapons program, including so-called "binary chemical warfare agents," received further support when Kim Jong-nam, the half-brother

[45] Only the clarification procedure in Article IX (2) has been used. O.Meier, A. Kelle, "The Navalny poisoning: Moscow evades accountability and mocks the Chemical Weapons Convention"; https://thebulletin.org/2021/10/the-navalny-poisoning-moscow-evades-accountability-and-mocks-the-chemical-weapons-convention/ Additional provisions include challenge inspections (CWC Article IX), investigations of alleged use (article X), measures to ensure compliance (CWC Article XII), and procedures for settlement of disputes (CWC article XIV); www.opcw.org/chemical-weapons-convention

[46] *SIPRI Yearbook 1998*, p. 461, footnote 19; https://www.sipri.org/yearbook/archive

[47] See https://www.globalsecurity.org/wmd/world/rok/cw.htm

[48] *Report: Korean Army Built Factory to Destroy Chemical Weapons*, Deutsche Presse-Agentur, 9 May 2000, quoted at https://www.nti.org/learn/countries/south-korea/

[49] *SIPRI Yearbook 2009*, pp. 419-20; https://www.sipri.org/yearbook/archive

[50] International Crisis Group, *North Korea's Chemical and Biological Weapons Programs*, Asia Report N°167, 18 June 2009; www.crisisgroup.org

[51] Ibid, pp. 9-10; M. Schwirtz, "UN Links North Korea to Syria's Chemical Weapons Program," *The New York Times*, 27 February 2018; https://www.nytimes.com/2018/02/27/world/asia/north-korea-syria-chemical-weapons-sanctions.html

of DPRK leader Kim Jong-un, was attacked with what subsequently was identified as the nerve agent VX at Kuala Lumpur airport in Malaysia in early 2017.[52] The attack was conducted by two female assailants (one a national of Indonesia and the other of Vietnam) who each smeared his face with a cloth, which has led experts to conclude that two components of a binary version of VX were applied. Kim Jong-nam died shortly after the attack on the way to hospital. This attack was met with international condemnation and the adoption of additional sanctions, for example, by the United States.[53] The DPRK denied any involvement and refused to cooperate with Malaysian authorities investigating the incident.[54] In 2019 the charges against the accused Indonesian citizen of the incident were dropped by Malaysian authorities. Subsequently, "the accused from Vietnam was sentenced to three years and four months jail," which concluded the legal proceedings resulting from the 2017 VX incident.[55]

The most notorious case of terrorist chemical weapon use in the Asia-Pacific was carried out by the Aum Shinrikyo doomsday cult during the mid-1990s. Two attacks with the nerve agent sarin were conducted in the city of Matsumoto in 1994 and in the Tokyo subway system in 1995 leading to the deaths of nineteen people and temporary hospitalizations for over a thousand more.[56] As investigators suspected that the first of the two incidents had been committed by the cult, and with cult members aware that the police were conducting a criminal investigation, the cult stopped running its CWPFs in early 1995. When a police raid appeared imminent, the cult hastily staged the Tokyo subway attack with sarin-filled plastic bags that were placed on three subway trains and punctured to allow sarin vapors to escape from the packaging. Besides the crude dispersal mechanism, another important aspect of Aum Shinrikyo employing chemical agents lies in their failure to weaponize biological agents—chemicals were their fallback option—after the

[52] D. Bradle. "VX nerve agent behind Kim Jong-Nam's murder," *Chemistry World*, 24 February 2017; https://www.chemistryworld.com/news/vx-nerve-agent-behind-kim-jong-nams-murder/2500460.article#/

[53] "OPCW Executive Council Condemns Chemical Weapons Use in Fatal Incident in Malaysia"; https://www.opcw.org/media-centre/news/2017/03/opcw-executive-council-condemns-chemical-weapons-use-fatal-incident;

[54] C. Vestergaard, *Chemical Assassination: The Role of International Organizations*, Commentary, 2 March 2017, available at: https://www.stimson.org/2017/chemical-assassination-role-international-organizations/.

[55] Malaysia: *Statement by H.E. Ambassador Ahmad Nazri Yusof Permanent Representative of Malaysia to the OPCW at the Ninety-First Session of the Executive Council*, OPCW: The Hague, 10 July 2019, p..2; https://www.opcw.org/resources/documents/executive-council/ec-91

[56] J. Tucker, *War of Nerves. Chemical Warfare from World War I to Al-Qaeda*, New York: Pantheon Books 2006, pp. 333ff.

difficulties they encountered with biological weapons proved insurmountable.[57] As the very detailed investigation after the attacks showed, Aum Shinrikyo had considerable resources at its disposal that were put into its chemical weapon program, which resulted in nineteen fatalities. This shows that chemical weapons do not automatically present an easy path for terrorists to induce mass casualties, albeit mass disruption was clearly a significant result of the attack.

While subsequent terrorist activities have not reached the level of disruption or casualties of the Aum Shinrikyo attacks of the 1990s, terrorism in the Asia-Pacific region continues to be a threat and some terrorist groups moving to the use of unconventional weapons, including chemical weapon agents, cannot be excluded.[58] An important group of states that seeks to prevent dual-use chemical materials and technologies from getting in the hands of proliferators or terrorists has become known as the Australia Group. Founded in the mid-1980s, three states from the Asia-Pacific region participate in the activities of the group: the United States, Japan, and the ROK.[59]

Science, Technology, and Chemical Weapons

The CWC is a treaty underpinned by science and technology, which, for review of treaty implementation, and in the discussion of what the future may bring, is a central theme.[60] This section seeks to examine some of the scientific dimensions and how scientific and technological change are viewed in the context of chemical disarmament and the broader prohibition of chemical weapons.

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[57] See M. Leitenberg, "The Experience of the Japanese Aum Shinrikyo Group and Biological Agents," in B. Roberts (Ed.) *Hype or Reality: The "New Terrorism" and Mass Casualty Attacks*, Alexandria, VA: CBACI, pp. 159-170.

[58] S. Mullins. "Terrorism in the Indo-Pacific: The Year Gone By and the Road Ahead." *Journal of Indo-Pacific Affairs*, Summer 2020, 4-35; https://media.defense.gov/2020/Jun/08/2002311969/-1/-1/1/MULLINS.PDF.

[59] For a listing of States participating in the Australia Group, see: https://www.dfat.gov.au/publications/minisite/theaustraliagroupnet/site/en/participants.html.

[60] (a) J. E. Forman, C. M. Timperley. "Chemical Disarmament in a Technologically Evolving World." In *Responsible Conduct in Chemistry Research and Practice: Global Perspectives*; E. T. Contis, A. Campbell, D. Phillips, B. Miller, L. Brown, L., (Eds.); ACS Symposium Series; American Chemical Society: Washington, DC, 2018; Vol. 1288, pp. 3– 35. (b) J. E. Forman, C. M. Timperley, S. Sun, D. van Eerten. "Chemistry and Diplomacy." *Pure Appl. Chem.* 2018, *90(10)*, pp. 1507– 1525. DOI: 10.1515/pac-2018-0902.

Chemical weapons are defined by the toxidromes they induce.[61] Traditional military chemical agents fall into four classes: choking agents, blood agents, blister agents or vesicants, and nerve agents.[62,63] Table 1 describes these classes and provides representative examples of the chemicals they include. It also indicates the approximate order of increasing toxicity amongst the agents (nerve agents are the most toxic, requiring smaller exposure concentrations for lethal doses as compared to the other classes).

The Annex on Chemicals of the CWC is a set of schedules that lists chemicals associated with most of the traditional warfare agents and their precursors.[28] It should also be appreciated that a chemical weapon can be derived from any chemical exploited for its toxic properties—not just those that appear in the Annex. For example, chlorine is not listed in the Annex, yet has been implicated as a chemical weapon in the conflict in Syria.[64] The CWC Schedules were developed based on 20th century military arsenals with the specific purpose of providing a tool for manageable verification measures. There are three Schedules, each containing a set of sub-schedules representing specific chemicals or groups ("families") of closely related substances.[65]

Schedule 1 is comprised of chemicals that have been developed, produced, stockpiled, or used as chemical weapons, notably vesicants and nerve agents (key nerve agent precursors, and the toxins ricin and saxitoxin[66] are also included).[28] Schedule 2 lists chemicals that possess sufficient lethal or incapacitating toxicity to enable them to be used as chemical weapons and also chemicals that can serve as precursors for the toxic chemicals listed in Schedules 1 and 2.[28] Schedule 3 is

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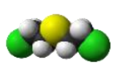
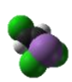
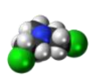
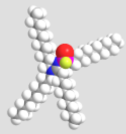
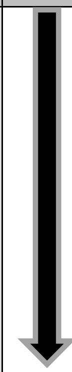
[61] G. R. Ciottone. "Toxidrome Recognition in Chemical-Weapons Attacks." *N Engl J Med* 2018; 378, pp. 1611-1620. DOI: 10.1056/NEJMra1705224.
[62] "What is a Toxic Chemical?" Organization for the Prohibition of Chemical Weapons; www.opcw.org/work/what-chemical-weapon#:~:text=General%20Purpose%20Criterion%20%E2%80%93%20Intent,not%20prohibited%20by%20the%20Convention
[63] S. Costanzi. "Chemical Warfare Agents." *Kirk-Othmer Encyclopedia of Chemical Technology* 2020; DOI: 10.1002/0471238961.0308051308011818.a01.pub3.
[64] See for example: ***First Report by the OPCW Investigation and Identification Team (IIT) Pursuant to Paragraph 10 of Decision C-SS-4/Dec.3 "Addressing the Threat From Chemical Weapons Use" Ltamenah (Syrian Arab Republic) 24, 25, and 30 March 2017,*** S/1867/2020, 8 April 2020, Organisation for the Prohibition of Chemical Weapons, The Hague; www.opcw.org/sites/default/files/documents/2020/04/s-1867-2020%28e%29.pdf
[65] G. Pontes, J. Schneider, P. Brud, L. Benderitter, B. Fourie, C. Tang, C. M. Timperley, J. E. Forman. "Nomenclature, Chemical Abstracts Service Numbers, Isomer Enumeration, Ring Strain, and Stereochemistry: What Does Any of This Have to Do with an International Chemical Disarmament and Nonproliferation Treaty?" *Journal of Chemical Education* 2020, *97*, pp. 1715–1730. DOI: 10.1021/acs.jchemed.0c00547.
[66] A. M. Sierra, R. Martinez-Alvarez. "Ricin and Saxitoxin: Two Natural Products That Became Chemical Weapons." *J. Chem. Educ.* 2020, *97(7)*, pp. 1707–1714. DOI: 10.1021/acs.jchemed.9b00841.

comprised of chemicals that have been produced, stockpiled, or used as chemical weapons, or can serve as a precursors for chemicals in Schedules 1 and 2.[28]

Table 1. Selected Chemical Warfare Agents[62,63]

Class	Toxidrome	Representative Chemicals	Dispersal	CWC Schedules	Toxicity[67]
Choking Agents 	Absorption through lungs induces alveoli to secrete fluid that builds up in the lungs and chokes the victim.	Phosgene Chloropicrin Chlorine	Gas	3A01 3A04 (chlorine is unscheduled)	
Blood Agents 	Absorbs through lungs and skin, and inhibits cellular oxygen use (e.g., preventing blood cells from transporting oxygen). Damages vital organs in central nervous, cardiovascular, and respiratory systems.	Hydrogen cyanide Cyanogen chloride	Gas	3A02 3A03	
Blister Agents (Vesicants)   	Absorbs through lungs and skin. Burns skin, mucous membranes, and eyes. Forms blisters on skin, windpipe, and lungs. Skin blisters are large, give rise to severe burns, and can be life-threatening. Exposure can lead to blindness and permanent respiratory tract damage.	Sulfur mustard Nitrogen Mustard Lewisite	Liquid, aerosol	1A04 1A05 1A06	
Nerve Agents	Absorbs through lungs and skin, Inhibits the enzyme acetylcholinesterase, which leads to accumulation of the neurotransmitter acetylcholine in synapses between nerve cells, overstimulation of nerve signal	G-series (e.g. Sarin) V-series (e.g. VX) Novichoks	Liquid, aerosol	1A01 1A02 1A03 1A13 1A14	**Increasing**

[67] This is illustrative, there can be overlaps between classes when comparing specific chemicals.

Class	Toxidrome	Representative Chemicals	Dispersal	CWC Schedules	Toxicity[67]
  	transmission. Symptoms include lacrimation, salivation, sweating, blurred vision, headache, breathing difficulty, vomiting, seizures, loss of body control, muscle paralysis, and unconsciousness, which in sufficient exposure dosages can lead to death.	Carbamates		1A15 1A16	

Unlike the Schedule 1 chemicals, many Schedule 2 and 3 chemicals have significant economic importance, and some are actually used to produce consumer products,[68] this illustrates one of the difficulties with banning chemical weapons. Industrial facilities that produce chemicals and many industrial chemicals themselves are dual-use in nature and can be used for chemical weapons programs, which is why the CWC's verification regime includes inspections of chemical production facilities that produce discrete organic chemicals not found in the schedules.[69]

While the CWC bans riot control agents for use in warfare, it does not list or identify these agents. Rather, it only provides criteria: a riot control agent is: "any chemical not listed in a Schedule, which can produce rapidly in humans sensory irritation or disabling physical effects which disappear within a short time following termination of exposure".[70] OPCW's Scientific Advisory Board (SAB) provided non-binding guidance on chemicals that could conform to these criteria,[71]

[68] *Most Traded Scheduled Chemicals 2022*. 2022, Organisation for the Prohibition of Chemical Weapons: The Hague, The Netherlands. www.opcw.org/resources/declarations/most-traded-scheduled-chemicals-2022.

[69] See (a) CWC Article VI: Activities Not Prohibited Under this Convention; www.opcw.org/chemical-weapons-convention/articles/article-vi-activities-not-prohibited-under-convention#:~:text=Article%20VI-,Activities%20Not%20Prohibited%20Under%20this%20Convention,not%20prohibited%20under%20this%20Convention (b) Parts VI-IX of the CWC's Verification Annex; www.opcw.org/chemical-weapons-convention/annexes/verification-annex/part-i-definitions

[70] See CWC Article II: Definitions and Criteria, paragraph 7; www.opcw.org/chemical-weapons-convention/articles/article-ii-definitions-and-criteria

[71] (a) "Advice from Scientific Advisory Board of the Organisation for the Prohibition of Chemical Weapons on riot control agents in connection with the Chemical Weapons Convention." C. Timperley, J. Forman, P. Aas, M. Abdollahi, D. Benachour, A. Al-Amri, A. Baulig, R. Becker-Arnold, V. Borrett, F. Carino, C. Curty, D. Gonzalez, M. Geist, Michael; B. Kane, Z. Kovarik, R. Martinez-Alvarez, B. Mikulak, N. Mourao, S. Neffe, E. Noguiera, P. Ramasami, Ponnadurai; S. Raza, V. Rubaylo, A. Saeed, K. Takeuchi, C. Tang, F. Trifiro, F. van Straten, A. Suarez, F. Waqar, P. Vanninen, M. Zafar-Uz-Zamen, S. Vucinic, V. Zaitsev, M. Zina, S. Holen, F. Izzati; *RSC. Adv*. 2018, 8, 41731-41739. DOI:

but conformity can also depend on factors broader than the identity of the chemical. These include exposure duration and concentration, physical surroundings and environmental conditions, and the underlying health of those exposed.[72]

Animals, plants, fungi, and microbes can also produce toxic substances; these are referred to as biological toxins.[73] Chemicals found in living systems that regulate life processes (bioregulators), are also potentially toxic,[74] although weaponization of bioregulators presents a number of difficulties.[75] Being chemicals, toxins and bioregulators are subject to the restrictions of the CWC if used for prohibited purposes, while also being considered biological toxins if used for prohibited purposes under the BTWC, creating an overlap of prohibitions for "mid-spectrum agents" between the two treaties (Figure 1). The presence of ricin (a plant toxin) and saxitoxin (produced by cyanobacteria and responsible for paralytic shellfish poisoning) on the CWC Schedules illustrates the treaty's purview in this realm. However, many other toxins with potential for harmful uses exist.[73] Given the potential to acquire toxins from natural sources, these substances are commonly considered as security threats, as illustrated by a 2019 foiled plot to use the toxin abrin in homemade bombs in Indonesia.[76]

10.1039/c8ra08273a. (b) *Response to the Director-General's Request to the Scientific Advisory Board to Provide Consideration on Which Riot Control Agents are Subject to Declaration Under the Chemical Weapons Convention*. SAB-25/WP.1, Organisation for the Prohibition of Chemical Weapons, The Hague, The Netherlands, 27 March 2017; www.opcw.org/sites/default/files/documents/SAB/en/sab25wp01_e_.pdf

[72] (a) R. J. Haar, V. Iacopino, N. Ranadive, S. D. Weiser, M. Dandu. "Health impacts of chemical irritants used for crowd control: a systematic review of the injuries and deaths caused by tear gas and pepper spray." *BMC Public Health* 2017, *17*, pp. 831. DOI: 10.1186/s12889-017-4814-6 (b) C. Rothenberg, S. Achanta, E. R. Svendsen, S. E. Jordt. "Tear gas: an epidemiological and mechanistic reassessment". *Ann N Y Acad Sci.* 2016, *1378(1)*, pp. 96-107. DOI: 10.1111/nyas.13141.

[73] (a) V. Pitschmann, Z. Hon. "Military importance of natural toxins and their analogs." *Molecules* 2016, *21*, 556. DOI: 10.3390/molecules21050556. (b) B. G. Dorner, R. Zeleny, K. Harju, J A. Hennekinne, P. Vanninen, H. Schimmel, A. Rummel; "Biological toxins of potential bioterrorism risk: Current status of detection and identification technology." *Trends in Anal. Chem.* 2016, *85*, 89-102. DOI: 10.1016/j.trac.2016.05.024.

[74] S. Bokan, Z. Orahovec Z. "An Evaluation of Bioregulators/Modulators as Terrorism and Warfare Agents." In *Technology for Combating WMD Terrorism*, P. J. Stopa, Z. Orahovec (Eds.), NATO Science Series (Series II: Mathematics, Physics and Chemistry), vol 174. Springer, Dordrecht, 2004. DOI: 10.1007/978-1-4020-2683-6_3.

[75] *Convergence of Chemistry and Biology: Report of the Scientific Advisory Board's Temporary Working Group*. SAB/REP/1/14, Organisation for the Prohibition of Chemical Weapons, 26 June 2014, The Hague, The Netherlands; www.opcw.org/sites/default/files/documents/SAB/en/TWG_Scientific_Advsiory_Group_Final_Report.pdf

[76] V. Arianti, "Biological Terrorism in Indonesia," *Diplomat*, 20 November 2019.

The CWC sets down obligations intended to be of an unlimited duration,[77] while the pace of scientific discovery, and with it our perception of the boundaries of scientific disciplines, continues to advance.[78] Scientific developments, especially in the field of chemistry, can bring great benefits to humankind, and under the provisions of the CWC, States Parties are obliged to ensure chemistry is not used in violation of the Convention. Yet, continued discoveries in chemistry continuously raise security concerns.[79]

The number of known chemicals increases by millions of substances every year, while the CWC's Annex on Chemicals has only seen one update since 1993 when it was originally agreed on. This was the addition of four groups of new types of nerve agents following the Skripal poisoning in 2018.[41] The new schedules (1A13-1A16) entered in force in June 2020.[80,81,82]

As modern science reveals more about the molecular world underpinning life processes, new types of toxic chemicals tailored to attacking specific biological functions are a potential outcome.[83] The development of nanomedicines targeting specific types of cells, tissues, and organs to deliver payloads of therapeutic or even toxic chemicals (which is effectively how nanomedicine-based chemotherapy agents function) elicit similar concerns.[84] There are clear pathways to poisoning and harm. There are also practical considerations, as the properties of a chemical intended to be weaponized may differ from those required of a chemical to be used for medical purposes under

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[77] See CWC Article XVI: Duration and Withdraw, paragraph 1; www.opcw.org/chemical-weapons-convention/articles/article-xvi-duration-and-withdrawal

[78] G. M. Whitesides. "Reinventing Chemistry." *Angew. Chem., Int. Ed.* 2015, *54*, pp. 3196-3209.

[79] *Preventing Chemical Weapons: Arms Control and Disarmament as the Sciences Converge*; M. Crowley, M. Dando, L. Shang (Eds.); Royal Society of Chemistry: London, 2018.

[80] S. Costanzi, G. D. Koblentz, "Controlling Novichoks after Salisbury: revising the Chemical Weapons Convention schedules." *The Nonproliferation Review*, 2019, 26 (5-6), pp. 599-612. DOI: 10.1080/10736700.2019.1662618.

[81] L. Howes, "New nerve agents added to Chemical Weapons Convention Novichok and carbamate compounds are the first added to the treaty since it came into force." *Chem. Eng. News* 2 December 2019; https://cen.acs.org/policy/chemical-weapons/New-nerve-agents-added-Chemical-Weapons-Convention/97/web/2019/12

[82] M. Peplow. "Nerve agent attack on spy used 'Novichok' poison Chemical weapon used in U.K. assassination attempt was developed by Soviet Union during Cold War" *Chem. Eng. News* 2018, *96(12)*; https://cen.acs.org/articles/96/i12/Nerve-agent-attack-on-spy-used-Novichok-poison.html

[83] *Report of the Scientific Advisory Board's Workshop on Chemical Warfare Agent Toxicity, Emergency Response and Medical Countermeasures*, SAB-24/WP.2, 14 October 2016, The Organisation for the Prohibition of Chemical Weapons, The Hague, The Netherlands; www.opcw.org/sites/default/files/documents/SAB/en/sab-24-wp02_e_.pdf

[84] K Nixdorff. "Advances in the Targeted Delivery of Biochemical Agents," pp. 259-292 In *Preventing Chemical Weapons: Arms Control and Disarmament as the Sciences Converge*; M. Crowley, M. Dando, L. Shang (Eds.); Royal Society of Chemistry: London, 2018.

controlled conditions. Development of nanomedicines for chemotherapy has revealed examples of toxic chemicals targeted against specific types of cells (tumors) that are not always more effective than untargeted (and less expensive) approaches.[85] This in turn introduces a degree of uncertainty as to the risk of such approaches as chemical weapons.

Covered by Biological Chemical Weapons Convention (CWC, Article II)					
Poisons (Toxic Chemicals)				**Infectious Agents**	
Classical CWA	**Other Toxic Chemicals**	**Small Molecule Toxins and Bioregulators**	**Large Molecule (Protein) Toxins**	**Genetically Modified BWA**	**Classical BWA**
		Mid-spectrum Agents			
Chlorine Phosgene Sulfur Mustard Nitrogen Mustard Lewisite G- and V-Series Nerve Agents	Industrial Chemicals Agricultural Chemicals Pharmaceuticals Central Nervous System-Acting Chemicals	Conotoxins Saxitoxin Tetrodotoxin Substance P Neurokinin A	Botulinum Toxins Ricin Staphylococcal enterotoxin B	Tailored and modified Bacteria and Viruses	Bacteria Viruses Rikettsia Anthrax Plague Small Pox Tularemia
		Covered by Biological and Toxins Weapons Convention (BTWC, Article I)			

Figure 1. Biochemical Threat Spectrum from Chemical Warfare Agents (CWA) to Biological Warfare Agents (BWA)[86]

Note: The chemical and biological agents listed are intended to be illustrative, not comprehensive. Solid borders between the example columns are absent in the representation as this is meant to illustrate a continuum.

[85] Y. Min, J. M. Caster, M. J. Eblan, A. Z. Wang. "Clinical Translation of Nanomedicine." *Chem. Rev.* 2015, *115(19)*, pp. 11147–11190. DOI: 10.1021/acs.chemrev.5b00116.

[86] Adopted from J. E. Forman, C. M. Timperley. "Chemical Disarmament in a Technologically Evolving World." In *Responsible Conduct in Chemistry Research and Practice: Global Perspectives*; E. T. Contis, A. Campbell, D. Phillips, D., B. Miller, L. Brown (Eds.); ACS Symposium Series; American Chemical Society: Washington, DC, 2018; Vol. 1288, pp. 3– 35.

The application of chemicals intended to incapacitate has led to concerns on the use of pharmaceutical-based substances that act on the central nervous system (CNS).[87] Aerosolized dispersal of chemicals intended to incapacitate by Security forces that ended the Dubrovka Theater Siege in Moscow in 2002[88] resulted in fatalities among both hostages and terrorists. In the aftermath, an intensive review began within OPCW's SAB[87, 89] alongside equally intensive deliberations among CWC States Parties on security concerns of chemicals intended for use in incapacitation roles, especially in regard to law enforcement usage.[90] In 2021, the States Parties adopted a decision by vote to "affirm that CWC States Parties understand that the use of aerosolized CNS-acting chemicals is inconsistent with law enforcement as a purpose not prohibited by the Convention".[91,92] Pertinent to the debates leading up to this decision have been suggestions that development of aerosolized incapacitating chemicals for law-enforcement purposes may be a back-door entryway for the development of new chemical warfare agents.[93]

While the outcome of the debate on the CNS-acting chemical issue was a decision of the States Parties, this was not a decision of consensus. At the vote, 128 States were present, eighty-five voted yes, ten voted no, and thirty-three abstained. There were fourteen Asia-Pacific States present,

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[87] R. J. Mathews. "Central Nervous System-Acting Chemicals and the Chemical Weapons Convention: A Former Scientific Adviser's Perspective." *Pure Appl. Chem.* 2018, *90(10)*, pp. 1559– 1675. DOI: 10.1515/pac-2018-0502.
[88] S. Jeffery. "The Moscow theatre siege A chronology of events following the storming of a Russian theatre by a gang of heavily armed Chechen militants". The Guardian, 28 October 2002; https://www.theguardian.com/world/2002/oct/28/chechnya.russia6
[89] *Central Nervous System Acting Chemicals – Considerations from the OPCW Scientific Advisory Board*, 28 November 2017; www.opcw.org/sites/default/files/documents/SAB/en/SAB_Considersations_on_CNS-Acting_Chemicals_2003-2017.pdf.
[90] See for example: (a) Joint Paper: *Aerosolisation of Central Nervous System-Acting Chemicals for Law Enforcement Purposes*. RC-4/NAT.26, 30 November 2018, The Organisation for the Prohibition of Chemical Weapons, The Hague, The Netherlands; www.opcw.org/sites/default/files/documents/2018/11/rc4nat26%28e%29.pdf. (b) Russian Federation: *Aerosolisation of Chemical Nervous System-Acting Chemicals for Law Enforcement Purposes*, RC-4/NAT.9, 21 November 2018, The Organisation for the Prohibition of Chemical Weapons, The Hague, The Netherlands; www.opcw.org/sites/default/files/documents/2018/11/rc4nat09%28e%29.pdf.
[91] Decision on aerosolised use of Central Nervous System-acting chemicals adopted by OPCW Conference of States Parties, Organization for the Prohibition of Chemical Weapons, 1 December 2021; www.opcw.org/media-centre/news/2021/12/decision-aerosolised-use-central-nervous-system-acting-chemicals-adopted.
[92] The summary of the voting is available in Report of the Twenty-Sixth Session of the Conference of the States Parties, C-26/5, Organization for the Prohibition of Chemical Weapons, The Hague, 2021; www.opcw.org/sites/default/files/documents/2021/12/c2605%28e%29.pdf.
[93] M. Crowley, M. Dando. Central Nervous System Weapons Dealt a Blow. *Science* 2022, *375 (6577)*, 153-154. DOI: 10.1126/science.abn6132.

Russia and China, who had previously called for further discussion on the issue,[94,95] voted against the decision, while Indonesia and Vietnam abstained.[92] Australia, Canada, Japan, Malaysia, the Marshall Islands, Palau, Philippines, ROK, Singapore, and the United States voted in favor.[92]

A chemical weapon (like any weapon system or technology) requires multiple components and considerations for use. This is seen within the CWC definition of a chemical weapon that covers both toxic chemicals and equipment for deploying the chemicals as weapons, even when the equipment contains no toxic chemicals. An advanced chemical weapons capability requires more than chemicals. Capabilities to produce and dispose of chemicals (chemical engineering), to protect against indiscriminate chemical effects (protective equipment, decontamination, and medical countermeasures), and to engineer and design the delivery systems are also necessary. It is a highly transdisciplinary endeavor.[96] Maintaining the chemical weapons programs of the Cold War required significant resources, as has the destruction efforts required by the CWC.[97] Such expertise and resource requirements might create a barrier to entry for initiating a traditional 20th Century state-level program. However, events in Syria and the assassination scenarios witnessed over the last few years[41,42,52] illustrate novel approaches to the weaponization of chemicals. This draws attention once more to scientific developments that are potentially enabling for such purposes.

It is estimated that there are more possible chemicals with drug-like effects than there are atoms in the universe,[98] an observation that does little to ease security concerns over new chemical discoveries. From a scientific perspective, exploring this "chemical space" to find new chemicals

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[94] Russian Federation: *Understanding Regarding the Aerosolized Use of Central Nervous System-Acting Chemicals for Law Enforcement Purposes*, EC-93/NAT.6, 6 March 2020, Organisation for the Prohibition of Chemical Weapons, The Hague, The Netherlands; www.opcw.org/sites/default/files/documents/2020/03/ec93nat06%28e%29.pdf

[95] People's Republic of China: Statement by the Delegation of the People's Republic of China to the OPCW at the Ninety-Fifth Session of the Executive Council, EC-95/NAT.30, 6 October 2020, Organisation for the Prohibition of Chemical Weapons, The Hague, The Netherlands; www.opcw.org/sites/default/files/documents/2020/11/ec95nat30%28e%29.pdf

[96] Report of the Scientific Advisory Board on Developments in Science and Technology for the Fourth Special Session of the Conference of the States Parties to Review the Operation of the Chemical Weapons Convention, RC-4/DG.1, 30 April 2020, Organisation for the Prohibition of Chemical Weapons, The Hague, The Netherlands; www.opcw.org/sites/default/files/documents/CSP/RC-4/en/rc4dg01_e_.pdf

[97] See for example *Chemical Munitions: Cost Estimates for Demilitarization and Production*, U.S. Government Accountability Office, NSIAD-86-1FS: 1985; https://www.gao.gov/products/128358

[98] A. Mullard A. "The drug-maker's guide to the galaxy." *Nature* 2017, *549(7673)*, pp. 445-447. DOI: 10.1038/549445a.

with superior properties to those we have now (as materials, medicines, and more) is a source of excitement for societal benefit. In pursuing these benefits, chemistry, which like so many scientific fields, embraces emerging technologies such as artificial intelligence and automation to aid in the discovery process,[99] and this gives us innovation, a faster pace of scientific development, and further security concerns.

Research involving chemical warfare agents in pursuit of better and more effective protective equipment, decontaminants, and medical countermeasures is on-going.[83,96, 100 , 101] The transdisciplinary nature of scientific discovery is as important here as it is for developing weapons. Much of the expertise and research on more effective ways to counter chemicals weapons takes place in well-resourced state-funded laboratories, and the OPCW facilitates a network of Designated Laboratories across member states.[102] These laboratories develop analysis methods to detect chemical agents to support verification, share procedures, and collectively participate in proficiency testing.[103104] The laboratory network serves to strengthen the CWC's verification

[99] See for example: P. S. Gromski, A. B. Henson, J. M. Granda, L. Cronin. "How to explore chemical space using algorithms and automation." *Nat Rev Chem* 2019, *3*, pp. 119–128. DOI: 10.1038/s41570-018-0066-y.
[100] C. M. Timperley, J. E. Forman, M. Abdollahi, A.S. Al-Amri, A. Baulig, D. Benachour, V. Borrett, F. A. Cariño, M. Geist, D. Gonzalez, W. Kane, Z. Kovarik, R. Martínez-Álvarez, N. M. Fusaro Mourão, S. Neffe, S. K. Raza, V. Rubaylo, A. G. Suárez, K. Takeuchi, C. Tang, F. Trifirò, F. Mauritz van Straten, P. S. Vanninen, S. Vučinić, V. Zaitsev, M. Zafar-Uz-Zaman, M. Saïd Zina, S. Holen. "Advice on assistance and protection provided by the Scientific Advisory Board of the Organisation for the Prohibition of Chemical Weapons: Part 1. On medical care and treatment of injuries from nerve agents." *Toxicology* 2019, *415*, pp. 56-59. DOI: 10.1016/j.tox.2019.01.004.
[101] C. M. Timperley, M. Abdollahi, A.S. Al-Amri, A. Baulig, D. Benachour, V. Borrett, F. A. Cariño, M. Geist, D. Gonzalez, W. Kane, Z. Kovarik, R. Martínez-Álvarez, N. M. Fusaro Mourão, S. Neffe, S. K. Raza, V. Rubaylo, A. G. Suárez, K. Takeuchi, C. Tang, F. Trifirò, F. Mauritz van Straten, P. S. Vanninen, S. Vučinić, V. Zaitsev, M. Zafar-Uz-Zaman, M. Saïd Zina, S. Holen, J. E. Forman, V. Suri. "Advice on Assistance and Protection from the Scientific Advisory Board of the Organisation for the Prohibition of Chemical Weapons: Part 2. On Preventing and Treating Health Effects from Acute, Prolonged, and Repeated Nerve Agent Exposure, and the Identification of Medical Countermeasures able to Reduce or Eliminate the Longer Term Health Effects of Nerve Agents." *Toxicology*, 2019, *413*, pp. 13-23. DOI: 10.1016/j.tox.2018.11.009.
[102] Designated Laboratories; www.opcw.org/designated-laboratories. For a current list of Designated Laboratories, see (a) *Note by the Director-General: Status of Laboratories Designated for the Analysis of Authentic Environmental Samples*, S/1893/2020, 2 September 2020, Organisation for the Prohibition of Chemical Weapons, The Hague, The Netherlands; www.opcw.org/sites/default/files/documents/2020/09/s-1893-2020%28e%29%20%281%29.pdf. (b) *Note by the Technical Secretariat: Status of Laboratories Designated for the Analysis of Authentic Biomedical Samples*, S/1904/2020, 2 October 2020, Organisation for the Prohibition of Chemical Weapons, The Hague, The Netherlands; www.opcw.org/sites/default/files/documents/2020/10/s-1904-2020%28e%29.pdf
[103] *Recommended Operating Procedures for Analysis in the Verification of Chemical Disarmament 2017 Edition*. P. Vanninen, (Ed.), University of Helsinki: Helsinki, Finland, 2017.
[104] C. M. Timperley, J. E. Forman, M. Abdollahi, A.S. Al-Amri, I. P. Alonso, A. Baulig, V. Borrett, F. A. Cariño, C. Curty, D. González Berrutti, Z. Kovarik, R. Martínez-Álvarez, R. Mikulak, N. M. Fusaro Mourão, P. Ramasami, S. Neffe, S. K. Raza, V. Rubaylo, K. Takeuchi, C. Tang, F. Trifirò, F. Mauritz van Straten, P. S. Vanninen, V. Zaitsev, F. Waqar, M. Saïd Zina, M.-M. Blum, H. Gregg, E. Fischer, S. Sun, P. Yang. "Advice on Chemical Weapons Sample Stability and

regime (these laboratories have been central to the analysis of samples and independent reporting of results from chemical weapon related fact-finding).[105] Additionally, the network exemplifies international scientific collaboration (a norm of the CWC). States in the Asia-Pacific with Designated Laboratories include Australia, China, ROK, Russia, Singapore, and the United States. Other regional States also have laboratories with capabilities for countering chemical weapons (most notably, Japan[106] and Malaysia[107]), but these laboratories are outside of the OPCW network.

New scientific developments with relevance to the CWC may also emerge from scientific communities beyond the specialized laboratories. Here, the chemical industry is not only a key driver of innovation, but it is also a key stakeholder in upholding the CWC's verification regime.[108] Industrial chemistry also facilitates the diffusion of chemical expertise and knowledge on a global scale. Asia-Pacific states have a significant chemical industry presence. Globally, chemical production and sales is dominated by China (responsible for more than 44% of 2020 global chemical sales), with the United States (12.3%), Japan (4.1%), the ROK (2.9%), and Russia (1.1%) also in the top ten chemical producing nations.[109]

Overall scientific output from Asia-Pacific mimics trends seen in global chemical production and dominates global scientific outputs (across all fields and sectors). The greatest amounts of global research and development funding are seen in China, USA, and Japan, with ROK and Russia also

Storage Provided by the Scientific Advisory Board of the Organisation for the Prohibition of Chemical Weapons to Increase Investigative Capabilities Worldwide." *Talanta* 2018, *188*, pp. 808-832. DOI: 10.1016/j.talanta.2018.04.022.

[105] See for example S. Mogl, P. Siegenthaler, B. Schmidt. "Chemical weapons in the Syrian conflict." *Spiez Laboratory Annual report 2013*; 2013; pp. 26 – 33; https://www.labor-spiez.ch/pdf/en/dok/jab/88_003_e_laborspiez_jahresbericht_2013_web.pdf

[106] The Japanese National Research Institute of Police Science participated in a recent OPCW Proficiency Test, see: *Note by the Director-General: Evaluation of the Results of the Fifth Official OPCW Biomedical Proficiency Test*, S/1903/2020, 2 October 2020, Organisation for the Prohibition of Chemical Weapons, The Hague, The Netherlands; www.opcw.org/sites/default/files/documents/2020/10/s-1903-2020%28e%29.pdf

[107] See for example paragraphs 12.1 to 12.2 of *Summary of the Third Meeting of the Scientific Advisory Board Temporary Working Group on Investigative Science and Technology*, SAB-28/WP.3, 4 June 2019, Organisation for the Prohibition of Chemical Weapons, The Hague, The Netherlands; www.opcw.org/sites/default/files/documents/2019/06/sab-28-wp03%28e%29.pdf

[108] *Report of the Scientific Advisory Board's Workshop on Trends in Chemical Production*, SAB-26/WP.2, 19 October 2017, Organisation for the Prohibition of Chemical Weapons, The Hague, The Netherlands; www.opcw.org/sites/default/files/documents/SAB/en/sab-26-wp02_e_.pdf

[109] *FACTS & FIGURES of the European chemical industry*, cefic; https://cefic.org/a-pillar-of-the-european-economy/.

in the top ten.[110] Research and development funding as a proportion of a State's GDP is the highest worldwide for the ROK (4.35% in 2021 as compared to 2.88% for the US and 1.98% for China).[110] In 2020, China produced the greatest amount of global scientific publications (23% of the world total, with more than 669,000 produced), followed by the United States (15.5%). Japan (3.4%), Russia (3.1%), and the ROK (2.5%) are also in the top ten.[111] Science is also international with collaborations across regions and states entrenched within the scientific enterprise (in both industrial and academic sectors). For the 2020 publication output, 22% of publications from Chinese scientists were co-authored with scientists from at least one other state. For scientists from the United States, 40% of 2020 scientific publications included international coauthors (26% were co-authored with scientists from China, 5.3% with scientists from Japan, and 4.5% with scientists from ROK).[111]

The scale of the scientific enterprise is daunting when considering how to answer calls for monitoring science to ensure states parties to the CWC or BTWC are not caught off guard. There are many scientific discoveries that could enable new ways to access, produce, and/or weaponize toxic chemicals, which in turn might be an entry-point for non-state actors and/or terrorists. Yet, the use of any technology, old or new, requires certain expertise, resources, and tacit knowledge, and especially for new and emerging technologies there will always be uncertainties with respect to the potential risk of harmful use.[112]

While the prospects of scientific advances for proliferation and lowering barriers for use of chemical weapons raise concerns, recent chemical weapons attacks have included chlorine gas (a chemical known for more than 200 years),[113] crude preparations of sulfur mustard,[114] setting a

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[110] P. Heney. 2021 Global R&D Funding Forecast released. R&D World, 2021; https://www.rdworldonline.com/2021-global-rd-funding-forecast-released/.

[111] *2022 National Science Board Science and Engineering Indicators: The State of U.S. Science and Engineering*. National Science Foundation, National Science Board, and National Center for Science and Engineering Statistics, Alexandria, VA, USA; https://ncses.nsf.gov/pubs/nsb20221. .

[112] *Measures to Prevent Hostile Use of Toxic Chemicals by Non-State Actors*, S/1291/2015, OPCW, The Hague, 26 June 2015; www.opcw.org/sites/default/files/documents/S_series/2015/en/s-1291-2015_e_.pdf.

[113] Chlorine, Royal Society of Chemistry, Periodic Table; https://www.rsc.org/periodic-table/element/17/chlorine.

[114] (a) See paragraphs 9.17 to 9.18 of *Report of the Twenty-Fifth Session of the Scientific Advisory Board,* SAB-25/1*, 31 March 2017, Organisation for the Prohibition of Chemical Weapons, The Hague, The Netherlands; www.opcw.org/sites/default/files/documents/SAB/en/sab2501_e_.pdf. (b) *Note by the Technical Secretariat: Report of the OPCW Fact-Finding Mission in Syria Regarding Alleged Incidents in Marea,*

sulfur mine on fire to generate toxic gases,[115] and assassinations scenarios with nerve agents (in one case by wiping binary precursors in succession onto an individual's face[52]). These observations are noteworthy in that they are not employing cutting edge scientific and technological advances. Furthermore, low technology approaches to chemical attacks (including the use of industrial chemicals rather than traditional chemical warfare agents)[116] are considered significant security threats.

The medical countermeasures currently available for nerve agents were introduced in the 1950s and 1960s, but the wealth of research demonstrating potential improvements has not been translated into operational use.[83,100,101] Similarly, despite advanced understanding of molecular biology, the mechanism through which sulfur mustard forms blisters is not fully understood,[83] **Error! Bookmark not defined.** limiting effectiveness of available treatments. There is need for continued research and development to counter and respond to chemical weapons, as well as a need to maintain skills and knowledge to counter the chemical weapons of the past.

Access to scientific expertise and enhanced technical capability plays an important role in countering chemical threats. There is need to be able to recognize, prevent, and mitigate the effects of chemical attacks and unexpected uses of new technologies. This is reflected in recommendations from the OPCW SAB for drawing on scientific advances to strengthen implementation of the CWC, respond to chemical threats both familiar and unknown, and to build greater confidence in verification and compliance.[96, 117] However, just as certain expertise,

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Syrian Arab Republic, August 2015, S/1320/2015, 29 October 2015, Organisation for the Prohibition of Chemical Weapons, The Hague, The Netherlands; www.opcw.org/sites/default/files/documents/2018/11/s-1320-2015_e_.pdf.

[115] O. Björnham, H. Grahn, P. von Schoenberg, B. Liljedahl, A. Waleij, N. Brännström. "The 2016 Al-Mishraq sulphur plant fire: Source and health risk area estimation." *Atmos. Environ.* 2017*, 169,* pp. 287-296.

[116] D. Russell, J. Simpson. "Emergency planning and preparedness for the deliberate release of toxic industrial chemicals," *Clinical Toxicology,* 2010, *48(3), pp.* 171-176. DOI: 10.3109/15563651003698042.

[117] (a) *Investigative Science and Technology: Report of the Scientific Advisory Board's Temporary Working Group*, SAB/REP/1/19, 1 December 2019, Organisation for the Prohibition of Chemical Weapons, The Hague, The Netherlands; www.opcw.org/sites/default/files/documents/2020/11/TWG%20Investigative%20Science%20Final%20Report%20-%20January%202020%20%281%29.pdf. (b) J. E. Forman, P. Aas, M. Abdollahi, I. P. Alonso, A. Baulig, R. Becker-Arnold, V. Borrett, F. A. Cariño, C. Curty, D. Gonzalez, Z. Kovarik, R. Martínez-Álvarez, R. Mikulak, E. de Souza Nogueria, P. Ramasami, S. K. Raza, A. E. M. Saeed, K. Takeuchi, C. Tang, F. Trifirò, F. M. van Straten, F. Waqar, V. Zaitsev, M. Saïd Zina, K. Grolmusová, G. Valente, M. Payva, S. Sun, A. Yang, D. van Eerten. "Innovative Technologies for Chemical Security," *Pure Appl. Chem.* 2018, *90(10)*, 1527-1557. DOI: 10.1515/pac-2018-0908. (c) *Verification Report of the Scientific Advisory Board's Temporary Working Group*, SAB/REP/1/15, 11 June 2015, Organisation for the Prohibition of Chemical Weapons, The Hague, The Netherlands;

resources, and tacit knowledge are needed to weaponize chemicals, these same considerations are also necessary for realizing the capabilities needed to effectively counter the proliferation of chemical weapons. States with greater science and technology resources are expected to be better equipped to draw upon more advanced expertise and capability.

Current Status and Future Prospects

Possession of chemical weapons by states in the Asia-Pacific has decreased significantly over the past two decades, thereby reducing the probability that such weapons would be used in a traditional war between States. However, a big unknown is the DPRK. Both the timing of a DPRK accession to the CWC and the size of any chemical weapons stockpile that it would declare in such a scenario remain a matter of speculation. If the DPRK accedes to the CWC, then the standard operating procedures for possessor states, as spelled out in the treaty, would not likely apply. Rather, a much higher involvement of the OPCW and, potentially, states from the region would likely be required to ensure the safe and irreversible destruction of DPRK chemical weapons under international verification. In preparing for this contingency, the case of dismantling the declared Syrian chemical weapons stockpile may offer lessons.[118]

While the prospect of a traditional military conflict involving chemical weapons among CWC States Parties seems unlikely, this has not prevented malign uses of chemicals by states as illustrated by the recent high profile poisonings with nerve agents that have been linked to Asia Pacific states. In addition, there are larger concerns within security communities of the erosion of the norms against chemical weapons upon which the CWC is founded. Future prospects for overcoming these issues rests with the political will of the states involved, including the will to use tools available in the CWC for addressing non-compliance.

Considering the recent uses of chemical warfare agents, the threat of chemical terrorism whether by non-state actors or those with state sponsorship is a real possibility. A number of Asia-Pacific

www.opcw.org/sites/default/files/documents/SAB/en/Final_Report_of_SAB_TWG_on_Verification_-_as_presented_to_SAB.pdf

[118] See Ralf Trapp, *Lessons Learned from the OPCW Mission in Syria*, Report submitted to the Director-General of the Technical Secretariat of the OPCW, 16 December 2015; http://www.the-trench.org/wp-content/uploads/2016/01/Trapp-20151216-OPCW-Syria-lessons-learned.pdf

states have experienced acts of terrorism and/or have active insurgencies.[119] While the majority of reported terrorist attacks are not chemical, the specter of chemical terrorism looms large and is not unknown. A recent study using data from the Global Terrorism Database identified 321 chemical attacks from 1970-2015, while South Asia was the region of the greatest number of these incidents, chemical attacks have also occurred in Australia and Oceania, East Asia, Eastern Europe, North America, and South East Asia, all of which are regions home to Asia-Pacific States.[120] Measures to mitigate and prevent chemical terrorism include as a basis the implementation of CWC provisions and their prohibitions into national laws and regulations that can be used to bring perpetrators to justice. In addition, strengthening chemical security measures in sectors ranging from healthcare and emergency medicine,[121] to chemical industry and civil defense, can aid in dealing with such terrorist attacks should they occur.

Non-traditional chemical threat scenarios represent another potential route for intentional chemical attacks. The large industrial base present in the Asia-Pacific presents potential targets for attacks on infrastructure that could result in chemical releases. Such attacks might also occur through cyber vulnerabilities, which requires non-traditional considerations toward chemical security in general.[122]

The Asia-Pacific is home to five of the world's top ten most highly resourced and funded states for scientific and technological research and development, as well as five of the top ten chemical producing states. Recent chemical incidents have demonstrated that low technology and non-traditional chemical threat approaches pose significant challenges. For traditional 20th century chemical weapons programs, the components and formats of chemical weapons systems are well understood, and key commodities and materials for their production are found under export control regimes to reduce proliferation risk (for example control lists from the Australia Group[123] and

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[119] S. Mullins. "Terrorism in the Indo-Pacific: The Year Gone By and the Road Ahead." *Journal of Indo-Pacific Affairs*, Summer 2020, 4-35; https://media.defense.gov/2020/Jun/08/2002311969/-1/-1/1/MULLINS.PDF

[120] C. Santos, T. El Zahran, J. Weiland, M. Anwar, J. Schier. Characterizing chemical terrorism incidents collected by the Global Terrorism Database, 1970-2015. *Prehosp Disaster Med*. 2019, *34(4)*, 385–392.

[121] M. Court, B. Edwards, F. Issa, A. Voskanyan, G. Ciottone. "Counter-Terrorism Medicine: Creating a Medical Initiative Mandated by Escalating Asymmetric Attacks." *Prehospital and Disaster Medicine* 2020, pp. 1-4. DOI: 10.1017/S1049023X2000103X.

[122] The United States Chemical Facility Anti-Terrorism Standards (CFATS) provides insights into security concerns related to chemical infrastructure; https://www.cisa.gov/chemical-facility-anti-terrorism-standards.

[123] Australia Group Export Controlled Chemical Weapons Precursors, available at: https://www.dfat.gov.au/publications/minisite/theaustraliagroupnet/site/en/precursors.html

Wassenaar Arrangement[124] that include chemical agents and their precursors). Low technology approaches, however, can draw upon non-traditional components and commonly available chemicals to enable attacks. These approaches challenge how to think about preventing the re-emergence of chemical weapons and preparedness for countering chemical attacks in a 21st century world. The chemical attacks we have witnessed (and those likely to come in future) are not following the doctrines of the Cold War that influenced negotiation and drafting of the CWC.

As the CWC approaches its 25th anniversary in April 2022 (and beyond), the prohibition of chemical weapons will increasingly benefit from science and technology as a source of innovation and opportunity to better detect, prevent, and/or respond to chemical threats. The OPCW SAB has provided useful views from where guidance can be drawn,[96,117] and scientific contributions from Asia-Pacific alongside collaboration among (and beyond) the regional states will certainly have a significant role. Ultimately, however, it is the actions and decisions of the States Parties of the CWC, not the science and technology they possess, that will drive success in prohibiting chemical weapons and preventing their re-emergence.

[124] The Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies Control Lists, available at: https://www.wassenaar.org/control-lists/

10. Asia-Pacific Perspective on Biological Weapons and Nuclear Deterrence in the Pandemic Era

Richard Pilch and Miles Pomper

Introduction

This article provides an Asia-Pacific perspective on biological weapons and their relevance to nuclear deterrence in the pandemic era. The entire class of biological weapons is banned by international law; however, biological weapons are generally less costly and less technically challenging to develop than nuclear weapons. Conversely, nuclear weapons are openly possessed by multiple countries in the Asia-Pacific despite their corresponding cost and technical complexity. These two types of weapons of mass destruction—biological and nuclear—do not exist in isolation but in a multifactorial geopolitical environment where the threat and control of one impact that of the other.

A third factor that holds the potential to influence this dynamic is the increasing likelihood of natural outbreaks and pandemics. The Asia-Pacific has been the source of the majority of recent natural outbreaks with global impact, including SARS (2003), H5N1 and H7N9 influenza, and now COVID-19, a trend that is expected to continue as surging population growth and industrial expansion brings humans into closer contact with novel disease agents and their animal reservoirs. Such natural events might be misinterpreted as deliberate biological attacks or used to mask them, with the potential for nuclear escalation in the balance.

In the following sections, we explore potential intersections of biological and nuclear weapons in the pandemic context. First, we describe the threat of biological weapons, including history, threat assessment methodology, and specific threats in the Asia-Pacific region. Next, we review options for biological weapons control. Finally, we discuss nuclear deterrence and escalation in the context

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of both natural and deliberate biological events. We conclude with a summary of key points and recommendations for regional security and stability.

Threat

a. Historical Context: 20-21st Century Bioweaponry

The biological warfare (BW) programs of Japan, the United States, and Soviet Union/Russian Federation provide a representative timeline of State-level BW activities in the 20-21st century.

Japan. The modern era of BW is rooted in the interwar period but arrived with Japanese BW activities during World War II and the coincident Second Sino-Japanese War.[1] While the United States, United Kingdom (UK), and Canada had active BW programs during this timeframe, only the Japanese extensively employed biological weapons against civilian and military populations both in captivity and in the field. In all, the Japanese BW program's experimentation on captives and prisoners of war, conservatively estimated, took over 10,000 lives, while field usage led to the death of as many as several hundred thousands of men, women, and children.[2]

Japan participated in Geneva disarmament discussions in the 1920s but did not ratify the 1925 Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous, or other Gases, and of Bacteriological Methods of Warfare ("Geneva Protocol"), which prohibits the use of chemical and biological weapons of war, until 1970.[3] In fact, as the Geneva discussions were ongoing, Shiro Ishii, a young Army doctor and Lieutenant at the time, recognized that because the world was against the development of biological weapons (and especially if these weapons were to be officially banned), the Japanese would likely benefit from their possession and use in coming wars. Ishii, who possessed both an MD degree and a PhD in microbiology, further noted that BW did not require iron and other raw materials that were difficult for the Japanese to acquire and would

[1] For a historical overview of BW, see Seth Carus, "The History of Biological Weapons Use: What We Know and What We Don't," *Health Security,* vol 13, no 4 (2015).
[2] For an in-depth account of Japanese BW activities, see J. Guillemin, *Hidden Atrocities.* (New York: Columbia University Press, 2017).
[3] https://2009-2017.state.gov/t/isn/4784.htm

likely be far less costly than conventional weapons despite comparable or even greater lethality. Ishii ascended rapidly to become Japan's primary catalyst for BW research and development.

During the 1930s, Ishii's efforts evolved from a small lab at the Tokyo Army Medical School's Department of Immunology to the so-called "Togo Detachment" (after Ishii had changed his name to Hajime Togo to maintain secrecy) to facilities in Manchukuo (Manchuria), a region defined by the borders of China's three north-eastern provinces. In Manchuria, after working temporarily in the town of Harbin and then for an extended period at a relatively advanced research station at the Zhong Ma Prison Camp in Beiyinhe, Ishii settled on Pingfan (a.k.a. Heibo), a cluster of villages approximately twenty-four kilometers south of Harbin, as the primary site of Japan's BW program.

The program was largely carried out under the auspices of the Epidemic Prevention and Water Supply Unit, also known as Water Purification Detachment 731 or "Unit 731." Unit 731 explored the weapons utility of numerous biological agents, including *Bacillus anthracis*, which causes anthrax; *Yersinia pestis*, which causes plague; and such food- and waterborne pathogens as *Vibrio cholerae* and *Salmonella* and *Shigella* species. Prisoners were often used in experiments to this end, including direct challenge testing by ingestion and injection as well as incendiary testing at Anta Station, Pingfan's proving ground. Incendiary experiments included the field testing of two different Japanese-made bombs, the *Ha* and the *Uji*. The *Ha* bomb was composed of 1,500 cylindrical projectiles immersed in a half-liter of anthrax solution and walled by thin steel; upon impact, the shrapnel would cause anthrax-infected wounds over a diameter of roughly forty meters. The *Uji* was an "eggshell" bomb with walls made of porcelain instead of steel, and was used to deliver fleas infected with *Y. pestis* into Chinese civilian populations during the war.

Ishii was transferred from Unit 731 in 1942 and replaced by Lieutenant General Masaji Kitano, previously second in command of the BW program, but he was reappointed Chief of Detachment 731 in March 1945, after which he orchestrated the dismantlement and cover-up of the Unit's operations. Soviet forces in the region captured and eventually tried twelve Japanese soldiers for BW-related activities, while the United States offered immunity in exchange for information on the program. A Washington sub-committee for the Far East, representing a cross-section of military branches, divisions, departments, and offices, addressed the decision as follows:

> "Data already obtained from Ishii and his colleagues have proven to be of great value in confirming, supplementing, and complementing several phases of US research in BW, and may suggest new fields for future research. This Japanese information is the only known source of data from scientifically controlled experiments showing the direct effect of BW agents on man. In the past it has been necessary to evaluate the effects of BW agents on man from data through animal experimentation. Such evaluation is inconclusive and far less complete than results obtained from certain types of human experimentation… Since it is believed that the USSR possesses only a small portion of this technical information, and since any 'war crimes' trial would completely reveal such data to all nations, it is felt that such publicity must be avoided in interests of defense and security of the US. It is believed also that 'war crimes' prosecution of Ishii and his associates would serve to stop the flow of much additional information of a technical and scientific nature."[4]

Ultimately, the Japanese BW program failed to produce a reliably effective biological weapon despite its actual deployment of BW in the field, demonstrated for example by the 1941 attack of Changteh in which *V. cholerae* was apparently used as a BW agent by the Japanese but then boomeranged, leading to nearly 10,000 cholera cases and 1,700 deaths among their own troops.[5]

The United States. By the end of World War II, the United States maintained a well-funded BW program of its own. Like Japan, the United States did not ratify the Geneva Protocol until after the war (1975) and deliberately retained the right to retaliate-in-kind to any BW attack. In a June 8, 1943, speech President Franklin D. Roosevelt stated:

> "Use of such weapons has been outlawed by the general opinion of civilized mankind. This country has not used them, and I hope that we never will be compelled to use them. I state categorically that we shall under no circumstances resort to the use of such weapons unless they are first used by our enemies."[6]

The US BW program began with the 1941-1942 establishment of the War Bureau of Consultants (WBC) under Dr. Edwin B. Fred, professor of Bacteriology at the University of Wisconsin, and

[4] US War Department. War Crimes Office. Judge Advocate General's Office. Appendix B. Declassified 8 July 1977.
[5] S. Riedel S. "Biological warfare and bioterrorism: a historical review." *Proc (Bayl Univ Med Cent)*. 2004;17(4):400-406. doi:10.1080/08998280.2004.11928002.
[6] https://2009-2017.state.gov/t/isn/4784.htm

War Research Service (WRS), a parallel civilian agency. WRS evaluated biological agents for weapons utility and passed the most promising candidates on to the Chemical Weapons Service (CWS, which was established near the end of the First World War) for offensive and defensive application, signifying a transfer from civilian to military oversight. In 1944, the WRS was absorbed by the War Department, eliminating the civilian component and consolidating BW research and development under CWS's Special Projects Division. The Special Projects Division's parent CBW research and pilot plant center was housed at the US Army's Camp Detrick, later renamed Fort Detrick, in Frederick, Maryland. Fort Detrick became the recognized epicenter of the US BW program, and today still houses key defensive research facilities including the United States Army Medical Research Institute of Infectious Diseases (USAMRIID).

Also within the War Department, the U.S. Biological Warfare Committee (USBWC) was established to work in conjunction with the Special Projects Division, and George Merck, notable pharmaceutical entrepreneur and chair of the WRS prior to its dissolution, was appointed USBWC chair responsible for final decisions of mass production and use. Merck summarized BW-related accomplishments during World War II in a report to the Secretary of War as follows:

1. Development of methods and facilities for the mass production of microorganisms and their products.

2. Development of methods for the rapid and accurate detection of minute quantities of disease-producing agents.

3. Significant contributions to knowledge of the control of airborne disease-producing agents.

4. Production and isolation for the first time of a crystalline bacterial toxin, which has opened the way for the preparation of a more highly purified immunizing toxoid.

5. Development and production of an effective toxoid in sufficient quantities to protect large scale operations should this be necessary.

6. Significant contributions to knowledge concerning the development of immunity in human beings and animals against certain infectious diseases.

7. Important advances in the treatment of certain infectious diseases of human beings and animals, and in the development of effective protective clothing and equipment.

8. Development of laboratory animal propagation and maintenance facilities to supply the tremendous number of approved strains of experimental animals required for investigations.

9. Applications of special photographic techniques to the study of airborne microorganisms and the safety of laboratory procedures.

10. Information on the effects of more than 1000 different chemical agents on living plants.

11. Studies of the production and control of certain diseases and plants.[7]

Postwar BW efforts initially focused on *B. anthracis*, botulinum toxin, and other agents. In 1953, Pine Bluff Arsenal, formerly a manufacturing center for magnesium and thermite munitions outside One Bluff, Arkansas, was repurposed for BW and CW production. Its biological plant, renamed the Directorate of Biological Operations (DBO), became the BW program's primary large-scale production facility with an operating budget that ballooned to $7 million per year by 1969.

Field testing was primarily conducted at Dugway Proving Ground approximately eighty miles west of Salt Lake City, Utah, where it was established as a CW testing facility by the Army in 1942 and remains active today. Open-air BW testing was also conducted by the Deseret Testing Center (DTC), established in 1962 to obtain empirical data on BW use. Tests were conducted in various locations often outside of the continental United States, for example, attacking a makeshift naval fleet on multiple occasions under Project SHAD ("Shipboard Hazards and Defenses").[8]

On November 25, 1969, President Richard Nixon unilaterally banned all offensive BW activities by the United States. The United States was in possession of a nearly eighty-ton BW stockpile at

[7] US Department of the Army. US Army Activity in the US Biological Warfare Programs. Volume I, 24 February 1977 (UNCLASSIFIED), pp. 70-1.
[8] See, for example, Institute of Medicine 2007. Long-Term Health Effects of Participation in Project SHAD (Shipboard Hazard and Defense). Washington, DC: The National Academies Press. https://doi.org/10.17226/11900

the time. The ban was followed by a similar ban of toxin weapons less than three months later, justified by the president as follows:

> "These decisions have been taken with full confidence that they are in accord with the overall security requirements of the United States. These decisions also underline the United States support for the principles and objectives of the United Kingdom Draft Convention for the Prohibition of Biological Methods of Warfare. The United States hopes that other nations will follow our example with respect to both biological and toxin weapons. The renunciation of toxin weapons is another significant step, which we are willing to take unilaterally, to bring about arms control and to increase the prospects of peace."[9]

The UK Draft Convention for the Prohibition of Biological Methods of Warfare referenced by President Nixon would become the first international treaty to ban an entire class of weapons—the Biological Weapons Convention (BWC). The BWC prohibited the development, production, and stockpiling of biological weapons, marking a significant step forward from the 1925 Geneva Protocol's limitation of BW use only. The United Kingdom, the United States, and Soviet Union (along with a number of other nations) were signatories of the Convention from its inception, April 10, 1972. Upon ratification by these three countries—the depository states—on March 26, 1975, the BWC went into force.

The Soviet Union and Russian Federation. Unlike the United States, the Soviet Union did not discontinue its BW program with the establishment of the BWC.[10] Soviet BW efforts began in the 1920s but accelerated after World War II and revelations of the Japanese, United States, United Kingdom, and Canadian BW programs. In the 1950s, the Kirov Institute became the lead BW research and development institute under the Soviet Ministry of Defense's (MOD) 7th Directorate of the General Staff, headed by Colonel-General Yefim I. Smirnov. Two additional MOD institutes were established: a virology institute near Zagorsk (now renamed Sergiev Posad) and a combined bacteriology institute/production plant in Sverdlovsk (now renamed Yekaterinburg). In 1979, an

[9] The Department of State Bulletin, Vol. LXII, No. 1594, January 12, 1970, pg. 227.
[10] For an abbreviated history of the Soviet BW program, see Zilinskas RA. "The Soviet Biological Weapons Program and Its Legacy in Today's Russia." Center for the Study of Weapons of Mass Destruction, Occasional Paper No. 11 (*National Defense University Press;* Washington, DC: July 2016).

accidental release of *B. anthracis* spores from the Sverdlovsk institute caused a large civilian inhalational anthrax outbreak that led to closure of the production plant and relocation of bacterial production activities to Stepnogorsk, Kazakhstan. The three MOD facilities—Kirov, Zagorsk/Sergiev Posad, and Sverdlovsk/Yekaterinburg—remain the core of Russian military biological activities that are widely assessed as both offensive and defensive in nature but the specifics of which are largely unknown.

By 1970, the program had successfully weaponized *B. anthracis*, *Francisella tularensis*, *Y. pestis*, *Coxiella burnetii*, *Rickettsia prowazekii*, *Brucella* species, Venezuelan equine encephalitis virus, smallpox virus, and botulinum toxin. Many of these agents were tested on Vozrozhdeniye Island in the Aral Sea, the Soviet Union's primary open-air testing location for biological weapons since the 1950s.

While the Soviet Union's primary focus throughout the Cold War was the United States, multiple inside sources have indicated that the Soviet BW program may instead have focused on China, particularly in the late 1960s. The Soviet Union and China shared a 4,300 km Sino-Soviet border where escalating military clashes culminated in overt conflict in 1969, prompting Moscow to publicly threaten and privately consider a preemptive nuclear strike on China's fledgling nuclear program.[11] Numerous Soviet weapons scientists have cited China's overwhelming population advantage as a key driver of Soviet BW activities during this period given the clear utility of BW against human populations.[12]

In the early 1970s, the establishment of the BWC and the coincident advent of potentially dual-use genetic engineering techniques provided a strategic opportunity for the Soviet Union to gain a military advantage by significantly expanding its BW program. Influenced by respected scientist Yuri Ovchinnikov and led by YI Smirnov under the Ministry of Defence (MOD) General Staff's newly-formed 15th Directorate (which replaced the 7th Directorate), the expanded BW program applied genetic engineering and other modern biotechnologies to develop enhanced or novel

[11] See, for example, M. Gerson, "The Sino-Soviet Border Conflict." (Center for Naval Analyses: November 2010.) https://www.cna.org/CNA_files/PDF/D0022974.A2.pdf. See also: https://nsarchive2.gwu.edu/NSAEBB/NSAEBB49/index2.html
[12] M. Leitenberg and R.A. Zilinskas. "The Soviet Biological Weapons Program." (Cambridge, Harvard University Press, 2012.) Page 207.

biological weapons. As MOD facility activities continued, the 15th Directorate established a large, ostensibly civilian component of the BW program called Biopreparat, which comprised numerous geographically-dispersed institutes responsible for conducting both offensive and defensive BW research and development. Key Biopreparat facilities—including its primary civilian bacteriology institute the State Research Center for Applied Microbiology and Biotechnology, Obolensk (SRCAM)[13] and primary civilian virology institute the State Research Center of Virology and Biotechnology (VECTOR)[14]— continue to work with dangerous pathogens for defensive purposes today.

The Soviet Union formally dissolved on December 25, 1991. In 1992, Russian President Boris Yeltsin ordered the cessation of offensive BW activities and publicly stated that the Soviet Union had conducted an offensive program in violation of the BWC.[15] Whether enhanced or novel biological agents were successfully weaponized before the program's disbandment is uncertain; however, program defectors reported significant achievements employing modern biotechnological techniques,[16] and open source scientific publications revealed the successful application of such techniques to enhance BW surrogates of *B. anthracis*[17]and the smallpox virus[18] during the 1990s.

It is unclear what if any such activities continued into the 2000s; however, a widely publicized 2012 essay by then-Prime Minister Vladimir Putin calling for the development of genetic weapons systems renewed concerns that the Russian Federation may be pursuing BW capabilities in breach of the BWC. Prime Minister Putin's essay read:

> "In the more distant future, weapons systems based on new principles…genetic, psychophysical and other technology) will be developed. All this will…provide entirely

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[13] See https://www.obolensk.org/eng/index.htm

[14] See http://www.vector.nsc.ru/

[15] John-Thor Dahlburg, "Russia Admits It Violated Pact on Biological Warfare," *Los Angeles Times,* September 15, 1992, https://lat.ms/3wbbur6

[16] See, for example, Ken Alibek and Stephen Handelman. "Biohazard: The Chilling True Story of the Largest Covert Biological Weapons Program in the World, Told from the Inside by the Man Who Ran It." (New York: Random House, 2000).

[17] A.V. Stepanov, L.I. Marinin, A.P. Pomerantsev, N.A. Staritsin, "Development of novel vaccines against anthrax in man." *J Biotechnol.* 1996;44(1-3):155-160. doi:10.1016/0168-1656(95)00092-5.

[18] S.N. Shchelkunov, S.B., Stavitskii, L.I. Batenko, et al., "Viral chimeric protein including a determinant of myelin basic protein is capable of inducing allergic encephalomyelitis in guinea pigs." *Biomed Sci.* 1991;2(5):493-497.

> new instruments for achieving political and strategic goals. Such high-tech weapons systems will be comparable in effect to nuclear weapons but will be more 'acceptable' in terms of political and military ideology."[19]

While the implications of President Putin's statement on genetic weapons remain clouded, the Russian Federation continues to invest heavily in potentially dual-use genetic research and development, with the expressed goal of becoming a world leader in the technical space.[20]

Summary. This brief timeline of key State-level BW activities in the 20-21st century provides useful context for subsequent analysis of biological threats and options for control, with key points as follows:

- States have successfully developed biological weapons in the past but have largely refrained from deploying them, with the notable exception of World War II-era Japan.
- Historical motivations for developing biological weapons included perceived strategic advantage and deterrence, including the ability to "retaliate in kind."
- While the BWC uniformly banned biological weapons, it was unsuccessful in preventing significant BW advances by the Soviet Union (as well as other States such as Iraq).
- Modern biotechnological advances have lowered technical barriers to biological weapons development while reducing cost, such that technologically sophisticated States like the Russian Federation are capable of developing enhanced or novel biological weapons and, more broadly, potentially dual-use biological capabilities are now widespread in most countries around the world.

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[19] Prime Minister Vladimir Putin. Rossiiskaya Gazeta. February 20, 2012.
[20] See for example http://publication.pravo.gov.ru/Document/View/0001201904260007?index=1&rangeSize=1; https://www.bbc.com/russian/features-52470990

b. BW Threat Assessment Methodology

To systematically assess State-level biological threats, we typically evaluate two key contributing factors: capability (i.e., whether a potential actor has the technical capability to pursue or enact the threat), and intent (i.e., whether a potential actor has the motivation to pursue or enact the threat).

Assessing BW capabilities. To establish the capability to mount a biological attack, four key technical hurdles must be overcome: a pathogenic (or toxigenic) strain of a biological agent must be acquired, a sufficient amount of the agent (or toxin) must be produced, the agent must be formulated for stability and effectiveness during storage and delivery (not an absolute requirement), and the agent must be successfully delivered. Accordingly, a BW *capability* may be boiled down to three primary building blocks: pathogens, infrastructure, and expertise. (***figure 1***).

Figure 1. Building Blocks for a Biological Weapon

(1) The hazardous biological agent itself [1]
(2) The equipment/infrastructure necessary for its acquisition, production, formulation, and delivery as a weapon [2]
(3) The expertise necessary for the same [2]

[1] Most biological agents are widely available in both nature and the laboratory (where legitimate research, e.g., on pathogenesis and therapy, is performed).

[2] Both the equipment/infrastructure and expertise necessary to produce a bulk amount of agent, formulate it, and deliver it are largely dual use in nature, meaning that the same materials and thus knowledge required for the peaceful development and production of experimental and commercial products like food additives, pesticides, pharmaceuticals, and vaccines can be diverted with relative ease toward weapons-related applications.

Pathogens are widely available in laboratories around the world and ubiquitous in the environment. Infrastructure and expertise are similarly available across academia and industry because of their dual-use nature, meaning that the same materials and knowledge utilized for peaceful purposes may be diverted toward illicit ends with relative ease. Therefore, in the absence of such highly suspect BW signatures as blast chambers and field-testing facilities, we must be able to gauge *intent* to distinguish between legitimate and illegitimate BW-related activities.

Technological change. Emerging technologies continue to lower technical barriers to establishing a BW capability while reducing cost. For example:

- *Acquisition*. De novo gene synthesis enables the synthesis of known or novel pathogens in the laboratory. Examples including polio virus (2002), 1918 pandemic influenza virus (2005), Ebola virus (2019), and SARS-CoV-2 (2002).
- *Production*. Single-use and clean-in-place technologies enable covert BW development while additive manufacturing and cloud laboratories enable perpetrators to circumvent existing dual-use technology controls.
- *Delivery*. Unmanned aerial vehicles (UAVs) enable remote dissemination of biological weapons at low risk to the perpetrator.

Assessing BW intent. Biological weapons development requires a conscious and necessarily covert decision to invest money, human and material resources, and time in contravention to interventional law. Indicators of interest in or pursuit of biological weapons may be derived from statements by political leadership, state media reports, government budgetary allocations, and scientific publications or lack thereof. Additional data sources include social media posts, electronic communications (Internet, tweet, text), and online communities, chat rooms, and message boards. Ultimately, understanding a potential proliferator's motivations is extremely challenging in the absence of timely and accurate intelligence.

c. BW Threats in the Asia-Pacific

China. While the People's Republic of China has played a central role in the historical context of BW as described earlier—both having suffered BW attacks at the hands of the Japanese and having been suggested as a potential target of Soviet biological weapons due to neighboring China's large population advantage—there is no corroborated evidence in the open source domain that China has ever maintained an offensive BW program, past or present.

As noted above, biological weapons development requires a conscious and necessarily covert decision to invest money, human and material resources, and time in contravention to international law. China acceded to the BWC in 1984,[21] and has submitted annual Confidence Building Measure (CBM) reports—which aim to improve cooperation of States Parties under the Convention, including CBM F on "Declaration of past activities in offensive and/or defensive biological research and development programmes"[22]—since 1989. China has restricted these submissions to States Parties only, such that their contents are not publicly available;[23] however, it is reasonable to assume the contents of these submissions are consistent with China's unwavering formal position that it has never engaged in offensive BW activities.[24]

The US State Department's 2019 report on Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments (Compliance Report) stated that "[i]nformation indicates that the People's Republic of China (China) engaged during the reporting period in biological activities with **potential dual-use applications**, which raises concerns regarding its compliance with the BWC," and "[t]he United States does not have sufficient information to determine whether China eliminated its assessed biological warfare (BW) program, as required under Article II of the Convention."[25] The report further states the that "[t]he United States assesses China possessed an offensive biological warfare program from the early 1950s to at least the late 1980s…China's CBM reporting has never disclosed that it ever pursued an offensive BW program." While it is unclear what information led the United

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[21] Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, UNODA, http://disarmament.un.org/treaties/t/bwc

[22] United Nations Office for Disarmament Affairs, *Guide to Participating in the Confidence-Building Measures of the Biological Weapons Convention, Revised Edition*, 2015, Geneva: United Nations Office for Disarmament Affairs. https://www.unog.ch/80256EDD006B8954/(httpAssets)/DE1EE44AFE8B8CF9C1257E36005574E4/$file/cbm-guide-2015.pdf

[23] See: https://bwc-ecbm.unog.ch/state/china

[24] For sake of completeness, it should be noted that some Chinese authors of unknown influence have suggested that China should consider BW as a viable and perhaps even more humane alternative to other forms of war. For example, a 2006 paper by Ji-Wei Guo of the Department of Medical Affairs, Southwest Hospital, Third Military Medical University, Chongqing argued that "[m]odern biotechnology…can be used to bring damages and injuries to individuals in war in a more accurate and effective fashion. Different military biotechnologies can be chosen in accordance with different pathogenic factors to meet different military goals. The attack, therefore, will wound different levels of specific gene, protein, cell, tissue, and organ. It no doubt will be more effective to cause damages than conventional weapons, yet the nonlethal effect will remain to be civilized in terms of postwar reconstruction and hatred control." Ji-Wei Guo, The Command of Biotechnology and Merciful Conquest in Military Opposition, Military Medicine, Vol. 171, November 2006.

[25] US Department of State, *2019 Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments (Compliance Report)*. Washington DC: US Department of State, pp. 45-46, https://www.state.gov/2019-adherence-to-and-compliance-with-arms-control-nonproliferation-and-disarmament-agreements-and-commitments-compliance-report/

States to cite an “assessed” BW program on behalf of China, the US position on China’s dual-use capabilities is certainly accurate: as described in the previous section of this paper, virtually all countries possess the building blocks for a BW capability, and as a global technology leader, China’s corresponding capabilities are more advanced than most. The question is whether China would attempt to pursue such a capability in breach of its BWC obligations?

While countries such as the Soviet Union and Iraq have breached the BWC in the past, an argument can be made that each country’s breach was strategic—the Soviet Union to gain an asymmetric advantage over the United States in the great power competition that characterized the Cold War (as well as, possibly, possessing a mass casualty weapon to counter neighboring China’s population advantage, as noted), and Iraq to counter superior military manpower and perceived WMD threats in the region (e.g., on the part of Iran).[26] Would pursuing an offensive biological weapons capability similarly fit China’s prevailing strategy?

China’s grand strategy is founded upon technological superiority and economic expansion in the Global South. That strategy has enjoyed remarkable success—China’s corresponding Belt and Road Initiative has engaged more than 60 countries and invested over $200B in infrastructure development to date.[27] However, one enduring risk to the strategy’s ultimate success is the perception of China on the global stage. A negative perception would undermine China’s ongoing soft power investment, which might explain the PRC’s concerted efforts during the ongoing COVID-19 pandemic not only to project strength but to emerge as a global leader in the area of global health security.

The discovery of a covert offensive BW program in China would threaten not only China’s external relationships with both partner nations and key international organizations like the World Health Organization (WHO), World Trade Organization (WTO), and World Bank, but also China’s internal stability. Biological weapons are widely abhorred, perhaps nowhere more so than in China (where, as noted, the Chinese people suffered BW attacks at the hands of the Japanese during the Second Sino-Japanese War that coincided with World War II).[28] And China has other,

[26] Republic of Iraq, Biological Full Final and Complete Disclosure (FFCD) to the United Nations, September 1997, Chapter 1.8.1.
[27] See, for example, https://www.cfr.org/backgrounder/chinas-massive-belt-and-road-initiative
[28] See, for example, https://www.nytimes.com/1997/02/04/world/germ-war-a-current-world-threat-is-a-remembered-nightmare-in-china.html.

more predictable military options for area denial and deterrence, which form the basis of its national military strategy.[29]

In summary, there is no indication in the open-source domain—including statements from Chinese leadership, state media reports, government budgetary allocations, and scientific publications or lack thereof—that China maintains an offensive BW program, despite access to the necessary building blocks.

North Korea. The Democratic People's Republic of Korea (DPRK) acceded to the BWC in 1987 but has submitted no annual CBM reports since 1990.[30] The US State Department's 2019 Compliance Report stated that "[t]he United States assesses that the Democratic People's Republic of Korea has an offensive BW program and is in violation of its obligations under Articles I and II of the BWC,"[31] but little information is available in the open source domain to support or refute the US position.[32] Despite public denials of the existence of an offensive BW program, which the United States claims has been in existence since the 1960s, the DPRK's strategic need to "counter US and South Korean military superiority" (per the US Compliance Report) might provide the necessary motivation to pursue biological weapons in contravention of international law, and the DPRK's open breach of international law in the nuclear sphere may lend some credence to this notion.

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[29] See, for example, https://www.csis.org/analysis/chinas-new-2019-defense-white-paper; and https://www.rand.org/content/dam/rand/pubs/conf_proceedings/CF145/CF145.chap7.pdf

[30] "Status of the Treaty, Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction,"http://disarmament.un.org/treaties/t/bwc; "BWC confidence building measures," http://disarmament.un.org/treaties/t/bwc; https://bwc-ecbm.unog.ch/?field_form_year_tid=555

[31] US Department of State. *Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments (Compliance Report)*, 2019, Washington DC: US Department of State, pp. 47-48, https://www.state.gov/2019-adherence-to-and-compliance-with-arms-control-nonproliferation-and-disarmament-agreements-and-commitments-compliance-report/

[32] For various open source assessments and commentary on North Korea and biological weapons, see, for example: https://www.rand.org/content/dam/rand/pubs/testimonies/CT400/CT486/RAND_CT486.pdf; https://www.belfercenter.org/sites/default/files/2017-10/North%20Korea%20Biological%20Weapons%20Program.pdf; https://www.nytimes.com/2019/01/15/science/north-korea-biological-weapons.html; https://www.38north.org/2019/01/jparachini013019/; https://thebulletin.org/2017/07/potemkin-or-real-north-koreas-biological-weapons-program/

A 2015 media event by leader Kim Jong Un provided some insight into the DPRK's dual-use capabilities that could be diverted toward BW efforts if the intent existed. Kim toured the Pyongyang Biotechnical Institute, a pesticide facility that publicly-shared photographs revealed to be well-equipped for the production of *Bacillus thuringiensis*, a biopesticide that is related to *B. anthracis*.[33] Many Western analysts have connected this media event—perhaps as a veiled threat—with the widely publicized, inadvertent shipment of viable *B. anthracis* spores by the US's Dugway Proving Ground to dozens of laboratories in multiple countries around the world, including the ROK, over a period of years.[34] Research collaborations between North Korean and foreign scientists that might advance dual-use biological capabilities have also been well-documented, including work on *Bacillus* species related to *B. anthracis*.[35] These open source data points, while establishing that the DPRK (like most countries around the world) possesses the building blocks for a biological weapon, provide no definite evidence that the DPRK either possesses or is in pursuit of such weapons.

India, Pakistan, and other nations of the Asia-Pacific. Both India and Pakistan are original signatories of the BWC and ratified the Convention in 1974.[36] Despite their status as nuclear powers, neither country has been assessed as possessing an offensive BW program, though both maintain extensive dual-use capabilities within their burgeoning tech sectors. Likewise, no other Asia-Pacific countries are assessed as possessing an offensive BW program despite widespread dual-use capabilities.

[33] Melissa Hanham, "Kim Jong Un Tours Pesticide Facility Capable of Producing Biological Weapons: A 38 North Special Report," 38North, July 9, 2015, https://www.38north.org/2015/07/mhanham070915/

[34] US Department of Defense, *Review Committee Report: Inadvertent Shipment of Live Bacillus Anthracis Spores by DoD*, 2015, Washington DC: US Department of Defense, http://www.documentcloud.org/documents/2178546-dod-anthrax-review-committee-report-23july2015.html?_ga=2.3006899.22627998.1599157323-1221756464.1596566377

[35] See: https://www.nonproliferation.org/wp-content/uploads/2018/12/op43-dprk-international-scientific-collaborations.pdf The report cites 224 international collaborations with North Korean scientists in the biology domain between 1958 and 2018.

[36] Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, UNODA, http://disarmament.un.org/treaties/t/bwc

Control

Options for BW control span the sequential steps along the timeline leading up to, including, and following a biological attack: (1) the decision to pursue a BW capability; (2) the successful development of a biological weapon, namely by overcoming the above-described four key technical hurdles of acquisition, production, formulation, and delivery; (3) the decision to use this weapon; and (4) successful attack. A systemic approach to establishing corresponding BW controls follows the "seven D's" of national security: dissuasion, disarmament, denial, disruption, deterrence, detection, and defense, each of which is discussed in turn below.[37]

Dissuasion. The goal of dissuasion is to decrease an adversary's interest in and pursuit of biological weapons. The primary mechanism of dissuasion is international policy, including incentives and disincentives (e.g., sanctions) that influence the international political environment to decrease BW demand. A secondary mechanism of dissuasion is to reduce vulnerabilities to limit the likelihood of success or anticipated impact of a biological attack, making the use of biological weapons an unappealing choice.

Disarmament. The goal of disarmament is to eliminate existing BW capabilities. The primary mechanism of disarmament is the BWC. The BWC consists of fifteen short sections, or Articles, four of which (Articles I, III, IV, and X) are of particular relevance. Article I contains the primary prohibition against biological weapons.

> *Each State Party … undertakes never in any circumstances to develop, produce, stockpile or otherwise acquire or retain:*
>
> *1. Microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes;*
>
> *2. Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict. (BWC, 1972: 2)*

[37] Richard Pilch, "Arms Control Measures," in Heggenhougen, H.K., *International Encyclopedia of Public Health*, 2nd Edition (San Diego: Elsevier Inc., 2016).

Article III restricts the transfer of all items covered by Article I to substate actors, including terrorist groups:

> *Each State Party to this Convention undertakes not to transfer to any recipient whatsoever, directly or indirectly, and not in any way to assist, encourage, or induce any State, group of States or international organizations to manufacture or otherwise acquire any of the agents, toxins, weapons, equipment or means of delivery specified. … (BWC, 1972: 2)*

Article IV affirms the need for *national* measures to impede proliferation in accordance with the provisions of the Convention.

> *Each State Party to this Convention shall … take any necessary measures to prohibit and prevent the development, production, stockpiling, acquisition, or retention of the agents, toxins, weapons, equipment and means of delivery specified in article I of the Convention, within the territory of such State, under its jurisdiction or under its control anywhere. (BWC, 1972: 2)*

Article X preserves 'peaceful' applications of corresponding dual-use capabilities:

> *… the economic or technological development of States Parties to the Convention or international cooperation in the field of peaceful bacteriological (biological) activities, including the international exchange of bacteriological (biological) agents and toxins and equipment for the processing, use or production of bacteriological (biological) agents and toxins for peaceful purposes in accordance with the provisions of the Convention. (BWC, 1972: 3–4)*

Denial. The goal of denial is to prohibit development of new BW capabilities via security, export control, and scientific oversight of biological weapon building blocks, i.e., pathogens, infrastructure, and expertise. Security measures are primarily applied in laboratories, which house each of these building blocks, in particular pathogens. Historically, the vast majority of attempts to illicitly acquire pathogen have involved a laboratory "insider," defined as anyone with legitimate access to the laboratory. Thus, security measures traditionally reflect an "inside-out" approach, such that the insider is addressed first, beginning with personnel reliability programs to minimize the potential for insiders, then protecting pathogens at the point of storage (e.g., a secured freezer) and point of use (e.g., a secured laboratory), and expanding outward out from there to secure pathways into and out of the laboratory, the respective building, and the facility as a whole.

The primary source of dual-use infrastructure is purchased on the open market. Thus, import/export and transfer controls are necessary to permit legitimate purchases while monitoring purchase orders for red flag indicators that might suggest nefarious intent. So-called "Know-Your-Customer" guidance uses national and international control lists such as the US Department of Commerce Bureau of Industry and Security's Entity List to screen purchasers.[38] Purchased items are similarly screened against national and international control lists such as the Common Control Lists of the Australia Group, an informal international body charged with harmonizing global export controls related to biological and chemical weapons[39] and evaluating for discrepancies in materials or quantities from those anticipated based on the purchaser's declared business.

Scientific oversight is performed in conjunction with the above security and export control activities to address the third biological weapon building block, relevant expertise. This expertise can come from former weapons programs or from legitimate scientific programs, by way of direct personnel hire, open sharing of information (e.g., in scientific publications), or intangible transfers such as phone calls, faxes, or emails. The knowledge of former bioweaponeers and the so-called brain-drain phenomenon remain of concern with respect to the former Soviet offensive BW program. These concerns are primarily addressed by cooperative programs designed to bring these scientists into the international scientific community and aid them in establishing legitimate research collaborations. Open transfer of information stems from the virtually unlimited amount of science with potential dual-use implications, most of which holds the potential for vast benefits and thus requires oversight measures founded on the principle of scientific self-regulation, such that national and international scientific communities establish their own boundaries for such activities (and any resulting data) to maximize benefits while minimizing risks. Patent applications, declassified military documents, and other so-called gray literature require a similar

[38] US Department of Commerce, "Entity List," Bureau of Industry and Security, https://www.bis.doc.gov/index.php/policy-guidance/lists-of-parties-of-concern/entity-list
[39] "The Australia Group,"https://www.dfat.gov.au/publications/minisite/theaustraliagroupnet/site/en/index.html

approach. The oversight of intangible transfers is a special case that generally necessitates national legislation in accordance with Article IV of the BWC.

Disruption. The goal of disruption is to interdict new BW capabilities or a biological weapon itself before or upon reaching the prospective end user. Such disruption measures include border and maritime security programs, import/export, and transfer control measures mirroring those described previously, and, perhaps most importantly, the diligent "tasking" of intelligence systems to identify trafficking networks. Unfortunately, because both biological weapons-related activities and the resulting weapons have few signatures and are readily concealable (i.e., weapons are small enough to be hidden on a person in many cases), disruption measures have proven challenging in comparison to, for example, those targeting radiological materials, which possess signatures that are clearly identifiable by dosimeters and the like. Thus, while disruption remains a necessary barrier in the biological threat continuum, its contribution may be limited.

Deterrence. The goal of deterrence is to prevent the deployment and employment of biological weapons. Deterrence primarily involves the criminalization of any biological weapons-related activity (including use), backed by a substantial law enforcement capability. Corresponding national legislation in accordance with Article IV of the BWC—for example, the US Biological Weapons Anti-Terrorism Act of 1989—has been invoked on numerous occasions in the past two decades to convict perpetrators of biological weapons-related plots and activities.[40]

Detection. The goal of detection is to ensure early warning of attack to enable effective intervention. In general, a biological attack is most likely to be detected in one of two ways. First, a detection system "alarm" may be triggered. Second, populations (animal or human) may begin to fall ill.

In the first instance, detection systems may identify an increased level of a biological agent over "background" levels that exist naturally in the environment, suggesting a biological attack and thus setting in motion a dedicated response. In the United States, for example, both military and civilian systems are in place to this end, with the civilian BioWatch program active in over thirty undisclosed US cities.

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[40] See, for example, https://www.france24.com/en/20200326-tunisian-handed-ten-years-for-ricin-bomb-plot-in-Germany; https://law.justia.com/cases/federal/appellate-courts/ca2/16-819/16-819-2018-08-27.html

In the second and arguably more likely instance, ill animal or human populations and epidemiological trace-back may lead to awareness of a common exposure, with certain characteristics of that exposure indicating a biological attack, for example, occurrence of an unusual disease for an area or animal, or the unusual presentation of a given disease in humans (e.g., if a patient presents with respiratory symptoms and signs indicative of an inhalational exposure as opposed to symptoms and signs that would be expected from infection via more common routes of natural exposure). Affected populations may be identified by individual diagnosis and case reporting to public health agencies, sentinel surveillance in which representative subsets of a population are monitored for trends in such indicators of illness as over-the-counter pharmaceutical sales and child absenteeism (animal populations may be similarly monitored), or syndromic surveillance in which subsets of a population are monitored for certain constellations of symptoms and signs associated with, for example, flulike, respiratory, gastrointestinal, cutaneous, or neurological illness.

Other possible ways in which a biological attack may be detected include law enforcement interdiction, whether pre-attack, at the time of attack, or postattack; an allegation by a state or non-state entity that it has been subjected to an attack; notification or tipoff, possibly on the part of the perpetrator; or identification and subsequent characterization of a visible substance such as a powder.

Defense. The goal of defense is to ensure effective response in the event of attack. This catch-all term encompasses crisis and consequence measures that rely on a field-tested incident response capability; adequate health-care surge capacity; the availability, mobilization, and administration of therapeutic countermeasures; rapid and reliable forensics to ensure attribution; and ready, proven decontamination technologies. Notably, the adequate safety of responders and healthcare workers is of primary consideration in crisis and consequence management and is critical in preventing exposure to persistent agents and/or propagation of infection. Perhaps most importantly, good communication, which serves as the backbone of all defensive efforts not only among those involved in a response but extending to policymakers and the general public, cannot be overemphasized. The improved understanding of specific disease pathogenesis and therapy, as well as the validation of approaches to mass casualty response, attribution, and environmental remediation, will contribute considerably to defense efforts in the future.

Nuclear Deterrence in the Pandemic Era

To this point, we have described the threat and control of biological weapons in a vacuum. The reality of biological weapons threats and their control is far more complex, however. For example, the Asia-Pacific is home to multiple nuclear-weapon states—how does their nuclear deterrent capability impact the threat and control of biological weapons? Furthermore, natural outbreaks and pandemics might be misinterpreted as deliberate attacks, or used to mask them—how do we avoid nuclear escalation and potential brinksmanship when we are unable to discern an outbreak's origin? In this section, we grapple with some of these real-world challenges in the Asia-Pacific, with the goal of deriving practical recommendations for regional stability and security.

Nuclear doctrine and pandemic context. The pandemic context carries a neglected risk for the Asia-Pacific region: the risk that nuclear-weapon states operating in the region could not only mistake a natural pandemic or accidental biological release for an intentional biological weapons attack but compound this error by responding with a nuclear attack. After all, many of these states have published nuclear doctrines that declare that they are prepared to respond to biological weapons attacks with nuclear ones, leaving open the question of how and when such attacks would be attributed. In particular:

United States. The United States has wrestled openly with the question of whether to retain the option of responding to a perceived BW attack with nuclear weapons but continues to maintain that option. In its 2010 Nuclear Posture Review (NPR), for example, the Obama administration debated whether to adopt a "universal policy that the 'sole purpose' of US nuclear weapons is to deter nuclear attack on the United States and our allies and partners," but backed away from doing so in part because of the perceived need to deter biological weapons. Thus, while strengthening its 'negative security assurances' that "the United States will not use or threaten to use nuclear weapons against non-nuclear weapon states that are party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and in compliance with their nuclear non-proliferation obligations," the NPR included a caveat for biological weapons:[41]

[41] See U.S. Secretary of Defense, 2010 Nuclear Posture Review Report (Washington, D.C.: Office of the Secretary of Defense, 2010), 15–16, https://www.hsdl.org/?view&did=777468

> Given the catastrophic potential of biological weapons and the rapid pace of bio-technology development, the United States reserves the right to make any adjustment in the assurance that may be warranted by the evolution and proliferation of the biological weapons threat and U.S. capacities to counter that threat.

The 2010 NPR went on to state that:

> In the case of countries not covered by this assurance—states that possess nuclear weapons and states not in compliance with their nuclear non-proliferation obligations—there remains a narrow range of contingencies in which U.S. nuclear weapons may still play a role in deterring a conventional or CBW attack against the United States or its allies and partners."

The former Trump administration in its 2018 Nuclear Posture Review did not make explicit changes when it came to how it would respond to a potential biological attack. More generally it appeared to broaden the potential use of nuclear weapons, however, particularly against non-nuclear-weapon states:

> 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. [42]

[42] U.S. Secretary of Defense, Nuclear Posture Review 2018 (Washington, D.C.: Office of the Secretary of Defense, 2018), 21, https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF

It also pointed to "the proliferation of highly-lethal biological weapons" as a form of technological uncertainty that could change the threat environment and "dramatically affect US nuclear force requirements, policy, and posture."[43]

Russia. Russia, likewise, has promulgated a military doctrine which retains the option of responding to a perceived biological attack with a nuclear one. [44] For example, its 2010 military doctrine stated that Russia "reserves the right to utilize nuclear weapons in response to the utilization of nuclear and other types of weapons of mass destruction against it and (or) its allies."[45] In Early June 2020, Russia released a new document titled, "On Basic Principles of State Policy of the Russian Federation on Nuclear Deterrence," that outlined the threats and circumstances that could lead to Russia's use of nuclear weapons. The document lists a number of threats that Russia might face and circumstances under which it might consider the use of nuclear weapons. It indicates that Russia could order a nuclear strike in response to the "use of nuclear weapons or other types of weapons of mass destruction by an adversary against the Russian Federation and/or its allies."[46]

China. China continues to declare that it will not engage in the first use of nuclear weapons and has not carved out any exceptions.[47] In the past, this declaratory policy was buttressed by China's small and largely un-mated arsenal. China has moved to a larger, more diverse arsenal, however, including naval systems where operational warheads are not separated from missiles. Concurrently, military experts in China are engaged in a growing debate about either abandoning the no-first-use doctrine altogether or carving out exceptions. Outsiders, meanwhile, increasingly question the credibility of Beijing's no-first-use declaration.

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[43] Ibid 14.

[44] For an excellent summary of Russian military doctrine, see Amy Wolff, *Russia's Nuclear Weapons: Doctrine, Forces, and Modernization* , Congressional Research Service, No. R45861 (Washington, D.C.: Congressional Research Service, July 20, 2020) https://crsreports.congress.gov/product/pdf/R/R45861

[45] "The Military Doctrine of the Russian Federation" approved by Russian Federation presidential edict on 5 February 2010,"https://carnegieendowment.org/files/2010russia_military_doctrine.pdf

[46] Ministry of Foreign Affairs of the Russian Federation. 2020. "On Basic Principles of State Policy of the Russian Federation." Moscow, June 2. https://www.mid.ru/en/web/guest/foreign_policy/international_safety/disarmament/-/asset_publisher/rp0fiUBmANaH/content/id/4152094

[47] Information Office of the State Council of China. 2015. "China's Military Strategy." http://english.www.gov.cn/archive/white_paper/2015/05/27/content_281475115610833.htm

North Korea. North Korean suspicions of the United States and the ROK could lead the DPRK to mistake a natural outbreak/pandemic or laboratory accident for a deliberate nuclear attack. Ever since the Korean War, when it falsely accused the United States of employing BW,[48] Pyongyang has been primed for a biological attack from the United States or the ROK. Therefore, a natural outbreak (particularly if it appears first in the DPRK) is likely to be viewed as a deliberate attack until proven otherwise. And Pyongyang also is primed to believe that even in the case of a natural outbreak, the United States or the ROK can be expected to exploit the crisis as an opportunity for subversion and a threat to the regime. [49]

India. India has long and loudly proclaimed that a cardinal principle of its nuclear doctrine is that it will not engage in the first use of nuclear weapons. However, it has been largely overlooked that for two decades this policy has included a significant caveat when it comes to biological weapons. India's 2003 nuclear doctrine states that "in the event of a major attack against India, or Indian forces anywhere, by biological or chemical weapons, India will retain the option of retaliating with nuclear weapons."[50] Interestingly, this caveat was not included in the initial draft doctrine India released after its 1998 nuclear tests. [51]

Pakistan. Given India's overwhelming conventional advantage, Pakistan has refused to renounce the first use of nuclear weapons. Government officials have not spoken specifically, however, on how Pakistan might respond to a chemical or biological attack. Whether and how these declaratory policies would play out under real-life circumstances is far from clear, however. These doctrines are primarily intended to communicate to potential adversaries as a form of deterrence. In the end, policymakers will decide, in the moment of crisis, how to respond to any outbreak and the possibility that it might stem from the use of biological weapons.

Bioterrorism and nuclear escalation. As we have seen, deciding that an outbreak is natural, accidental, or intentional is highly challenging. Furthermore, this attribution challenge could be

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[48] Milton Leitenberg, "False Allegations of U.S. Biological Weapons Use during the Korean War," in Anne L. Clunan, Peter R. Lavoy, and Susan B. Martin, eds., *Terrorism, War, or Disease? Unraveling the Use of Biological Weapons* (Palo Alto, CA: Stanford University Press, 2008) 120-143.

[49] Correspondence with North Korea expert Joshua Pollack, 8 September 2020.

[50] Prime Minister's Office. 2003. *Cabinet Committee on Security Reviews Progress in Operationalizing India's Nuclear Doctrine*. New Delhi: Government of India.

[51] Kumar Sundaram and M. V. Ramana, "India and the Policy of No First Use of Nuclear Weapons," *Journal for Peace and Nuclear Disarmament*, 1:1, 152-168, DOI: 10.1080/25751654.2018.1438737

intentionally or unintentionally exacerbated by non-state actors to leverage nuclear escalation for their own purposes.

For example, a millennial terrorist group such as Al Qaeda or ISIS could launch a biological attack against countries such as the United States, the DPRK, or Russia with hopes that it would be perceived as an attack by that country's adversary, with consequent retaliation. Or Kashmiri militants with links to Pakistan could launch such an attack against India with or without support from Islamabad and with or without publicly acknowledging their responsibility. Alternatively, such militants could claim that what was in fact a natural outbreak on either side of the line of control was a BW attack, bringing nuclear escalation dynamics into play. The potential for the latter such effort is illustrated by a 1994 plague outbreak in Western India which was initially suspected to be a bioterrorist attack. [52]

Discerning between natural and deliberate outbreaks. As described in the "detection" discussion above, there are two most likely scenarios in which a biological attack may play out: a detection system may be triggered, or human or animal populations may begin to fall ill. While the former scenario is largely specific to an attack (though false positives commonly occur due to detection of natural biological agents above expected background levels), the latter scenario requires that that the outbreak's origin—natural versus deliberate [53]—be determined to inform nuclear deterrence and, potentially, escalation options.

Initially, suspicion of a deliberate attack would likely be low in the absence of unique indicators (e.g., detection system alarm, law enforcement interdiction, allegation, tipoff, or visible substance such as a powder). Thus, a typical epidemiological investigation would most likely be conducted to determine the who, what, when, where, why, and how of the outbreak. First, investigators would perform case histories and interviews to determine who is being infected, by what disease agent,

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[52] Ron Barrett, "The 1994 Plague in Western India: Human Ecology and The Risks of Misattribution," in Anne L. Clunan, Peter R. Lavoy, and Susan B. Martin, eds., *Terrorism, War, or Disease? Unraveling the Use of Biological Weapons* (Palo Alto, CA: Stanford University Press, 2008), 49-71.

[53] In practice, as we have seen with the SARS-COV 2 pandemic, investigators actually might have to distinguish between three scenarios—natural outbreak, accidental laboratory release, and a deliberate attack. See, for example, Felippa Lentzos, "Natural spillover or research lab leak? Why a credible investigation is needed to determine the origin of the coronavirus pandemic," Bulletin of the Atomic Scientists, May 1, 2020, https://thebulletin.org/2020/05/natural-spillover-or-research-lab-leak-why-a-credible-investigation-in-needed-to-determine-the-origin-of-the-coronavirus-pandemic/. For the purposes of this paper, however, we have simplified the discussion to leave out this potential scenario,

when did infection occur, and in what location; this is called "descriptive epidemiology." Investigators would then seek to determine how infection occurred and why by assessing (a) the epidemiological triangle for indicators of convergence that would enable spillover of the infecting agent from its natural reservoir to humans, and (b) the infecting agent genome for indicators of geographical and temporal spread; this is called "analytical epidemiology." Throughout the investigative process, findings may suggest the possibility of a deliberate attack, as summarized in figure 2.

Figure 2. Potential Indicators of Deliberate Attack

Descriptive Epidemiology

Multiple, geographically-dispersed index cases are identified
Infecting agent is a traditional biological warfare agent
Infecting agent is unusual for location or time of year
Symptoms are unusual or unexpected (e.g., pulmonary symptomatology)
Animal populations are affected in concert with humans
Animal effects are unusual or unexpected for the species

Analytical Epidemiology

(a) Epidemiological Triangle Assessment

Lack of recognizable animal-human interface (e.g., exposure to sick animal, tick bite)
Epidemiological traceback of multiple cases to a common location or exposure

(b) Genome Assessment

Infecting agent genome matches known weapons strain
Infecting agent genome displays "frozen evolution"
Infecting agent genome has been engineered / edited

The epidemiological triangle is a simplified representation of the relationship between (1) a disease agent, typically in an animal reservoir; (2) a human host; and (3) the environment, which form the three points of a triangle. The lines of the triangle that connect these points can be long or short and can be lengthened or shortened. The goal of the assessment is to determine whether the lines have shifted in a way that has brought the infecting agent (or its animal reservoir) into contact with the human host. Initially, assessment focuses on tracing back human cases to any known animal reservoirs, whether exposed through direct contact, consumption of byproducts, or another route. If no epidemiological link is apparent, investigators can seek to identify risk factors that might enable such exposure by asking the following key questions:

- Has the human population expanded into areas where the disease agent resides in animal reservoirs, for example, due to wildlife trade, deforestation, or industrial farming?
- Has the disease agent expanded into human populations, for example, due to animal reservoir overgrowth, vector population overgrowth (e.g., ticks, fleas), or interspecies spillover?
- Has the environment brought animal and human populations closer together, for example, due to short-term meteorological shifts or longer-term climate shifts?

Like the epidemiological triangle, the infecting agent's genome may also hold clues to the outbreak's origin. This is especially true for viral agents, and RNA viruses in particular, where mutations routinely occur as the virus replicates (i.e., reproduces, which requires infection of a host cell). Mutations that offer a selective advantage for the virus survive, providing a geospatial and temporal map of the outbreak based on prevailing mutations. By comparing the infecting agent's genome with the genomes of well-characterized reference strains in the public domain, investigators can (1) identify the closest known relative of the infecting agent; and (2) determine whether the infecting agent's genome has amassed mutations consistent with known patterns of natural emergence. Investigators can further determine whether the infecting agent's genome so closely resembles a given reference strain that a period of limited or no replication is likely. Such so-called "frozen evolution," when an infecting agent's genome lacks the expected accumulation of mutations over time, suggests that alternative origin hypotheses such as a laboratory accident or deliberate attack must be explored.[54]

Based on descriptive and analytical epidemiology findings, investigators may collect and/or analyze additional animal, human, or environmental samples with the goal of closing information gaps in the prevailing origin hypothesis. For example, if contact with an animal reservoir is

[54] See, for example, D.J. Pascall D, K. Nomikou, E. Bréard, S. Zientara, AdS. Filipe, B. Hoffmann, et al. (2020) "Frozen evolution" of an RNA virus suggests accidental release as a potential cause of arbovirus re-emergence. PLoS Biol 18(4): e3000673. https://doi.org/10.1371/journal.pbio.3000673

suspected, investigators may collect animal or environmental samples at the suspected animal-human interface, whether a market, farm, abattoir, or in the wild; analysis of these samples may identify the reservoir or provide additional clues that can be traced back epidemiologically and genetically. "Banked" human samples predating the outbreak may also be tested to this end. Often, such clinical samples are retained for extended periods of time and may be revisited for further analysis, for example, if they came from patients with clinical presentations resembling the current outbreak.[55] In addition, investigators may actively collect human samples that might indicate exposure or infection in so-called sentinel populations at the animal-human interface; for example, serological testing of hunters or wildlife traders may identify antibodies against the agent causing the current outbreak, indicating exposure that may then be traced back to an animal reservoir.[56]

If findings of the outbreak investigation suggest the possibility of a deliberate attack, law enforcement must become involved either at the national level, possibly with support from other states, or at the international level under the UN Secretary General's Mechanism (UNSGM), likely in coordination with other relevant international organizations such as the World Health Organization (WHO) or World Organization for Animal Health (OIE). A law enforcement investigation would likely be initiated involving additional sample collection, careful documentation of chain-of-custody, and analysis in an accredited laboratory to ensure the integrity of evidence in a court of law; supplementary evidence collection and examination; targeted patient and witness interviews; and coordination with intelligence officials regarding adversary capabilities and motivations.

Despite a national or international investigative body's best efforts, it may not be possible to definitely determine the origin of a particular outbreak. For example, a 1942 outbreak of tularemia among German and Soviet troops during the Battle of Stalingrad has been alternately attributed to natural and deliberate causes. The most widely accepted explanation cites natural convergence on

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[55] For example, banked samples from a December 2019 patient with influenza-like illness and pneumonia in France were retested after the emergence of COVID-19 and found to be positive for the pandemic coronavirus, thus predating all previously identified cases outside of China. See A. Deslandes, V. Berti, Y. Tandjoui-Lambotte, et al., ''SARS-CoV-2 was already spreading in France in late December 2019.'' *International Journal of Antimicrobial Agents*. Volume 55, Issue 6, June 2020, 106006. https://doi.org/10.1016/j.ijantimicag.2020.106006

[56] See, for example, P. Dovih, E.D. Laing, Y. Chen, D.H.W. Low, B.R. Ansil, X. Yang, et al. (2019) ''Filovirus-reactive antibodies in humans and bats in Northeast India imply zoonotic spillover.'' *PLoS Negl Trop Dis* 13(10): e0007733. https://doi.org/10.1371/journal.pntd.000773

the epidemiological triad as the likely cause: the war's disruption of the local grain harvest led to population overgrowth of infected rodents, which passed the disease to both armies.[57] However, allegations that the outbreak was caused by a Soviet biological attack have persisted, including on the part of former Soviet bioweaponeers themselves.[58]

A similar debate today might spark an unfounded nuclear escalation spiral, the evidentiary basis of which becomes lost in the "fog of war." Similarly, imprecise analysis, for example the misinterpretation of environmental interferents as has commonly occurred with fielded biological detection devices,[59] might inadvertently lead to an asymmetric response. The risk of misattributing a natural event as a BW attack necessitates a deliberate, data-to-decisions approach that emphasizes degrees of certainty when determining proportional response. At a minimum, nuclear-weapon states must carefully consider how they operationalize doctrines the leave open the possibility of a nuclear response to a perceived BW attack.

Asymmetric opportunities for exploitation of a natural outbreak or pandemic. As described previously, we typically assess the threat of a deliberate biological attack by evaluating the two key contributing factors of capability (i.e., whether a potential actor has the technical capability to pursue or enact the threat) and intent (i.e., whether a potential actor has the motivation to pursue or enact the threat). A predisposing or concurrent natural outbreak holds the potential to alter each of these threat dimensions while also conferring potential advantages on the perpetrator, for example the ability to mask a BW attack since symptoms such as fever and flu-like illness are common across a range of infections regardless of origin. Options for control include disruption, deterrence, and defense.

From a capability perspective, natural outbreaks offer targetable reservoirs for acquisition of harmful biological agents while potentially enabling production, formulation, and delivery

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[57] See, for example, M. Leitenberg M and R.A. Zilinskas, *The Soviet Biological Weapons Program.* Cambridge, Harvard University Press, 2012; and Geissler E. Alibek, Tularemia, and the Battle of Stalingrad. CBWCB 69+70, September/December 2005.

[58] Ken Alibek, Biohazard: *The Chilling True Story of the Largest Covert Biological Weapons Program in the World, Told from the inside by the Man Who Ran It.* (New York: Random House, 1999.)

[59] Institute of Medicine (US) and National Research Council (US) Committee on Effectiveness of National Biosurveillance Systems: Biowatch and the Public Health System. Biowatch and Public Health Surveillance: Evaluating Systems for the Early Detection of Biological Threats: Abbreviated Version. Washington (DC): National Academies Press (US); 2011. Available from: https://www.ncbi.nlm.nih.gov/books/NBK219708/ doi: 10.17226/12688; pg. 50.

requirements to be circumvented if the agent causes contagious disease. Illicit attempts to acquire biological agents during outbreaks has been documented; for example, the apocalyptic cult Aum Shinrikyo, which perpetrated the Tokyo subway sarin attack in 1995 (sarin is a chemical weapon), reportedly attempted to acquire Ebola virus by posing as medical workers during a 1992 outbreak in Zaire (now the Democratic Republic of Congo).[60] During outbreaks of contagious disease such as influenza and COVID-19 (Ebola virus does not cause contagious disease), an ill constituent may be all that is needed to deliberately infect a target population; for example, a 2020 threat assessment by the US Department of Homeland Security (DHS) stated that "[m]embers of extremist groups are encouraging one another to spread the virus, if contracted, to targeted groups through bodily fluids and personal interactions."[61]

In 2019, the James Martin Center for Nonproliferation Studies (CNS) completed a detailed assessment of the risk that Islamist terrorists might use infected humans to spread a contagious disease. Our experts found that Islamist terrorists, and extremist groups more generally, are not bound by ideological or psychosocial norms that prohibit such behavior. In addition, the use of infected humans to spread a contagious disease requires comparatively limited technical know-how on the part of the perpetrator. And one of the primary limiting factors to such an attack—recruiting humans willing to infect themselves—does not apply in this case because potential perpetrators are those who are already infected with the virus. Our experts concluded that such an attack "could prove to be highly lethal to the targeted population(s), provide a low cost weapon, have a traumatic psychological shock value…undermine a country's public health and medical infrastructure's ability to respond, and erode faith in the government's ability to protect the public."[62]

From the perspective of intent, any potential perpetrator seeking a radical leveling approach—whether an asymmetrical state actor like the DPRK or a motivated terrorist organization—may be influenced by the demonstrated impact of natural outbreaks/pandemics to pursue biological weapons. For example, COVID-19's public health, economic, and social impact has unequivocally

[60] See, for example, https://wwwnc.cdc.gov/eid/article/5/4/99-0409_article

[61] https://www.cnn.com/2020/03/25/us/missouri-man-killed-fbi-investigation/index.html

[62] J.M. Bale, N.A. Hynes, and T.J. Reidy, *Assessing the Risk of Islamist Terrorists using Human Vectors to Deploy Contagious Pathogens.* James Martin Center for Nonproliferation Studies Report for the Smith Richardson Foundation (2019).

demonstrated the vulnerability of US and global populations to biological threats, whether of natural or deliberate origin. In our global society, pathogens have ready access to much of the world, traveling on or inside humans, animals, plants, or commerce. The US healthcare system is lean and depends on global supply chains, both of which contribute to capacity limitations during a large-scale event. Medical countermeasures such as diagnostics, therapeutics, and vaccines require resources and time to develop, test, and deploy. Citizen compliance with risk-reduction measures is influenced by civil liberties communication deficiencies and confusion spurred by fractured leadership at the state and federal level, and, importantly, disinformation from malign influence campaigns. And perhaps most notably, the economic fallout of COVID-19 has been far more severe than anticipated.

Options for preempting the exploitation of a natural outbreak or pandemic include disruption, deterrence, and defense. Disruption involves the interdiction of a potential actor as he attempts to acquire or spread the causative agent. Deterrence involves preventing the use of the agent as a weapon by ensuring severe consequences, whether through criminal legislation or various means of retaliation that include nuclear options in the extreme. Defense involves a range of measures that reduce the potential impact of an attack.

Conclusion

The Asia-Pacific has witnessed BW attacks on military and civilian populations, the first and only use of nuclear weapons, and now the emergence of SARS-CoV-2 and the global COVID-19 pandemic. Excluding Russia, the region is home to three historical nuclear powers—China, India, and Pakistan—and one emerging nuclear power, the DPRK. Like most countries around the world, countries of the Asia-Pacific possess dual-use biological capabilities that could be diverted to an offensive BW program, though no such program exists based on available information in the public domain. Countries in the region should be monitored for indicators of intent to enable early identification and mitigation of any such divergence.

The region comprises more than half of the world's population and is projected to amass more than half of the world's GDP in the next twenty years. Such unchecked population growth, industrial expansion, and corresponding ecological disruption increases the likelihood that novel disease agents will come into contact with naïve human populations, leading to emerging infectious disease outbreaks and pandemics. Because biological events of both natural and deliberate origin may be met with nuclear deterrence, escalation, or even use, corresponding origin investigations must bridge epidemiological and law enforcement principles and involve international bodies such as the UNSGM as appropriate. At the same time, given the risks of unclear or incorrect attribution, countries should, at a minimum, reconsider how they operationalize doctrines which leave open the possibility of a nuclear attack in response to a perceived BW attack. Natural biological events may also be leveraged for illicit ends, and therefore must be met with controls that include disruption, deterrence, and defense.

Ultimately, the Asia-Pacific's unique combination of nuclear-weapon states, dual-use biotechnological advance, and ecological disruption provide opportunities for intersection that warrant the highest level of vigilance on the part of regional stakeholders and their allies.

Section 2

INDIA-PAKISTAN NUCLEAR DYNAMICS
Rakesh Sood

NUCLEAR ESCALATION IN A TAIWAN STRAIT CRISIS?
Robert Ayson

ASYMMETRIC WMD THREATS: DPRK NUCLEAR, CYBER, AND BIO-CHEMICAL WEAPONS CAPABILITIES
Sang-Hyun Lee

11. India-Pakistan Nuclear Dynamics

Rakesh Sood

Introduction

The long-standing conflict between India and Pakistan took on a sharper edge with wider regional and even global implications when both countries announced their emergence as nuclear weapon states in 1998. Any expectations that this would lower tensions were soon belied. The nuclear discourse has been dominated by Western analysts. And, since both the Indian and Pakistani strategic communities were familiar with it, it provided the dominant framework for understanding the new nuclear relationship. It made dialogue easier even though the underlying politics and geography bore little resemblance to the ideology-driven Cold War-world. For Pakistan, the Western attribution that the India-Pakistan theater was a "nuclear flashpoint" was also politically convenient as it kept Western attention focused on Kashmir.

This paper seeks to unpack the India-Pakistan nuclear dynamics by taking an empirical look at the different crises beginning from the late 1980s. The first section deals with the origins of the India-Pakistan conflict and how the changing internal political dynamics have influenced and shaped the nuclear dynamic. The second section compares the nuclear doctrines of both countries as well as the current nuclear capabilities and future plans for their nuclear arsenals. Since neither country has released official figures about its arsenal, the estimates of capabilities are drawn from the Global Nuclear Database published by the U.S.–based *Bulletin of Atomic Scientists*. The third section covers the numerous crises since the late 1980s with relevant references to domestic political drivers. Two of these pertain to the pre-1998 and the rest to the post-1998 period. The fourth section shows the role of external actors and how India and Pakistan drew different conclusions from the crises. The fifth and final section concludes the essay by outlining steps that can be taken, unilaterally, bilaterally, and globally, to lengthen the nuclear fuse and to ensure that the nuclear threshold is not crossed.

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One could certainly suggest *unilateral* measures that, on the one hand, India could take to restore normalcy in the state of Jammu and Kashmir or, on the other, that the civilian government in Pakistan could take to reduce the role of the military in policymaking. However, these are beyond the scope of this paper as they entail taking a deep dive into domestic politics of both countries. In any case, the prospect that either would take such actions in current times are about as likely as global elimination of nuclear weapons. This paper accordingly focuses on the more realistic scenario, based on the assumption of continued hostile relations between the two neighbors, but also on the assumption that there is a shared convergence in seeking to prevent inadvertent escalation that might lead to unintended consequences and, ultimately, to nuclear war.

Origins of a Troubled Relationship

India and Pakistan have been locked into a conflictual relationship since they both became independent in 1947, arising out of the partition of British India. The British rulers divided India, creating Pakistan as a separate homeland for the Muslims of the Indian sub-continent, on the grounds that Hindus and Muslims constituted two separate nations—the concept of the "two nation theory."[1] Within months, India and Pakistan were locked in a conflict over the state of Jammu and Kashmir, which had legally acceded to India but was claimed by Pakistan on the grounds that it was a Muslim majority state. After four inconclusive wars in 1947-48, 1965, 1971, and 1999, the state of Jammu and Kashmir remains a disputed territory with India in possession of roughly two-thirds of the erstwhile state and the remaining under the control of Pakistan. The 740 km boundary in the state of Jammu and Kashmir is called the Line of Control, while the remaining 2,400 km border between the two countries is the "international boundary," which is not disputed.

Today, however, it is clear that Kashmir is not the only source of conflict. Nor can the conflict be explained in terms of a continuation of the "two nation theory" because there are more than 170 million Muslims in India accounting for 14.2 percent of India's population, up from less than 10 percent in 1951. In comparison, Pakistan's population is 210 million; Hindus account for less than

[1] The two nation theory posits that Hindus and Muslims are two separate nations and therefore Muslims should have their own homeland distinct from a Hindu majority India. The Muslim League, led by Muhammed Ali Jinnah, used this to raise the demand for a separate homeland for Muslims.

2 percent of its population, down from 12 percent in 1951 because many Pakistan Hindus, finding themselves reduced to second class citizens, have either converted or migrated. Moreover, when the glue of religion proved unable to hold East Pakistan and West Pakistan together, leading to its eastern wing emerging as Bangladesh in 1971 after a brutal suppression widely described as "genocide," the "two nation theory" was unambiguously controverted.[2]

As a new state, Pakistan consciously turned its back on its sub-continental civilizational roots that it shared with India and sought to redefine its identity anew, in the name of Islam. However, Pakistan found it difficult to reconcile the notion of a modern state with its founding ideology. The Muslim clergy represented by *Jamaat e Islami*, led by Maulana Maudoodi, had an uneasy relationship with the Muslim League, the political party led by Mohammed Ali Jinnah that had spearheaded the call for a separate homeland of the Muslims of the Indian sub-continent. The clergy suspected the League of using religion for political ends while actually desiring a modern state rather than one based on Islamic law (*shariah*). The desire for a national identity rooted in religion became the first source of divergence with India whose leaders sought to create a secular, plural, and democratic state.

The second source of divergence came with the decline of political parties in Pakistan, leading to long periods of military dictatorship. From 1958 to 1971, from 1977 to 1988, and from 1999 to 2008, Pakistan was under army rule, taking its toll on political parties and weakening institutions like the judiciary and media. Even with the restoration of democracy in 2008, the military still plays a leading role, especially where security, defence, and foreign policy are concerned. Repeated involvement of the military in governance has led to a militarization of the state. Perpetuating a hostile relationship with India has become necessary for the military to retain its role in the country's political life.

Further, like authoritarian rulers in other countries, the military rulers often sought to legitimize their coups by presenting themselves as defenders of not just the frontiers of the state but also guardians of Pakistan's Islamic ideology. The military rulers relied on the street power of the

[2] The census figures are drawn from the first census in both countries conducted in 1951, the 2017 census in Pakistan, and the census estimations for India just before the 2019 elections. A new census in India is due in 2021. A recent report in the *New York Times* also highlights the demographic trend in Pakistan, https://www.nytimes.com/2020/08/04/world/asia/pakistan-hindu-conversion.html?referringSource=articleShare

mullahs (Islamic religious leaders), a technique that was effectively used by General Zia ul Haq. It cast the hostility with India into a "jihad," a fight between the Muslim and the infidel, deepening the divide. Defining an identity by negating its subcontinental civilizational roots and making it "non-Indian" has remained Pakistan's dilemma. The military-mosque nexus shifted it from non-Indian to "anti-Indian," changing the historical narrative and locking not just the state but also the people into a relationship of hostility.[3]

On 6 February 2020, Pakistan's retired military officer, Lt. Gen Khalid Kidwai (who headed the Strategic Plans Division or SPD from 2000 to 2013 and is an adviser to Pakistan's Nuclear Command Authority) spoke at the International Institute of Strategic Studies in London on strategic stability. He identified four drivers of Indian policy as *Hindutva* philosophy, seeking to erase the "sense of humiliation of a Hindu nation of a thousand years of Muslim rule;" restoration of the perceived glory of Hindu India, going back to 300 BC; India's "quest for regional domination," particularly in relation to Pakistan; and finally, a "self-delusional one way competition with China," by aligning with the United States as an Indo-Pacific power.[4] Lt. Gen (retd) Kidwai's thinking is not new; it is reflected in official military writings in Pakistani training institutions and has played a major role in defining Pakistan military's strategic culture. It is therefore unsurprising that the army felt threatened by, and quickly stymied the few attempts by elected civilian leaders to improve relations with India (by Prime Minister Benazir Bhutto in 1989 and Prime Minister Nawaz Sharif in 1999).

Four key themes may be identified in the Pakistani military's strategic culture, of which three directly affect its relationship with India and the fourth does so indirectly. First, the Pakistani army considers the partition to have been an unfair process and therefore it considers it "incomplete." This view explains their obsession with Kashmir as well as the role of the army as the "guardian

[3] Many authors have written extensively about Pakistan's search for an identity, but I have relied on the writings of the eminent Pakistani-American historian Dr Ayesha Jalal, recipient of Pakistan's highest civilian awards Sitara – e-Imtiaz for her work. Dr Jalal's works include *The Sole Spokesman: Jinnah, the Muslim League, and the Demand for Pakistan,* New York: Cambridge University Press. (1985); *The State of Martial Rule: The origins of Pakistan's political economy of defence,* Cambridge: Cambridge University Press (1990); and *The Struggle for Pakistan: A Muslim Homeland and Global Politics,* Cambridge, Massachusetts: The Belknap Press of Harvard University Press (2014).

[4] See "Keynote Address and Discussion Session with Lieutenant General (Retd) Khalid Kidwai," February 6, 2020, at: https://www.iiss.org/events/2020/02/7th-iiss-and-ciss-south-asian-strategic-stability-workshop

of Pakistan's ideological frontiers." Linked to this factor is the conviction that India remains implacably opposed to the "two nation theory," has never accepted partition, and does not accept the existence of an independent, sovereign Pakistan. Proof of this proposition to the Pakistani military is India's role in the 1971 war that led to the break-up of Pakistan, with East Pakistan seceding to declare itself as independent Bangladesh. The third theme is that India is a hegemon and poses an existential threat to Pakistan because it seeks to impose a regional security and economic structure on South Asia with the goal of converting its smaller neighbors into satellite states. In their view, such Indian ambitions must be thwarted. The fourth theme has to do with Afghanistan, which has never accepted the Durand Line as the border with Pakistan. In the past, Pakistan sought "strategic depth" in Afghanistan. It has become increasingly paranoid about Indian presence in Afghanistan and the possibility of collusion between India and Afghanistan to destabilize Pakistan's Pashtun and Baloch borderlands.[5]

Pakistan has sought to compensate for its disparity with India in terms of size, population, and economy by resorting to asymmetric warfare and seeking alliances. Having been a frontline state in the United States' covert war against the Soviet Union in Afghanistan from 1979 to 1989, Pakistan's Inter-Services Intelligence (ISI) successfully weaponised "jihad" as the instrument to radicalize groups to undertake terrorist strikes and low-intensity conflict. Pakistan was no stranger to asymmetric warfare, having previously supported insurgencies in India that included the Naga insurgency from East Pakistan in the 1960s, Sikh militancy in the 1980s, and, since 1990, by waging a proxy war through the training, equipping, and infiltration of terrorists into Kashmir in the name of "jihad."

[5] For the role of the Pakistani army in shaping the politics of Pakistan, I have relied on Hussain Haqqani, a former Pakistani journalist who also served as the Ambassador to Sri Lanka and the United States. He wrote, among others, *Pakistan: Between Mosque and Military*, published by the Carnegie Endowment for International Peace (2005) and Dr. C Christine Fair, a U.S. academic, *Fighting to the End: The Pakistan Army's Way of War,* Oxford University Press, 2014.

During the Cold War, Pakistan was a member of two U.S.–led military alliances—SEATO (South East Asia Treaty Organisation)[6] and CENTO (Central Treaty Organisation).[7] Since the 9/11 attacks in the United States in 2001, after which the United States and other countries became more concerned with the global implications of jihadi terrorism, Pakistan has strengthened its ties with China. In addition to the cooperation in conventional, nuclear, and missile sectors, China has also emerged as by far the largest source of foreign investment in Pakistan. The strategic underpinning between the two is apparent since India and China have an unresolved boundary dispute and fought a war in 1962. In 2020 the situation worsened, leading to clashes between these two great powers that caused casualties for the first time in 45 years.

In May 1998, both India and Pakistan conducted a series of nuclear tests, declaring themselves nuclear weapon states and adding a new dimension to their hostile relationship. Many would argue that the nuclear shadow over the relationship existed even earlier. Some would go back to January 1972 when, after the creation of Bangladesh, Prime Minister Zulfikar Ali Bhutto convened Pakistan's nuclear scientists exhorting them that the only guarantee for ensuring Pakistan's territorial integrity was to develop nuclear weapons. Or, even earlier after the unsuccessful 1965 war when he famously declared "we will eat grass if we have to, we will make the nuclear bomb."[8] Others would link the nuclear shadow to India undertaking a peaceful nuclear explosion (PNE) in 1974, or the U.S. attempt at coercive nuclear diplomacy by bringing in the aircraft carrier *USS Enterprise* into the Bay of Bengal during the 1971 war, or even earlier to 1964, when China announced its entry onto the world's nuclear stage, after having inflicted a humiliating defeat on India in the border conflict in 1962.[9]

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[6] SEATO was created in 1954 and included the United States, the United Kingdom, France, Australia, New Zealand, Philippines, Thailand, and Pakistan to prevent Communism from spreading in the region. It was disbanded in 1977 after the end of the Vietnam war.
https://history.state.gov/milestones/1953-1960/seato

[7] Originally called the Baghdad Pact in 1955 and renamed CENTO in 1959, it included the United States, the United Kingdom, Iran, Iraq, Pakistan, and Turkey and was disbanded after the Islamic revolution in Iran in 1979.
https://2001-2009.state.gov/r/pa/ho/time/lw/98683.htm

[8] Feroz Hassan Khan, *Eating Grass: The Making of the Pakistani Bomb*, (Stanford, CA, Stanford University Press, 2012).

[9] For a history of the Indian nuclear program, see George Perkovich, *India's Nuclear Bomb: The Impact on Global Proliferation*, University of California Press (2002) and Ashley Tellis, *India's Emerging Nuclear Posture: Between Recessed Deterrent and Ready Arsenal*, Rand(2001). For Pakistan, see Feroz Hassan Khan's book in the previous footnote.

The India-Pakistan nuclear rivalry is just another dimension of the more deep-seated hostility between the two countries. What this hostility means is that resolving the Kashmir conflict would not normalize the relationship because Pakistan sees India as an existential threat and this perception is not going to change easily, certainly not as long as the military continues to dominate its security and foreign policymaking, and perhaps even beyond that because a new historical narrative has taken root in Pakistan. Some of the recent *Hindutva*-tinted rhetoric from the *Bharatiya Janata* Party (BJP) in India only serves to convince the Pakistan military that India's secularism was always a sham and that it is just a matter of time until the liberal-secular urban elite in India will be marginalized and yield to the majoritarian Hindu impulse.

Evolving Nuclear Doctrines

The nature of warfare changed fundamentally when the United States dropped the first atomic bomb on Hiroshima on 6 August 1945, followed by a second attack on Nagasaki three days later. It was clear then that the sheer destructive power of nuclear weapons was qualitatively different from any other weapon system. This remains true today. The biggest conventional bomb is the GBU Massive Ordnance Air Blast with an explosive yield of 11 tonnes of TNT equivalent; in comparison, the Hiroshima bomb was 15 kilotons (kt) or 15,000 tonnes. Today, the nuclear arsenals of many states contain weapons with yields in the megaton range and even the tactical nuclear weapons have yields of 0.5 kt or more. This realization contributed to the nuclear taboo, a term referring to the moral force behind the fact that nuclear weapons have not been used since 1945. though there were numerous instances during the Cold War when the taboo was close to being breached.

The only use of nuclear weapons occurred when the United States was the sole possessor of nuclear weapons. By the time the former Soviet Union exploded its nuclear device in 1949, the Cold War had already begun, as reflected by the division of Germany and Europe into East and West. The North Atlantic Treaty Organisation (NATO), a U.S.-led military alliance for the defence of Western Europe, was created in 1949 and a Soviet-led Warsaw Pact came into being in 1955 following West Germany's induction into NATO in 1953. The United States and the former Soviet Union were soon locked into a qualitative and quantitative nuclear arms race. This political, economic, and military competition based on the threat of nuclear annihilation between two nuclear superpowers has shaped the growth of a nuclear theology.

Two schools of deterrence theory soon emerged in the United States. One was led by Bernard Brodie, a political science professor who had served at the U.S. Department of the Navy during World War II and later spent nearly two decades at RAND Corporation. Brodie held that deterrence is automatic and ensured through retaliation because the one who initiates the nuclear attack cannot be certain that the adversary's entire nuclear arsenal has been eliminated. The following idea is attributed to Brodie: "Thus far the chief purpose of our military establishment has been to win wars. From now on, its chief purpose must be to avert them. It can have almost no other purpose."

The other school was led by Albert Wohlstetter, a mathematics major with a strong focus on modelling economic and business cycles, who had worked at the U.S. War Production Board during World War II and who, like Brodie, later moved to RAND. Although he too believed in massive retaliation, he felt that ensuring second strike capability needed larger arsenals and survivability to prevent a nuclear Pearl Harbor. He used modelling studies based on weapon yields, bomber ranges, accuracies and reliabilities of systems, and blast resistance in what became the classic basing studies for the U.S. Strategic Air Command. For Brodie, the risk of retaliation was an adequate deterrent while for Wohlstetter, it was the certainty of retaliation with large numbers that was necessary for deterrence to work. Given that the nuclear arms race led to the two nuclear superpowers accumulating more than 65,000 nuclear weapons at its peak, it is clear that Wohlstetter carried the day.[10]

Acceptance of Wohlstetter's approach gave rise to new concepts of flexible response, escalation dominance, counter-value and counterforce, survivability, compellence and "prevalence" (implying an extension of compellence when deterrence has broken down, by ensuring control of limited use at each step to prevail). It is counterfactual to enquire whether this conceptual evolution contributed to a stable deterrence posture between the United States and its allies on the one hand, and the former Soviet Union on the other. It certainly ensured, however, that the nuclear arms race continued because the two countries were engaged in an all-out rivalry

[10] The U.S. debate on deterrence has been captured by Bernard Brodie in his writings, the first being *The Absolute Weapon: Atomic Power and World Order*. Harcourt, 1946 and Albert Wohlstetter, "*The Delicate Balance of Terror,*" RAND Paper P1472*,* The Rand Corporation 1958, https://www.rand.org/pubs/papers/P1472.html

in political, economic, and conventional and nuclear military dimensions. During the best documented nuclear crisis, that is, the Cuban Missile Crisis in 1962, the United States had an arsenal of 25,540 bombs whereas the former Soviet Union had only 3,346. Despite this imbalance, deterrence clearly worked. It nevertheless established the ground rule of mutual vulnerability as the basis for deterrence. As the former Soviet Union achieved numerical equivalence in its arsenal, the concept of managing the nuclear arms race by introducing equivalent strategic capabilities through arms control gained prominence.

Deterrence stability was underwritten by “parity” and “mutual vulnerability.” The latter was codified by the 1972 Anti-Ballistic Missile (ABM) Treaty. Eventually, the United States withdrew from the ABM Treaty in 2002. But for most of the Cold War, the two nuclear superpowers sought to restrain the nuclear arms race and to preserve strategic stability through arms control agreements like SALT, START, and INF, the last in the sequence being New START in 2010. Finally, they tried to manage crises through hotlines, nuclear risk reduction centers, and early warning systems. It is important to recall that during the 1970s and 1980s, nuclear stability did not appear to be assured and many believed the Cold War was unlikely to end peacefully or that the nuclear taboo would last as long as it has. Documents declassified after the end of the Cold War also indicate there were some tense occasions, some inadvertent, and some a result of misperception arising out of system glitches. In these cases, it was pure luck, and not arms control measures, that ensured that nuclear weapons were not launched. The trinity of deterrence stability, arms race stability, and crisis management stability formed the vocabulary of nuclear arms control, the essence of the nuclear theology referred to above.

The prism of U.S.–Soviet bipolarity, however, does not help much in understanding Indian and Pakistani nuclear doctrines and their mutual security crises, although Western analysts tend to view it through this prism. The key difference is that the United States and former Soviet Union reflected a degree of symmetry in terms of their arsenals and doctrinal approaches, relying on mutual vulnerability and assured second strike capability, once the Soviet Union had caught up with the United States. Further, given their position as nuclear superpowers, it was possible to look at the United States–Soviet Union equation as a standalone nuclear dyad. In contrast, the India–Pakistan relationship is marked by asymmetry in terms of doctrinal approaches, as elaborated below. Secondly, since India declared itself a nuclear weapon state in 1998, it has maintained that its capability was intended as a deterrent against both Pakistan *and* China whereas Pakistan defines its capability as India-specific. Given these differences, it is not possible to see the India-Pakistan equation in terms of a dyad.

The geopolitical shift from Euro-Atlantic to the Indo-Pacific also shows the presence of many more nuclear actors in an increasingly crowded geopolitical space. It includes the Democratic People's Republic of Korea (DPRK) and the return of major power rivalry, with the United States, Russia, and China added into the mix of multiple rivalry equations as well as the United States' treaty allies—Japan and South Korea. The region therefore hosts multiple nuclear dyads, but each dyad may be linked to other nuclear actors, creating a loosely linked "nuclear chain." The creation of a nuclear chain has made the search for nuclear stability in today's world more elusive at a time when the old arms control agreements are being discarded in response to changing political realities.

India first laid out the elements of its nuclear doctrine in a paper titled "Evolution of India's Nuclear Policy," tabled by then Prime Minister Atal Behari Vajpayee in parliament shortly after the 1998 nuclear tests. The paper made it clear that India did not see nuclear weapons as weapons of war fighting, but in a more limited role, intended to address nuclear threats through deterrence. The prime minister's speech and the paper were followed by another draft paper prepared by a newly constituted National Security Advisory Board and circulated in 1999 to elicit wider discussion. A more succinct and authoritative text was released in 2003 following a meeting of the Cabinet Committee on Security.[11] The key elements of the doctrine were:

- Building and maintaining a credible minimum deterrent, based on a triad that includes land-based, sea-based, and airborne delivery systems.
- Sustaining a posture of nuclear no-first-use vis-à-vis nuclear armed states and non-use of nuclear weapons vis-à-vis non-nuclear weapon states.

[11] "Evolution of India's Nuclear Policy, Paper Laid on the Table of the House," https://media.nti.org/pdfs/32_ea_india.pdf and Government of India, "*The Cabinet Committee on Security Reviews perationalization of India's Nuclear Doctrine,*" Ministry of External Affairs Press Release, 4 January 2003, https://mea.gov.in/press-releases.htm?dtl/20131/The_Cabinet_Committee_on_Security_Reviews_perationalization_of_Indias_Nuclear_Doctrine+Report+of+National+Security+Advisory+Board+on+Indian+Nuclear+Doctrine

- Ensuring nuclear retaliation in response to a nuclear attack on Indian territory or on Indian forces anywhere, inflicting massive and unacceptable damage.
- Retaining the option of nuclear retaliation in response to a chemical or biological weapons attack.
- Continuing the moratorium on nuclear explosive testing.
- Remaining ready to join Fissile Material Cut-off Treaty negotiations.
- Ensuring strict export controls on nuclear and missile-related materials and technologies.
- Continuing commitment to the goal of a nuclear weapons-free world through global, verifiable, and non-discriminatory nuclear disarmament.

Since India's doctrine makes clear that its nuclear weapons are only to deter a nuclear threat or attack, India needs additional capabilities to deal with threats of sub-conventional and conventional conflicts. By eschewing a warfighting role for nuclear weapons, India is able to duck the temptations of a nuclear arms race with Pakistan or China. Given the short distances between India and these two potential adversaries that compress time available for decision-making, India believes that it is not possible to make a distinction between "tactical" and "strategic" nuclear weapons or their use. This reflects another departure from the United States–Soviet approaches that provided a 25-minute interval for a missile launched from the mainland to reach a target on the adversary's mainland. In the U.S.–Soviet arms control vocabulary, long-range vectors were considered "strategic" and systems with ranges below 5,500 km were further divided into intermediate, medium, and short-range systems. Extended deterrence assurances to allies in Europe and Asia also introduced political compulsions for forward deployment of U.S. and Soviet weapons that were attributed tactical or battlefield roles. Such distinctions undoubtedly contributed to the arms race but do not exist in South Asia.

Pakistan has chosen to give its nuclear weapons a different role. It prefers to retain a degree of ambiguity claiming that it strengthens deterrence while maintaining that its nuclear capability is India-specific, and, consequently, its size will be determined by India's arsenal. Although Pakistan states that it maintains a minimum credible deterrent (sometimes also called a minimum defensive deterrent), its role is not just to deter nuclear use by India but also to act as an equalizer against India's conventional superiority. Pakistan therefore rejects the idea of a no-first-use policy. In 2002, it had first declared "four red lines that could trigger a nuclear response: occupation of a large part of Pakistan territory by India, destruction of a large part of Pakistan's military capacity, attempt to strangulate Pakistan's economy, and creating political destabilization."[12]

Pakistan's doctrine has since evolved to "full spectrum deterrence" as Pakistan has added short-range nuclear armed systems for tactical use (60 km range Hatf IX or Nasr ballistic missile) and is also adding a number of cruise missile systems with dual capability. The Nasr was flight tested in 2011 and, according to a statement by the Inter-Services Public Relations (ISPR) Directorate,[13] it "adds deterrence value to Pakistan's Strategic Weapons Development Programme at shorter ranges." The Nasr could carry "nuclear warheads of appropriate yield with high accuracy" and is a quick response system with shoot and scoot capabilities (which can fire and then quickly relocate). According to Lt. Gen (retd) Kidwai, Pakistan's range of nuclear weapons provide "full spectrum deterrence, including at strategic, operational, and tactical levels." By deliberately lowering the nuclear threshold, Pakistan believes it strengthens deterrence and as Lt. Gen (retd) Kidwai explains "it is the Full Spectrum Deterrence capability of Pakistan that brings the international community rushing into South Asia to prevent a wider conflagration."[14]

Neither India nor Pakistan have made any official statements regarding the sizes of their nuclear arsenals. Analysts are therefore left to derive estimates based on fissile material production capacities, occasional press releases about missile launches, and other indicators about likely inductions of new delivery systems. According to the Stockholm International Peace Research Institute's database on *World Nuclear Forces,* India is estimated to have produced approximately 156 warheads by January 2021.[15] These are currently distributed over seven delivery platforms and increasing at the rate of about ten warheads every year. The delivery platforms include two

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[12] The first reference to these red lines is in a report of an Italian think tank Landau Network dated 14 January 2002. The report can be found here: https://pugwash.org/2002/01/14/report-on-nuclear-safety-nuclear-stability-and-nuclear-strategy-in-pakistan/. This is borne out by Brig (Retd) Feroz Hassan Khan in his paper Going Tactical (IFRI, September 2015) Footnote 58.
https://www.ifri.org/sites/default/files/atoms/files/pp53khan_0.pdf

[13] ISPR Press Release dated 19 April, 2011, https://www.ispr.gov.pk/press-release-detail.php?id=1721

[14] The history of Pakistan's nuclear program has been documented by Brig (retd) Feroz Khan in *Eating Grass: The Making of the Pakistani Bomb* (Stanford University Press, 2012), while the Pakistani nuclear doctrine quotations also draw upon two lectures by Lt Gen (retd) Khalid Kidwai at the Carnegie Nuclear Policy Conference on 23 May 2015 (transcript - https://carnegieendowment.org/files/03-230315carnegieKIDWAI.pdf) and a subsequent one at the IISS on February 6, 2020, https://www.iiss.org/events/2020/02/7th-iiss-and-ciss-south-asian-strategic-stability-workshop

[15] Hans M Kristensen and Matt Korda, "World Nuclear Forces," *SIPRI Yearbook 2021*, (Oxford University Press), pp.333-412 https://sipri.org/sites/default/files/2021-06/yb21_10_wnf_210613.pdf

aircraft (Mirage 2000 and Jaguar, both originally deployed in the 1980s), four land-based ballistic missiles (Prithvi II, Agni I, Agni II, and Agni III, each capable of carrying a single warhead with ranges from 350 km to 3,000 kms) and one submarine-launched ballistic missile (K-15 Sagarika with a range of 700 kms) for its nuclear-powered submarines (SSBN). Given these ranges, the Indian triad is still an exercise in the making.

India's stockpile of weapons-grade plutonium (its arsenal is entirely plutonium-based) is considered adequate for 200 warheads, but plutonium production could increase depending on how its Prototype Fast Breeder Reactor project develops.[16] The Indian land-based missile program was launched in the mid-1980s but the Prithvi II was inducted only in 2003. The Agni-series of land-based missiles are solid-fuelled systems and road or rail-mobile. Two land-based systems, Agni IV and Agni V, are currently under development with ranges of 4,000 and 5,000 km respectively. There is speculation that Agni V may carry Multiple Independently-targetable Re-entry Vehicles (MIRVs), but it would mean reducing range and, unless China develops a missile defence system, there would be little military need for MIRVs on Agni V. MIRVs may become more likely once India develops missiles with ranges over 8,000 km. The indigenous SSBN programme has suffered long delays and only one SSBN has completed sea trials. Another SSBN is expected to be commissioned next year and India is likely to build three or four more SSBNs. The K-15 has a limited range of 700 km. Such a short range only enables India to target southern Pakistan. To target coastal China, the submarine would need to get to South China Sea. Another SLBM K-4 with a range of 3,500 km is being tested and will eventually replace the K-15. India is also developing a ground-launched cruise missile that was finally flight-tested up to 700 km in 2017

[16] "Prototype Fast Breeder Reactor (PFBR)," Bharatiya Nabhikiya Vigyut Nigam Limited, https://bhavini.nic.in/userpages/viewproject.aspx

after numerous failures. There are rumours that this missile may be dual-capable (it can serve in both conventional and nuclear roles) though there are no official statements to indicate this.

Table 1. India's Nuclear Forces.
Source: SIPRI; Bulletin of Atomic Scientists; Centre for Strategic and International Studies.

INDIA			
Estimated Nuclear Warheads = 156^			
Class	Missile Name	Range	Status
Aircraft	Mirage 2000H	1850 km	Operational
	Jaguar IS	1600 km	Operational
SRBM	Prithvi-II	250-350 km	Operational
	Dhanush (Ship-launched	250 - 400 km	Operational
	Agni-I	700 - 1,200 km	Operational
	Prahaar	150 km	In development
MRBM	Agni-II	2,000 - 3,500 km	Operational
IRBM	Agni-III	3,000 - 5,000 km	Operational
	Agni-IV	3,500 - 4,000 km	In development
ICBM	Agni-V	5,000 - 8,000 km	In development
SLBM	Sagarika/K15*	700 km	Operational
	K4	3500 km	In development
Cruise Missile	Nirbhay	800 - 1,000 km	In development

* India is also developing a land-based, short-range version (750 km) of the K-15 submarine-launched ballistic missile (SLBM)—known as the Shaurya. However, there are no official government statements to confirmed this. Only three or four flight tests of the Shaurya have been reported.

^ Kristensen, Hans M., and Matt Korda, "World Nuclear Forces," SIPRI Yearbook 2021, Oxford University Press, pp.333-412, https://sipri.org/sites/default/files/2021-06/yb21_10_wnf_210613.pdf

Pakistan's nuclear stockpile is estimated at 165 warheads[17] as of January 2021, and estimated to grow to 220 to 250 warheads by 2025[18] in view of an ambitious expansion of both its uranium enrichment and plutonium production capacities. In addition to the Kahuta enrichment plant,

[17] Kristensen, Hans M., and Matt Korda, "World Nuclear Forces," *SIPRI Yearbook 2021,* (Oxford University Press), pp.333-412, https://sipri.org/sites/default/files/2021-06/yb21_10_wnf_210613.pdf
[18] Kristensen, Hans M., and Robert S. Norris. "Pakistani Nuclear Forces, 2015." *Bulletin of the Atomic Scientists* 71, no. 6 (November 2015): 59–66. https://doi.org/10.1177/0096340215611090

another has been built at Gadwal, and three plutonium production reactors have been added at the Khushab complex during the last decade. In 1998, Pakistan reportedly tested both types of devices, based on highly enriched uranium and plutonium. It is estimated that Pakistan's fissile material inventory of 3,400 kg of highly enriched (90 percent) uranium and about 280 kg of plutonium is enough to produce between 236 and 283 warheads.

Pakistan's delivery platforms include Mirage III/V and F-16 aircraft, and there are reports that the withholding of additional aircraft supplies by the United States and France emerging as a key Indian strategic partner, Pakistan would in future rely on the JF-17, jointly developed with China for a nuclear role, possibly using Ra'ad, an air launched cruise missile. It has six operational land-based ballistic missile systems Abdali (Hatf-2) range of 200 kms, Ghaznavi (Hatf-3) range of 300 kms, Shaheen 1 (Hatf-4) range of 750 kms, Ghauri (Hatf-5) range of 1,250 kms, Shaheen 2 (Hatf-6) range of 1,500 kms, and the most recent Nasr (Hatf-9) with a range of 60 kms. All are solid-fuelled except for the Ghauri, which is liquid-fuelled and is a variant of the DPRK's Nodong missiles that Pakistan acquired in the 1990s in exchange for sharing nuclear enrichment technology. Shaheen 1 is based on the Chinese M-9 missile supplied in the 1990s. Pakistan has also tested Shaheen 3 with a range of 2,750 kms. In 2017 it also tested Ababeel, a new missile with MIRV capability. Hatf 2,3,4, and 9 are dual-capable, in keeping with Pakistan's policy of ambiguity, and are deployed in garrisons close to the Indian border.

Pakistan has also developed a ground launched Babur (Hatf-7) and the air-launched Ra'ad (Hatf-8), both nuclear-capable cruise missiles. Currently, efforts are underway to improve their ranges. Babur was originally tested at 350 kms. More recent tests indicate the range has been nearly doubled. Ra'ad was also deployed with a range of 350 kms, but its newer versions indicate a range of 550 kms. A sea-launched version of Babur with a range of 450 kms has been tested both from surface and underwater launch platforms. It will eventually be deployed on the diesel-electric Agosta submarines or the newer Yuan class Type 041 submarines being acquired from China.

Table 2. Pakistan's Nuclear Forces
Source: SIPRI; Bulletin of Atomic Scientists; Centre for Strategic and International Studies.

PAKISTAN			
Estimated Nuclear Warheads = 165^			
Class	Missile Name	Range	Status
Aircraft	Mirage III/V	2100 km	Operational
	F16 A/B**	1600 km	Operational
Battlefield SRBM	Hatf 1 (1, 1A and 1B)	70 - 100 km	Operational
	Nasr (Hatf 9)	60 - 70 km	In service
	Abdali (Hatf 2)	180 - 200 km	Operational
	Ghaznavi (Hatf 3)	300 km	Operational
SRBM	Shaheen 1 (Hatf 4)	750 - 900 km	Operational
MRBM	Shaheen 2 (Hatf 6)	1,500 - 2,000 km	Operational
	Hatf 5 "Ghauri"	1,250 - 1,500 km	Operational
	Ababeel	2,200 km	In development
	Shaheen 3	2,750 km	In development
Cruise Missile	Babur (Hatf 7)	350 - 700 km	Operational
	Ra'ad (Hatf 8)	350 km	In development
** Reports of some of the US-procured F-16 aircrafts being modified by Pakistan for a nuclear weapon delivery role are yet unconfirmed. ^ Kristensen, Hans M., and Matt Korda, "World Nuclear Forces," SIPRI Yearbook 2021, Oxford University Press, pp.333-412, https://sipri.org/sites/default/files/2021-06/yb21_10_wnf_210613.pdf			

Pakistan's development of battlefield and dual-capable systems has generated widespread concerns. In the 2018 Threat Assessment, U.S. Director of National Intelligence Daniel Coats said, "Pakistan continues to produce nuclear weapons and develop new types of nuclear weapons, including short range tactical weapons, sea-based cruise missiles, air launched cruise missiles, and longer-range ballistic missiles. These new types of nuclear weapons will introduce new risks for escalation dynamics and security in the region."[19] In the 2017 South Asia Strategy issued by the White House, the Trump administration had urged Pakistan to stop sheltering terrorist

[19] Worldwide Threat Assessment by Daniel Coats on 13 February 2018
https://www.dni.gov/files/documents/Newsroom/Testimonies/2018-ATA---Unclassified-SSCI.pdf

organizations and emphasised the need "to prevent nuclear weapons and materials from coming into the hands of terrorists."[20] Pakistani officials have rejected these concerns indicating that Pakistani missiles are in stored separately from warheads and are only put together at the eleventh hour.

Crises Under a Nuclear Shadow

Given the sources of insecurity and the doctrinal asymmetry, it is hardly surprising that India and Pakistan have very different interpretations of the crises that have raised concerns about nuclear escalation. The first case of nuclear signalling can be dated to the Operation Brasstacks crisis in 1987. India had undertaken a large-scale military exercise on the Pakistan border leading to apprehensions in Pakistan that India was preparing to launch a major attack. In late January, A. Q. Khan, widely considered the father of Pakistan's nuclear bomb, gave a surprise interview to a visiting Indian journalist Kuldip Nayar during which he admitted that Pakistan possessed a nuclear bomb and would not hesitate to use it in case of war with India.[21] Given Khan's high-level security clearance in Pakistan's nuclear weapons program at the time, it is reasonable to assume the interview had been cleared by the Pakistani military authorities. There is widespread conviction in Pakistani security circles that the nuclear threat worked, and India backed down. Indian observers maintain the crisis had peaked days earlier and de-escalation was under way before Khan made his statement.

The second crisis occurred in May 1990 when there was an uprising in Kashmir, and India stepped up the presence of its security forces amid rumours that Pakistan's military might try to take advantage of the situation. Based on satellite imagery, the United States concluded that Pakistan was preparing to move its nuclear weapons and dispatched deputy national security advisor Robert Gates to Delhi and Islamabad in a bid to defuse the situation. The crisis subsided and Foreign

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[20] Text of Donald Trump's speech https://www.thehindu.com/news/international/full-texts-of-donald-trumps-speech-on-south-asia-policy/article19538424.ece

[21] Kuldip Nayar informs us: 'Pakistan has nukes,' Deccan Herald, 29 August 2018, https://www.deccanherald.com/specials/kuldip-nayar-informs-us-pakistan-has-nukes-689623.html

Secretary level talks resumed the following month. Both these incidents took place *before* Pakistan acknowledged possession of nuclear weapons and consequently the signalling was indirect.

The situation changed after the 1998 nuclear tests and nuclear signalling became more explicit in the crises thereafter. If there was any expectation that the overt nuclear situation might bring about some stability by introducing an element of restraint, it was soon dispelled. Barely had the ink dried on the forward-looking Lahore Declaration and the related Memorandum of Understanding on nuclear confidence building measures—signed during Prime Minister Atal Behari Vajpayee's historic visit to Lahore in February 1999—when the Kargil conflict erupted. In a pre-emptive move, Pakistan intruded across the Line of Control (LoC) to occupy certain heights that threatened Indian access into the Ladakh region. It was a brazen attempt to alter the territorial status quo. India mounted an uphill assault and deployed the air force but in a restrained manner as the aircraft were directed not to cross the LoC. Widespread international concern at such reckless behavior and heavy casualties eventually forced Pakistan to withdraw and retreat across the LoC. It later emerged that the Pakistani political leadership had not been fully briefed about the pre-emptive move by the army generals. Growing internal differences eventually contributed to the ouster of the civilian government in a military coup in October 1999, which led to a decade of military rule. Clearly, Pakistan saw its nuclear capability as a shield under which it could seek to alter the territorial status quo, confident in its assessment that Indian retaliation would be deterred as it believed had happened in the earlier crises.

The next crisis was precipitated by an attack on the Indian parliament in December 2001 by two internationally proscribed terrorist groups based in Pakistan—*Lashkar e Taiba* (LeT) and *Jaish e Mohammed* (JeM). India responded by mobilizing its army along the border in early 2002. In an address to the nation on 12 January 2002, General Pervez Musharraf sought to defuse the situation by condemning the "terrorist attack" and announcing a ban on five jihadi organizations, including LeT and JeM. He declared that no organization would be allowed to carry out terrorist strikes within Pakistan or anywhere else. Before matters could stabilize, tensions escalated again in May when three Pakistani fedayeen (suicide attacker) attacked an army camp at Kaluchak killing 34 Indian soldiers and their family members. As Indian rhetoric sharpened, in June, General Musharraf warned that if India attacked, Pakistan retained the option of first-use of nuclear weapons. Consequently, the United States, Russia, France, Japan, and the United Kingdom engaged in active diplomacy to mediate a de-escalation of the crisis. The United States needed Pakistani military cooperation on the Pakistani-Afghan border in its war against Al Qaeda and the Taliban, and eventually tensions eased when Pakistan began to dismantle the terrorist training camps and the launch pads close to the LoC. Finally, a ceasefire across the LoC was announced in November 2003 that lasted for five years. However, according to Lt Gen (retd) Kidwai, India's coercive exercise had failed as the Indian military had "lost the advantage of relative asymmetry in conventional forces because of Pakistan's nuclear equalizer."

The five-year ceasefire laid the grounds for a promising backchannel dialogue. The peace was broken in November 2008 by an audacious strike by LeT terrorists who arrived by boat and simultaneously attacked a number of targets in Mumbai. There was credible evidence that the ISI was involved in the attacks. The newly elected democratic government in Pakistan initially promised to cooperate in the investigation, even offering to send the ISI chief to India though the offer was subsequently withdrawn. It sparked a debate in India, however, about the utility of the no-first-use doctrine that was somewhat misguided because nuclear weapons were never intended to deter terrorists. That requires a different set of capabilities, which India did not possess. India therefore relied on international pressure on Pakistan since the Mumbai attack was widely seen as India's "9/11" moment. There was strong universal condemnation of the attack, especially because foreign citizens had also been killed; at the same time India's strategic restraint was appreciated by the international community. However, it also exposed the lack of kinetic options available to India. Nuclear strategic analysts, already unfamiliar with asymmetric nuclear dyads, were now saddled with the additional challenge of thinking through nuclear deterrence with respect to non-state actors that enjoyed covert state support.

In 2014, Prime Minister Narendra Modi came to power and promised a more muscular counterterrorism policy, both domestically and against Pakistani-aided cross-border infiltration. The first incident after the current government came to power was a terrorist attack in September 2016 by four JeM fedayeen terrorists against an army brigade headquarter in Uri (in Kashmir), in which seventeen Indian soldiers were killed. Later in the month India announced that it had carried out retaliatory surgical strikes destroying the launch pads across the LoC and killing terrorists who were present there waiting to be sent across, normally done under covering fire by Pakistani forces. Pakistan denied that there were any surgical strikes, and the situation did not escalate. Prime

Minister Modi successfully projected the surgical strikes as a sign of newfound Indian determination that it would not be deterred by Pakistan's first use threat or tactical nuclear weapons. In the official briefings, it was described as "target specific, limited calibre, counter-terrorist operations across the LoC." Clearly, the Modi government wanted to show that it was not averse to raising its coercive rhetoric. The time for "strategic restraint" that had characterized India's approach after the Mumbai attack was over. At the diplomatic level, the SAARC (South Asian Association for Regional Cooperation) summit was postponed, and SAARC has been in limbo ever since.

On February 14, 2019, an Indian Kashmiri militant drove an explosive-laden SUV into a convoy transporting paramilitary forces in Pulwama (Kashmir), killing 46 troops. JeM claimed responsibility for the strike. With general elections less than two months away, the Modi government vowed retaliation. Twelve days later, Indian aircraft bombed a JeM training camp at Balakot in Khyber-Pakhtunkhwa. Pakistan undertook an air attack the following day and as Indian fighters scrambled, in the ensuing dogfight, an Indian pilot ejected from his damaged aircraft landing in Pakistan territory. He was returned within 48 hours with the United States, Saudi Arabia, and United Arab Emirates (UAE) claiming to have intervened to ensure safe and early return of the captured pilot. Pakistan maintained that there was no training camp at Balakot and that the Indian aircraft had dropped their ordnance on a hillside. Pakistan's counterattack the following day showed its resolve to defend its sovereignty, and the prompt return of the captured pilot exemplified its responsible behavior. A few weeks later, both sides withdrew their High Commissioners and these positions have not been restored since.

In the official briefing the day following the Indian air strike, India's focus was on downplaying the escalation by pointing out that it was a non-military terrorist target and a pre-emptive strike as it had advance intelligence, and the Indian operation was now terminated. The rhetoric through media channels emphasized, however, that India had called Pakistan's nuclear bluff and created a new normal, in sharp contrast to the official briefing. Lt. Gen (retd) Kidwai maintains that this was yet another attempt by India to "induce strategic instability" and Pakistan's calibrated response had "restored strategic stability and no new normal was allowed to prevail." He suggests that "Pakistan has ensured seamless integration between nuclear strategy and conventional military strategy, in order to achieve the desired outcomes in the realms of peacetime deterrence, pre-war deterrence and also in intra-war deterrence."

Table 3. Timeline of India-Pakistan Crises under the Nuclear Shadow.

Timeline of India-Pakistan Crises under the Nuclear Shadow	
1986-87	Operation Brasstacks
May 1990	Kashmir Uprising
May 1998	Indian and Pakistani Nuclear Tests
May-July 1999	Kargil Conflict
2001-02	Indian Parliament Attacks-Operation Parakram (Twin Peaks Crisis)
November 2008	Mumbai Terrorist Attacks
September 2016	Uri Terrorist Attack
February 2019	Pulwama Terrorist Attack - Balakot Airstrikes

Roles of External Actors

In the preceding section, seven instances were examined—two relating to the pre-1998 period, and the rest after both countries had declared themselves to be nuclear weapon states. The pre-1998 cases can be described as reflecting a situation of "recessed deterrence"—that is, as some Indian analysts stated, a form of deterrence arising from the existence of their nuclear weapons but not yet declared by the two possessor states. This posture was overtaken in 1998 when nuclear weapons began to play an explicit role. It is useful to see what lessons may be drawn from the five instances after 1998 and the role of the major powers, particularly those of the United States and China. Has anything changed over the last two decades in this regard, and if so, what?

It is possible to discern five distinct levels of conflict between India and Pakistan:

1. Sub-conventional conflict or attacks by terrorist groups that are based in Pakistan and have an established modus vivendi with the Pakistani authorities, as in their attacks on the Indian parliament in 2001 or Mumbai in 2008.
2. Hybrid sub-conventional conflict employing both militant groups and regular troops but trying to deny the role of the latter as in the case of Kargil in 1999.

3. Conventional conflict below the nuclear threshold.
4. Conventional conflict escalating to the use of tactical or battlefield nuclear weapons.
5. Full-scale conflict with large scale use of nuclear weapons.

The five instances under examination fall in the first two categories. The unmistakable message to India is that possession of nuclear weapons will not deter such attacks. In each instance, India faced the challenge of finding appropriate retaliation that could combine both deterrence by denial and deterrence by punishment while keeping it below the nuclear threshold in line with its nuclear doctrine of no-first-use.

Since the Kargil crisis involved Pakistan changing the territorial status quo, the Indian objective was modest but clear—restoration of the status quo ante. In this, it had the support of the entire international community as Pakistan's action was seen as provocative. High-level Pakistani visits by Prime Minister Nawaz Sharif and by Chief of Army Staff General Musharraf to Beijing to seek Chinese support elicited quiet rebuffs and provided space for the United States to play the key diplomatic role in the resolution of the crisis.

The attacks in 2001 and 2008 by Pakistan-based terrorist groups also witnessed the United States playing a diplomatic role. In the first instance, the Indian army had mobilized on the border and both armies were face-to-face. However, the United States needed Pakistan to redeploy its forces to the Pakistan-Afghan border as it had just embarked on its operations in Afghanistan after 9/11. The crisis took time to defuse until India was satisfied with Pakistani assurances that it would take action against groups like LeT and JeM. The 2008 attack in Mumbai created a dilemma for Indian decision makers. The confessions by one of the terrorists who had been captured alive and mobile telephone intercepts of conversations between the terrorists and their handlers made it evident that Pakistani authorities had been involved. The attack exposed weaknesses in India's coastal security and was a rude reminder that it lacked appropriate kinetic options. Since the victims included nationals of other countries, however, India had to be content with international condemnation and pressure.

Pakistan concluded that it was nuclear deterrence that stymied Indian kinetic retaliation. It began to develop tactical nuclear weapons so that the space for the third category of conflict, namely conventional war below the nuclear threshold, could be constricted and that Indian kinetic retaliation would rapidly escalate matters to the fourth level, involving tactical nuclear weapons.

The Modi government that came to power in 2014 and was re-elected in 2019 sought to dispel the notion that the threat of tactical nuclear weapons would deter it from kinetic retaliation in response to a cross-border terrorist attack. According to retired military officers, India had undertaken retaliatory cross-border operations earlier in response to certain attacks but without much fanfare. This policy of "restraint" was discarded in 2017 when the Modi government declared that it had conducted "surgical strikes" across the LoC. Pakistan denied that any such attempt had been made and claimed that India had merely indulged in artillery firing across the LoC. These conflicting assertions enabled both countries to satisfy domestic constituencies while providing an avenue for de-escalation, without the involvement of any external actor.

The 2019 Pulwama terrorist attack followed by the Balakot air strike introduced the element of unintended consequences. Elections in India were due in two months creating a more febrile political environment. Limiting response to non-kinetic retaliation was not an option. India mounted an air strike against a JeM terrorist training camp at Balakot. Aircraft crossed over into Pakistan for the first time since 1971. Further, Balakot was in Khyber Pakhtunkhwa province and not in the contested part of Kashmir under Pakistani control. Both actions were a step up from the 2017 surgical strikes. Indian media was quick to claim that Pakistan's nuclear bluff had been called. The unexpected happened the following day when in an aerial dogfight between the two, an Indian plane was shot down. The pilot ejected and landed in Pakistani territory. Amidst rising rhetoric, external actors again stepped in. U.S. President Donald Trump claimed credit for defusing the situation, as did Saudi Arabia and the UAE. Pakistan claimed "air-superiority" and then took credit for "responsible behavior" by promptly announcing the return of the captured Indian pilot.

Notwithstanding shrill political rhetoric, the military authorities were cautious and measured in their statements during 2017 and 2019, taking care not to cross each other's red lines. On both occasions, the Indian side emphasised that the limited objective of the retaliation had been met, the target was non-military, and the action was pre-emptive as there was reasonable intelligence about an imminent attack by terrorists gathering at the targeted location. The statements by the military authorities were carefully worded because notwithstanding the chest-thumping that is the staple of TV talk shows and the loose rhetoric employed by politicians, the military on both sides is conscious that military options available on both sides are limited, given current capabilities.

If Pakistan had developed a comfort zone that India would be deterred from kinetic retaliation in response to a cross-border terrorist strike, the Modi government's actions were a signal that this would not be so. The age of paralyzing restraint was over and India would seek to expand the envelope for a level three conflict. Naturally, the Indian response would depend on the scale of terrorist attack and the visibility of ISI involvement, as well as Pakistan's response in terms of either cooperating or engaging in denial. Significantly, the Modi government's action has ensured that any future Indian government will now be pushed to undertake some form of kinetic action in response to a cross-border terrorist strike, however limited or modest.

An objective analysis would indicate that the Indian action is not enough to change Pakistani behavior and the "deterrence by punishment" under current capabilities is merely intended to assuage domestic audiences. India's limited options help bring in the external actors with "off-ramp" de-escalation initiatives. In the past the United States has played the key role with others (notably China) playing a more supportive role. In 2019, for the first time, Saudi Arabia and the UAE indicated that they too had played a role. Traditionally, Saudi Arabia has been a significant partner for Pakistan, providing oil at concessional rates and financial support to address a balance of payments crisis, but the Modi government has been active in wooing the Gulf Arab countries. With the recent United States withdrawal from Afghanistan, how far the United States will remain engaged in India-Pakistan matters is open to question. Meanwhile, China can be expected to play a more prominent role given its growing investments in Pakistan's infrastructure, but India is unlikely to find a Chinese role acceptable given the progressive downturn in India-China relations. Growing U.S.–China differences may also make China less willing to countenance a leading U.S. role as it seeks to assert its influence in the region. In short, external actors may not be able to provide off-ramps in the future as readily as in the past.

Another takeaway is the different approaches that India and Pakistan adopt towards involvement of external actors and the "nuclear flashpoint" hypothesis that is a favorite for Western analysts and media. Pakistan uses this notion to highlight the centrality of the long-standing Kashmir dispute, hoping to catalyze some international involvement in the U.N. Security Council that would push for its resolution. International involvement is anathema to India; highlighting India's commitment to bilateralism enshrined in the 1972 Shimla Agreement with Pakistan. Further, India responds to the "nuclear flashpoint" by highlighting Pakistan's irresponsible behavior of nuclear saber-rattling (though Indian media and politicians have also been prone to this in recent years), A. Q. Khan's well documented proliferation activities that earned Pakistan the sobriquet of a "nuclear Walmart," and linkages of the Pakistani "deep state" with internationally proscribed terrorist outfits.

The Western analysts' playbook was developed during the Cold War to deal with a stand-alone nuclear dyad, separated by an ocean, and through notions of arms control, non-proliferation, and crisis management. It is difficult to apply this playbook to asymmetric nuclear situations with the additional complexity of two neighboring states locked in a long-standing boundary dispute, one of whom is not averse to using proxy war, forcing the other to search for appropriate retaliation. The situation is rendered even more complex on account of Pakistan's ever-closer strategic relationship with China, with whom India has had a difficult relationship since the 1962 border conflict and who is becoming increasingly adversarial and contentious.

The Way Forward

Virtually all India-Pakistan crisis escalation scenarios begin with a terrorist strike on Indian territory, followed by limited kinetic action by India using ground and/or airpower, Pakistani retaliation, and matters getting into an escalatory spiral. It is worth reflecting as to whether scenarios imply a tacit acceptance by the proponents of the "nuclear flashpoint," which Pakistan's army will continue to host and use such terrorist groups in a proxy war against India. Since this factor was absent in the United States–Soviet Union deterrence dyad, it marks the first point of departure leaving India with the dilemma of discovering the scope and limits of kinetic action below the nuclear threshold, even as Pakistan seeks to diminish this space with its full spectrum deterrence policy.

Unless the international community can convince Pakistan to discard the policy of sub-conventional warfare using terrorists, which has long been part of its tool kit, the risk of inadvertent escalation will remain. The only countermeasure India can take is to strengthen its coastal and border surveillance and intelligence capabilities to thwart such efforts by restoring deterrence by denial and enhance its conventional kinetic capabilities, thereby strengthening punitive deterrence. The drawback is that this posture, which some refer to as “mowing the grass,” will be costly because it is unlikely to bring about a change in Pakistan’s policy.

Whereas India seeks to enhance its space for kinetic action without crossing Pakistan’s redlines, however, Pakistan seeks to blur these redlines to flash the nuclear card at the earliest possible time to draw in external actors. When India and China have periods of tensions on their border, for example, at Doklam in 2017 resulting in a stand-off that lasted 73 days, and in 2020 in eastern Ladakh, where the stand-off is ongoing (at the time of writing), the nuclear card has been absent in these periodic confrontations, even in the political rhetoric. There are two reasons for this difference that are worth examining. The first is that both countries, despite the asymmetry in their capabilities, have adopted a no-first-use policy as a key element of their nuclear doctrine. The second is that while India and China often allege incursions by the forces of the other side across the Line of Actual Control, there is no attempt by either side to pass this activity off as actions by non-state militants. These differences are instructive and explain why the nuclear factor does not cast a shadow on India-China boundary tensions even when these two parties engage in low-intensity military escalation. In contrast, Pakistan seeks to lower the nuclear threshold to hype the “nuclear flashpoint” to bring in external involvement to its advantage by constraining India. Undoubtedly the risks of India–Pakistan nuclear escalation would certainly diminish if both sides had a no-first-use policy.

External involvement has often helped in defusing tensions between these two nuclear armed states. But it is an open question whether this will continue in the future given the changing geopolitical environment. In the past, China was willing to let the United States take the lead in the region in such matters. However, growing tensions between the two, coupled with the United States’ withdrawal from Afghanistan, may change the American and Chinese calculations, leaving the field open for Chinese diplomacy. Such a shift in great power roles is likely to be unacceptable to India, which is now increasingly voicing its threat perceptions in terms of a two-front war. Therefore, erstwhile external actors may not be able to play the same kind of role as in the past. This contextual shift means that some kind of dialogue between India and Pakistan has become essential for crisis management. India’s blanket rejection of any dialogue, maintaining that “terror and talks don't go together," implies a dependence on external actors for an off-ramp outcome and is not politically tenable in the long run.

In the United States–Soviet Union nuclear standoff, the idea that deterrence was automatic was blown away during the Cuban missile crisis in 1962 when the two came face to face in a full-blown showdown which brought the world closer to the brink of nuclear war that it had ever been. It also marked the beginning of a shared realization of the risks of unintended escalation that laid the foundations of bilateral and multilateral nuclear arms control. Therefore, while doctrinal asymmetry in the India-Pakistan case imposes its own constraints, the lesson that crisis management requires a minimal level of communication still holds. It is unlikely to resolve Kashmir or other fundamental differences; therefore, expectations need to be modest because any undue expectations will overload the process ensuring its collapse. If it proves its utility, then perhaps some confidence-building measures can be visualized, but acting on these will likely be further down the road.

At a regional level, a nuclear dialogue between India and China would help, particularly if Pakistan could also be drawn into a trilateral no-first-use understanding given that both India and China have adhered to it. The prospects for this breakthrough seem remote today because China has shied away from any nuclear talks with India as its policy remains intent on constraining India in South Asia. Growing tensions in the Sino-Indian relationship during 2020 have also deepened mistrust. Similarly, a global no-first-use agreement would put pressure on Pakistan to follow suit, but this approach is unlikely given the direction in which U.S. and Russian nuclear doctrines are evolving.

It is worth noting that while nuclear weapons remain the most destructive weapons designed to date, the science at its core is nevertheless 75 years old. In many ways, nuclear weapons are primitive weapons. A host of new disruptive technologies are emerging that add new complexity to the old deterrence equations. Foremost among these are missile defence capabilities, hypersonics—particularly as a dual-capable system—vastly improved surveillance and early warning systems that permit development of "left of launch" postures, and finally, offensive cyber activities that can hack into nuclear command and control networks. Pakistan is developing dual-use cruise missile systems and MIRV technologies; India is focusing on hypersonic weapons and missile defences. Any or all of these can give rise to new types of instability. If the development and deployment of these technologies are to be regulated and restrained, shared understanding on these new risks must be struck via dialogue. This process could be conducted at a bilateral level or even at a multilateral level. Similarly, many analysts have cautioned against interfering with nuclear command and control systems using offensive cyber capabilities; though as relations between major nuclear weapon states lock in a downward spiral, talks have not been possible. Yet, it is clear these technological developments will impact the deterrence equations rendering them even more fragile in the future than in the past.

12. Nuclear Escalation in a Taiwan Strait Crisis?

Robert Ayson

Introduction

Many of the ingredients are already in place for a Taiwan Strait crisis to precipitate a nuclear escalation between China and the United States. Some of the background factors that could give rise to such a catastrophe stem from *political* tensions between Beijing and Taipei over Taiwan's future against a wider context of growing great power competition and distrust between China (seen by Taiwan as the principal threat to its security) and the United States (seen by Taiwan as its main protector). Some of the *strategic* factors stem from the shifting asymmetries of military power between China and Taiwan and between China and the United States, which may create incentives for escalatory options as a crisis grows. And some of the problems are *operational*, including the difficulties that may face China and the United States in ensuring clear firebreaks between conventional military options and attacks which involve, or put at risk, nuclear capabilities. In general, there is a risk that military postures designed to demonstrate everyday resolve could stand in the way of heading off further escalation once the first shots are fired.

In addition to examining these various risks, and the connections that could occur between them, it is also important to consider the reasons why nuclear escalation might be regarded as unlikely. If we assume that nuclear use in the Taiwan Strait will not occur as a bolt-out-of-the blue attack, at least three major thresholds probably need to be crossed before nuclear war has arrived. First, there needs to be a serious crisis in the Taiwan Strait (for which there are precedents since the early 1950s) in which the use of military force is threatened and anticipated (ie., a higher benchmark than the mere onset of a crisis). Second, for the first time in decades, one or more of the three key actors—Taiwan, China, and the United States—will need to decide to begin using armed violence to bend a Taiwan Strait crisis in their favor. And this decision needs to be reciprocated if a serious conventional military escalation is to occur.

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Unless that conventional violence was carefully circumscribed, (and not reciprocated) we would at this point already be witnessing the most serious military exchange in East Asia for decades. But nuclear escalation requires something even more unusual than this. The third requirement is that the threshold between conventional and nuclear military operations is crossed either by China or the United States (and both if a nuclear *exchange* is to occur). Crossing this threshold would constitute the first violent use of nuclear weapons anywhere in the world since 1945.

The pressures that play on decision-makers in a serious, escalating crisis, and the possibilities of overreaction and misjudgment, bear little comparison to what seems rational in the cold light of a pre-crisis day. But to mount a convincing argument that nuclear escalation in the Taiwan Strait is a serious possibility we need to show how the situation can go from A (the current presence of tension in the absence of a precipitating crisis) to B (a serious and escalating Taiwan Strait crisis) to C (conventional war in the Taiwan Strait) and to D (the use of nuclear weapons). The several steps in this process allow several opportunities for recommendations about measures the three main actors might adopt to reduce the chances of escalation, and in particular an escalation that could lead to the use of nuclear weapons.

Political Conditions: The Context for a Crisis

The strategic relationships that can fuel or dampen down a dangerous crisis in the Taiwan Strait are not nearly as good as we might want but not as bad as they have been. In the mid-1950s, for example, these relationships were much worse. Only a few years after the United States and China had been at war over Korea, in response to China's bombardment of offshore islands in the Taiwan Strait, the Eisenhower Administration contemplated using nuclear weapons in response.[1] And the first two decades of the 21st century have not produced an obvious parallel to the 1995-96 crisis where the visit of President Lee to the United States precipitated a dramatic few months in Taiwan-China and China-US relations.[2]

[1] For a recent study, see Pang Yang Huei, *Strait Rituals: China, Taiwan, and the United States in the Taiwan Strait Crises*, *1954-1958,* (Hong Kong: Hong Kong University Press, 2019).
[2] See Robert Ross, "The 1995–96 Taiwan Strait confrontation: Coercion, credibility, and the use of force." *International Security*, 25:2, 2000, pp. 87-123.

Peace in the Taiwan Strait depends on mutual restraint between the two great powers. At times it has been possible to detect an informal understanding where in exchange for Beijing's decision to avoid using force, Washington has signaled that its support for Taiwan is conditional on the latter avoiding the most provocative steps towards independence. While Beijing has been uncomfortable with any level of American assistance to Taiwan, Washington's deliberate ambiguity about the support it could or would provide in an actual conflict has suited China in comparison to more robust US policy alternatives. Given these tacit agreements between the two bigger players, the main source of China-US tensions over the Taiwan Strait often appeared to be Taiwan itself: a third-party catalyst to great power war.

Taiwan's politics continue to be marked by the emergence of a democratic identity that bucks the trend away from liberal values apparent in so many parts of the world, including in parts of Asia. And popular support in Taiwan for independence from China continues to grow.[3] But nearly two decades after President George W. Bush signaled Washington's opposition to a Taiwanese quest for independence,[4] Taipei's leaders (including in the Democratic Political Party) still tread a relatively careful line. Their focus has been on establishing for Taiwan an enhanced international status and promoting Taiwan's separate political identity without pushing too hard on formal independence per se.

Yet the modus vivendi of the recent past is at risk. Just five years ago, Scott Kastner referred to an "unprecedented period of détente in cross Strait relations" in making the argument that "the risk of armed conflict has been declining and is likely to decline in the years ahead."[5] But any such optimism has been complicated since that time by two less reassuring developments. First, China's willingness to tolerate Taiwan's autonomous political decision-making, never a strong suit, has been diminishing. In other words, Beijing's redlines may be getting more restrictive. The growing capabilities of the People's Liberation Army (PLA), including vis-à-vis both Taiwan and the

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[3] Dennis V. Hickey, "More and More Taiwanese Favor Independence – and Think the US Would Help Fight for It," *The Diplomat*, 3 December 2020, https://thediplomat.com/2020/12/more-and-more-taiwanese-favor-independence-and-think-the-us-would-help-fight-for-it/

[4] See Dana Milbank and Glenn Kessler, "President Warns Taiwan on Independence Efforts," *Washington Post*, 10 December 2003, https://www.washingtonpost.com/archive/politics/2003/12/10/president-warns-taiwan-on-independence-efforts/374c46e0-6f94-4874-825a-d1a12bdc51b1/

[5] Scott L. Kastner, "Is the Taiwan Strait Still a Flash Point?: Rethinking the Prospects for Armed Conflict between China and Taiwan," *International Security*, 40:3, Winter 2015/2016, pp. 54, 56.

United States, give this problem a material edge. But many of the motivating factors are political and are closely related to China's domestic affairs. Appeals for the unification of Taiwan with the motherland have become more pressing as Xi Jinping consolidates his power around the revitalization of the Communist Party's authority, accompanied by significant doses of nationalism. Taipei's leaders will have watched with growing apprehension the recent developments in Hong Kong, where the new national security law passed by Beijing has turned the "one country two systems" logic into an historical artifact.[6]

Second, the Biden Administration has come to office at a time when US congressional support for democratic Taiwan and antipathy to nondemocratic China have both been increasing. Walter Lohman and Frank Jannuzi suggested immediately before the 2020 federal election that "there is more support for Taiwan in Congress now than at any time in at least 30 years."[7] America's strategic ambiguity, which may have been an off-ramp for past tensions,[8] no longer finds many suitors as China appears more willing to exploit its growing powers of intimidation across the Strait.[9] Members of the Senate's Armed Forces Committee were told in March 2021 by the Pentagon's Indo-Pacific Commander that China could translate its threats into action in as little as six years.[10] And there is very little sign that the Biden team has any intention of pleasing Beijing by winding back Washington's relationship with Taipei.[11]

Moreover, rising pressures in the China-Taiwan-US triangle of relationships are not an exception to an otherwise calm regional geopolitical situation in Asia. If they were, the Taiwan Strait might

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[6] See Huileng Tan, "Taiwan slams Hong Kong national security law, opens office to help city's residents," *CNBC*, 3 July 2020, https://www.cnbc.com/2020/07/03/taiwan-slams-hong-kong-national-security-law-opens-office-to-help.html

[7] Walter Lohman and Frank Jannuzi, "Preserve America's Strategic Autonomy in the Taiwan Strait," *War on the Rocks*, 29 October 2020, https://warontherocks.com/2020/10/preserve-americas-strategic-autonomy-in-the-taiwan-strait/

[8] See Brendan Taylor, *The Four Flashpoints: How Asia Goes to War*, (Carlton VIC: LaTrobe University Press, 2018), p. 163.

[9] For a prominent articulation of this point, see Richard Haass and David Sacks, "American Support for Taiwan Must Be Unambiguous," *Foreign Affairs*, 2 September 2020, https://www.foreignaffairs.com/articles/united-states/american-support-taiwan-must-be-unambiguous

[10] See Brad Lennon, "Chinese threat to Taiwan 'closer than most of us think,' top US admiral says," *CNN*, 25 March 2021, https://edition.cnn.com/2021/03/24/asia/indo-pacific-commander-aquilino-hearing-taiwan-intl-hnk-ml/index.html

[11] Chao Deng, "Biden Brushes off China's Complaints, Sends First Delegation to Taiwan," *Wall Street Journal*, 14 April 2021, https://www.wsj.com/articles/biden-sends-unofficial-delegation-to-taiwan-as-beijing-ramps-up-pressure-11618384940

be regarded as a somewhat localized dispute whose broader consequences could be cushioned by wider currents of regional stability. A Taiwan crisis would have a better chance of being quarantined in these more favorable conditions. But in the coming years a serious Taiwan Strait crisis could be egged on by broader political tensions between Beijing and Washington in which Taipei is as much a passenger as a participant.

The broader relationship between China and the United States has been on a generally downward trajectory. Great power competition is in vogue. Washington has come to see China as the biggest threat to America's interests, and Xi Jinping's brand of authoritarianism, including abuses against Uighur Muslims in Xinjiang, as a central challenge to America's values. A much stronger PLA which is changing the East Asian maritime military balance, China's cyberattacks on private and public sector organizations in several countries, its expansionism in the South China Sea, and Beijing's Belt and Road Initiative plan are all being seen through a highly competitive lens in Washington.

A more competitive great power landscape puts the spotlight on Taiwan's place in the region's strategic geography. So long as it remains outside of Beijing's control, Taiwan remains an obstacle to China's quest to dominate its first island chain, project maritime military power further into the region, and intensify the costs to the United States of furnishing support for regional allies such as Japan. Hitherto cooperative parts of the great power relationship have been crowded out, including by Trump era efforts to decouple important parts of the two economies, and Washington's determination to reduce the involvement in the US market by China's information technology companies. The arrival of the Biden Administration has breathed at least some life into hopes for US-China cooperation, including on climate change.[12] But the basis for that great power collaboration remains narrow.

Beijing's crackdown on Hong Kong's autonomy has made Taiwan's vibrant democracy only more valuable to American political leaders. Biden himself has made the commitment to democracy at home and abroad the cornerstone of his Presidency. But the bigger picture is the contest between the United States and China for military and economic supremacy in Asia. As one of the two great

[12] Roger Harrabin, "China and US pledge climate change commitment," *BBC*, 18 April 2021, https://www.bbc.com/news/world-asia-china-56790077

power participants in this contest, Beijing has taken umbrage at what it sees as American-led attempts to contain its growth and question the legitimacy of its return to great power status. Despite early signs that Trump regarded Xi as a partner on the North Korean nuclear issue, Beijing became the 45th president's most convenient international scapegoat, including on the covid-19 pandemic. As the 46th president, Joe Biden has taken issue with the Trump era inclination to apply trade pressure on America's traditional allies and partners, a famously counterproductive approach. But the pressure on Beijing will be hard to undo if Biden is to live up to his domestic promises of being tough on China.[13] Indeed one of the only current points of bipartisan concord is the China threat argument, which also has become a key justification for federal spending on defense and infrastructure.

A background of tension between Beijing and Washington could shape the narrative for a future Taiwan Strait crisis and its implications for great power stability in new ways. For many years the world occasionally worried about a fresh crisis between China and Taiwan dragging in the United States to perform a tenuous balancing act—reassuring Taiwan without provoking China to serious escalation. But today we might be more concerned that a relatively minor Taiwan Strait problem involving China and Taiwan will grow quickly into a grander crisis as a symptom of deep US-China tensions. The less that the two great powers trust each other, and the more they regard each other as adversaries in almost every dimension of policy, the greater the chance that tensions in the Taiwan Strait become a Sino-US contest for resolve.

The intentions of the two great powers at this point would be divergent. Could China get away freely with greater intimidation of Taiwan despite Washington's obligations under Section 2 of the 1979 Taiwan Relations Act to "consider any effort to determine the future of Taiwan by other than peaceful means, including by boycotts or embargoes, a threat to the peace and security of the Western Pacific area and of grave concern to the United States" and "to maintain the capacity of the United States to resist any resort to force or other forms of coercion that would jeopardize the security, or the social or economic system, of the people on Taiwan?"[14] In other words, might

[13] See Brian Flood, "Biden White House Defends Trump China Tariffs in Legal Showdown," *Bloomberg Law*, 16 March 2021, https://news.bloombergtax.com/international-trade/biden-white-house-defends-trump-china-tariffs-in-legal-showdown

[14] *H.R. 2479 – Taiwan Relations Act*, 96th Congress, (1979-1980), https://www.congress.gov/bill/96th-congress/house-bill/2479

Beijing achieve two things: a big step towards reunification and an even bigger step towards regional supremacy? Or would America offer decisive support to Taiwan in a crisis at a time when Beijing's commitment to reunification (by force if necessary) has been growing? And in doing so, could the Pentagon demonstrate that American military superiority in Asia has not been matched by the PLA's growing capabilities?

These competitive quests might combine in combustible fashion. Brittle political communications between Washington and Beijing, coupled with problems in securing military-military dialogue,[15] including the planned Military Maritime Consultative Agreement meeting in 2020,[16] increases the chances of Sino-American political misjudgments on Taiwan. For its part, Taipei needs to read the signals accurately. Will its leaders conclude that under China's increasing pressure the time for expanding Taiwan's place in international diplomacy is running out? Will Taiwan be looking even more desperately for extra US support as soon as it needs it in the early stages of a crisis? And is the United States going to be in a position—domestically as well as internationally—to refuse that request? At the same time, will Xi see a Taiwan Strait crisis as an ideal opportunity to test the resolve of Biden's Presidency in its early stages? What happens if, in an echo of Khrushchev's misreading of Kennedy during the Cuban Missile Crisis, the Biden Administration pushes back harder than China expects? The wider backdrop does not appear promising.

From Crisis to War: The Trouble with Asymmetries

Beijing's estimation of Washington's resolve becomes even more significant when we factor in the relationship between political objectives and military action. Inaction may sometimes appear be the better word here. In 2012 Washington did little to come to the immediate assistance of the Philippines, a formal treaty ally, when China placed pressure on Manila in a standoff at the Scarborough Shoal. This is not quite the whole picture. Four years later the Obama Administration appears to have signaled behind the scenes to China that the United States would not tolerate

[15] See Shannon Tiezi, "Another US-China Dialogue Bites the Dust," *The Diplomat*, 2 October 2018, https://thediplomat.com/2018/10/another-us-china-dialogue-bites-the-dust/
[16] Chun Han Wong, "China a No-Show at Joint Military Safety Meeting with U.S.," *The Wall Street Journal*, 17 December 2020, https://www.wsj.com/articles/u-s-stood-up-by-china-at-military-safety-meeting-11608199871

attempts by China to begin reclamation activities at Scarborough.[17] And more generally in the South China Sea, the United States has continued to conduct freedom of navigation operations[18] to demonstrate the ability of its forces to move unimpeded on, under and above international waters. But the United States has shown little sign of trying to roll back China's island building efforts, let alone Beijing's militarization of these features.

Taiwan sits in the northern portion of the South China Sea, much closer to the concentration of PLA firepower than most of the other claimants involved in maritime territorial disagreements with Beijing. If China was to conduct a sustained campaign of military intimidation of Taiwan as part of a growing crisis—steps short of the actual violent use of force, including obvious mobilization, provocative exercises, intercepting Taiwanese aircraft, and explicit threats of military action—and the United States did little but monitor the situation, would Xi Jinping have achieved an historical victory? There are multiple precedents for such a campaign of intimidation: from China's firing of missiles in the 1995-6 crisis which prompted the United States to deploy two aircraft carrier battle groups in the seas around Taiwan to the more recent intensification of aircraft flying across the half-way point in the Strait,[19] and Beijing's ongoing campaign of cyber pressure. There is also China's clear record of military coercion (short of war) in relations with nearby Japan in the East China Sea.

China's coercive position is strengthening in regard to the Taiwan Strait military balance. Kastner refers to a "dramatic improvement in the PRC's relative military capabilities in the Taiwan Strait"[20] since 2000. A more recent IISS note suggests that while China's quantitative advantage has remained relatively unchanged over the last ten years, the PLA's qualitative advances have driven the asymmetry further in Beijing's advantage.[21] Given China's ability to bombard Taiwan

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[17] Zack Cooper and Jack Douglas, "Successful Signaling at Scarborough Shoal?" *War on the Rocks*, 2 May 2016.

[18] See Dzirhan Mahadzir, "SECDEF Esper: U.S. Will Keep Up the Pace of South Chins Sea Freedom of Navigation Operations," *USNI News*, 21 July 2020, https://news.usni.org/2020/07/21/secdef-esper-u-s-will-keep-up-the-pace-of-south-china-sea-freedom-of-navigation-operations

[19] See Minxin Pei, "China and the US risk accidental war over Taiwan," *Nikkei Asian Review*, 29 October 2020, https://asia.nikkei.com/Opinion/China-and-the-US-risk-accidental-war-over-Taiwan

[20] Kastner, p. 70.

[21] Meia Nouwens and Henry Boyd, "Taiwan in the Pentagon's Spotlight, "IISS, *Military Balance Blog*, 18 September 2020, https://www.iiss.org/blogs/military-balance/2020/09/taiwan-pentagon-report-2020

with conventional ballistic missiles, Beijing does not need the capacity to invade Taiwan to make life intolerable on the other side of the Strait. China also knows that, to adapt Thomas Schelling, "the power to hurt" Taiwan economically "is bargaining power."[22] Beijing has reasons to believe that its growing military capabilities (in the air and on and under the sea) also give it a greater ability to impose a blockade on trade dependent Taiwan: the interdependence of the two economies means this would harm Beijing as well as Taipei, but the latter much more than the former.

China could exploit this power to hurt without its armed forces firing a single shot, even if, as Brendan Taylor suggests, the blockade would involve PLA forces seeking to control the airspace above Taiwan and the entry points to Taiwan's seaports.[23] If time permitted the United States might rally its closest allies around a retaliatory ban on People's Republic of China (PRC)-flagged commercial vessels, seeking to put pressure on Beijing while keeping the crisis in an economic frame. But the onus could also be on Taiwan to take the next step, by testing China's willingness to enforce the blockade, and China's calculus of what might happen next if it attacked a Taiwanese vessel or aircraft, including the possibility that the United States would see this as an unacceptable resort to violence which demanded a response.

How Taipei reads the military intentions of the great powers would be crucial as the threats of violent action grew. Taiwan is developing its ability to raise the costs of PLA operations *after* China has begun to use force, which puts a premium on force preservation.[24] But Taipei might still be faced with "use it or lose it" choices in regard to its still limited arsenal of missiles that can reach China's coastline and which would among the early targets in PLA strikes on Taiwan.[25] These pressures would be even higher if Taiwan had doubts about the prospect of an early and

[22] Thomas Schelling, *Arms and Influence*, (New Haven and London, Yale University Press, 1966,) p. 2.
[23] Taylor, *The Four Flashpoints,* p. 151.
[24] Lee Hsi-Min and Eric Lee, "Taiwan's Overall Defence Concept, Explained," *The Diplomat*, 3 November 2020, https://thediplomat.com/2020/11/taiwans-overall-defense-concept-explained/
[25] See Michael Hunzeker and Alexander Lanoszka, "Taiwan wants more missiles. That's not a bad thing," *Defense One*, 24 March 2021, https://www.defenseone.com/ideas/2021/03/taiwan-wants-more-missiles-s-not-bad-thing/172887/

decisive American military response. Some analysts seem increasingly concerned just how fast the United States could respond in practice with some force elements.[26]

Moreover, even if US retaliation against China was more or less guaranteed, this would not necessarily preclude Taiwan from being extensively disarmed (and for extensive harm to be caused to people and cities) before the US response kicked in. It would be in Taiwan's interests for China to know very early in a crisis that PLA forces were *already* at a real and present risk of a devastating American attack. In such a case Taiwan would have incentives to bring the United States into the crisis as quickly as possible. Risk-taking would make sense for Taiwan if that is what it took to get the United States into the action.

China's interests in such a situation would be markedly different (and more emphatic than America's given the greater political importance of Taiwan to China and of the Taiwan Strait to China's security[27]). Beijing would want to show (a) that Taiwan is certain to bend to its demands in the crisis, (b) that the United States is not able to prevent that from happening, and (c) that the United States is a spent force in Asia. All three of these interests have a common thread: China must make it clear to the United States that the costs of military involvement in a local dispute are too high for Washington to bear and for US forces to operate effectively (deterrence by punishment and denial).

In the two and a half decades since the last serious Taiwan Strait crisis China has substantially raised the costs for US military operations close to mainland China and the first island chain. Washington's freedom to repeat its approach a generation later—including by deploying aircraft carriers to the waters near Taiwan—is increasingly complicated by extra risks, not least because of advances in China's growing ballistic missile, submarine warfare, and anti-ship missile capabilities. With enhanced intelligence, surveillance, and reconnaissance systems (including satellites), the PLA has more accurate systems that provide it with real options for precision

[26] A widely noticed example of this view by a serving US marine corps officer concluded that the United States should return forces to Taiwan to act as a tripwire. See Walker D. Mills, "Deterring the Dragon: Returning US Forces to Taiwan," *Military Review* 100:5, 2020, p. 59.
[27] See Robert S. Ross, "Navigating the Taiwan Strait: Deterrence, Escalation Dominance, and U.S.-China Relations," *International Security*, 27:2, Fall 2002, pp. 54-6.

strikes.[28] China's ability to put US forces at risk is not a question of if. It is a question of how much.

Beijing would want America to know that the risks of intervention are high even before the US Commander in Chief decides to deploy forces closer to the Strait (assuming they were not there already for some reason). In a growing crisis, there would be strong incentives for China to intensify cyber activities aimed at US communications, radar, and command and control systems, including space-based systems, and to shadow US naval and air forces in the wider region to remind Washington that Beijing is watching every move. China will know that, in turn, its own C4I systems would be very early targets for an American attack. It will be aware that Washington's strategy depends not just on China knowing that the response to its military action in the Taiwan Strait would be prohibitively costly to Beijing (once again deterrence by punishment) but also on making China question its ability to achieve the military effects it wishes to in the Taiwan Strait (deterrence by denial).

This equation might also encourage China to conduct very early strikes against Taiwanese targets in the hope that these could occur *before* the United States can make it especially difficult for Beijing to do so. And the longer it takes for that American response to be delivered, the more terrible the situation could be for Taiwan. To reduce Beijing's freedom to dictate terms to Taipei, might there be circumstances where Washington would be inclined to remove military options in the Strait from China's hand before they were used? A deepening crisis involving the exchange of threats, including of military action and economic actions (including sanctions) might well be stopped before violent action begins. But the chances of avoiding violence decrease as soon as any one of the actors believes that violence is imminent.

Moreover, the threshold between non-violent and violent action (peace and war) may not be as clear in all circumstances as one might wish. For example, as the crisis builds, should the United States treat intensified PLA cyber activities directed at US (and Taiwanese) command and control systems as something close to a hostile act, or an act of war? How does Beijing read the same type of attempts coming from the other side? If China issues a bellicose statement on enforcing its East

[28] On these themes, see Akira Marusaki, "Developments in China's Conventional Precision Strike Capabilities," *Project 2049 Institute*, 23 November 2015, https://project2049.net/2015/11/23/developments-in-chinas-conventional-precision-strike-capabilities/

China Sea Air Defense Identification Zone—and announces a new zone in the South China Sea—what are the implications for "routine" movements of American maritime vessels and aircraft?[29] How does the Pentagon know what the risks actually are? As Chinese and Taiwanese and Chinese and American maritime force elements come into close proximity with each other, how does each actor know how the other side will respond to an accidental collision? And would the ramming of an American vessel by a Chinese ship,[30] apparently on purpose but quickly blamed by Beijing on American risk-taking, signal a commitment to hostilities or something short of that?

China and the United States have not fought each other for nearly 70 years. That beneficial situation means we can have some confidence that they can avoid war breaking out in a crisis. During the Vietnam War, for example, China and the United States quietly sought to avoid a confrontation between the two of them.[31] But the extended period of China-US peace means there is no recent precedent for how the two great powers might control escalation once the threshold of conventional military action between them has been *crossed*. China's recent high-altitude dispute with India (another great power), where the use of force bore little resemblance to advanced maritime combat,[32] is no preparation for escalation control and intra-war deterrence with the United States. Meanwhile almost all of America's recent wartime experiences have been against decidedly inferior adversaries where achieving US escalation dominance has been an achievable option for Washington rather than an untested possibility. And Taiwan has minimal experience of managing violent armed conflict involving modern military systems.

China has no recent experience of managing the domestic political pressures for escalation that are likely to arise once violence in the Taiwan Strait is in play, especially because Beijing would

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[29] For a recent non-crisis example of China the United States citing a Taiwan Strait transit (by two naval vessels) as "routine" and China calling the same mission a "provocation," see Minnie Chan, "US in rare double-warship Taiwan Strait transit after China starts sea drills," *South China Morning Post*, 31 December 2020, https://www.scmp.com/news/china/military/article/3115955/china-us-tension-american-warships-sail-through-taiwan-strait

[30] On one of the close calls in recent years during a US freedom of navigation deployment, see Brad Lendon, "Photos show how close Chinese warship came to colliding with US destroyer," *CNN*, 4 October 2018, https://edition.cnn.com/2018/10/02/politics/us-china-destroyers-confrontation-south-china-sea-intl/index.html

[31] Frank E. Rogers, "Sino-American Relations and the Vietnam War, 1964-66," *China Quarterly,* 66 (1976), pp. 293-314.

[32] See Sudhi Ranjan Sen et al, 'With Stones and Iron Rods, India-China Border Clash Turns Deadly," *Bloomberg*, 17 June 2020, https://www.bloomberg.com/news/articles/2020-06-16/china-india-ties-tested-after-border-standoff-takes-deadly-turn

almost undoubtedly blame the expanding war on Taiwan and its American supporters. It is hard to avoid assuming that social media pages in China will be full of demands that Taiwan be crushed. Congressional and public pressure for decisive action to come to Taiwan's aide may well also grow in the United States once the fighting has begun.

A great deal will depend on how much the United States wants to restrict China's escalatory options. This may sound counterintuitive—surely the more those options are restricted the less we might be worried about more serious levels of violence. But here asymmetry raises its destabilizing head once again. China's leaders will know that many of the PLA's crucial systems for attacking Taiwanese targets can be held hostage by the threat of an American conventional attack, and they will know American military strategy often exploits precision strikes to reduce an adversary's ability to use its available forces. Caitlin Talmadge envisions that the United States effort would not only be focused on "the weapons systems that China could use to strike Taiwan or U.S. military based or forces in the region" but also "the Chinese C4ISR that would underlie China's campaign."[33]

Many of China's newer missile systems are more mobile and survivable than earlier variants. And Beijing knows its increasingly advanced forces[34] will pose extra costs and risks to United States forces entering any sort of Taiwan conflict. But it would be naive for Beijing to conclude that its rocket forces, aircraft, anti-ship missiles and the platforms they are launched from, and the command and control systems which manage these capabilities, were therefore invulnerable to American action. And what happens to Washington's thinking if it believes that China plans to use these capabilities against Taiwanese and US targets early, recognizing also that several thousand American citizens live in Taiwan? Timescales could be squeezed, and quick decisions are not always the most stabilizing.

We should also guard against the assumption that any military action will be restricted to the Taiwan Strait. Previous crises may encourage the view that the United States and China have been able to fashion tacit agreements which limit the spread of their conflict. But in the twenty-first

[33] Caitlin Talmadge, "Would China Go Nuclear? Assessing the Risk of Chinese Nuclear Escalation in a Conventional War with the United States," *International Security*, 41:4, Spring 2017, p. 66.
[34] For example, see Ian Williams and Masao Dahlgren, "More than Missiles: China Previews its New Way or War," *CSIS Briefs*, 16 October 2019, https://www.csis.org/analysis/more-missiles-china-previews-its-new-way-war

century, the two great powers will need to find extra reserves of political commitment to avoid the escalatory temptations that material factors bring into play. For example, while almost all of the forces that Taiwan might use are confined to that geography (by definition), the same does not apply to the forces that China and the United States might rely on. The wider spread of relevant American forces opens up the possibility that they might be targeted by China *beyond* the immediate conflict area. And the growth in PLA power projection capabilities gives Beijing options for targeting US forces which it lacked in earlier Taiwan Strait crises.

China faces the difficult question of how far out from the Taiwan Strait (and the first island chain more generally) it needs to put US forces at real risk (and perhaps subject them to attack) in order to reduce America's ability to intervene decisively. Depending on how responsive it believes America's closest regional allies (Australia and Japan) are going to be to American expectations of assistance in a Taiwan Strait armed conflict, Beijing may need to extend that question beyond considerations about targeting just US military elements. Beijing will be well aware of American expectations that Australia would come to its ally's assistance in a Taiwan Strait war.[35] But it is the Japan factor that is more complex.

Several factors make a Japan connection possible. For reasons of geographical proximity Tokyo would see a militarized crisis in the Strait directly affecting its own security. The United States and Japan are giving increased attention to Taiwan Strait issues in their own relationship,[36] and Japan's capabilities (including its naval forces) are an important part of East Asia's military balance. There is also the simple fact that America's plans for military contingencies in the Taiwan Strait are likely to involve American forces normally based in Japan. This makes attacking targets on and near Japan's territory an obvious consideration for Beijing even if it appears as though Tokyo wishes to stay out of the fight.[37] And if those targets are hit, the chances of a normally (and

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[35] See Brendan Taylor, "Taiwan Flashpoint: What Australia can do to stop the coming Taiwan Crisis," Policy Brief, Lowy Institute for International Policy, 25 February 2020, https://www.lowyinstitute.org/publications/taiwan-flashpoint-what-australia-can-do-stop-coming-taiwan-crisis

[36] See Sheila A. Smith, "Much Ado About Taiwan," *Asia Unbound*, Council on Foreign Relations, 21 April 2021, https://www.cfr.org/blog/much-ado-about-taiwan

[37] See Julian Ryall, "Japan troops won't get involved if China invades Taiwan, PM Yoshiga says," *South China Morning Post*, 21 April 2021, https://www.scmp.com/week-asia/politics/article/3130423/japan-troops-wont-get-involved-if-china-invades-taiwan-pm

constitutionally) very cautious Japan getting involved (as an act of self defense and also in conjunction with its larger ally) might well increase.

As if this is not challenging enough, there is no cast iron guarantee that the DPRK will sit back and quietly watch the United States use force in Northeast Asia against Pyongyang's main guarantor. If Washington was getting fully distracted by an escalating and increasingly violent Taiwan Strait crisis, would Pyongyang decide to add to America's challenges by disruptive action on or across the parallel? This would be an extremely risky time for the DPRK to be doing this. And it might not be to China's advantage. But the regional implications of a Taiwan Strait war involving the United States and China would be more demanding than a non-violent Taiwan Strait crisis.

China will also need to deal with the temptation of extending its attacks into another domain entirely, by targeting the space-based communications systems[38] which are crucial for America's military command and control capabilities. In turn the United States will also face perverse incentives of its own which could also encourage escalation. For example, Washington's national security policymakers will need to consider how far into China US forces will need to target PLA forces to restrain Beijing's useable options. Of the many bases for PLA rocket forces that the United States would target in a conventional conflict, not all would necessarily be in coastal locations adjacent to Taiwan. Deeper strikes may well be envisaged. Which brings us to the biggest threshold of all.

The Nuclear Dimension

A military conflict in the Taiwan Strait will have a nuclear dimension regardless of whether the United States is directly involved. Both Taiwan and China know that the latter is nuclear armed and could, at least in theory—but in violation of its No First Use policy—use nuclear weapons against Taiwan.[39] The nuclear dimension is intensified if the United States is factored in because it means that two nuclear-armed great powers are on opposing sides of an armed conflict. It is

[38] See Frank A. Rose, "Managing China's Rise in Outer Space," *Brookings Institution*, April 2020, pp. 4-8.
[39] The possibility of China relying on nuclear threats against Taiwan is examined below.

intensified further if we make the plausible assumption that one of the reasons that Taiwan is interested in protection from the United States is that the latter has nuclear weapons. America's arsenal constitutes one of the main appeals of extended deterrence. But it also means that the United States needs to factor in China's nuclear prowess when it considers the assistance it offers to Taiwan in an armed conflict and the actions it is willing to take against China's forces.[40]

There are more deliberate and less deliberate ways in which the threshold could be crossed from a Taiwan Strait conventional armed conflict to one involving nuclear weapons. In terms of the deliberate side of the equation, it cannot be exaggerated how big such a decision—by China, by the United States, and/or by both—would be for course of the war and the course of history. Why then might either of them be willing to violate the nuclear taboo that has been in place since 1945? Under what circumstances would such a step make any sense at all as a deliberate policy choice?

We can take some solace that there is no obvious answer to these questions. But there are still some more detailed issues that need to be considered. For example, even if China has been emboldened by its dominant cross-Strait military position to intensify its conventional attacks on Taiwan as the crisis moves into war, it would end up encountering a different balance of military power to the extent that the United States becomes involved. Of course, the latter comes with much greater immediate risks than it once did. American analysts may be increasingly aware of the costs and risks of intervening militarily in a Taiwan Strait crisis. They may wonder how quickly the United States could reposition its forces for a more protracted conflict with China. Hence Washington probably has less scope to repeat its 1996 playbook. It is arguably harder for the United States to *deter* a PLA attack on Taiwan today than it was a quarter of a century ago. And it is certainly much harder for the United States to deter China from coercing Taiwan.

Yet if Taiwanese and American deterrence of China has failed, and China is at war with Taiwan, Washington may very well decide to commit to a limited conventional war against China. (Strategic ambiguity raises questions about the time, place, nature, and probability of an American response. But these questions don't allow us to conclude that if China attacks Taiwan, the United States *won't* get involved in a fighting war). Notwithstanding China's ability to put American

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[40] See Steve Chan, "Extended Deterrence in the Taiwan Strait: Discerning Resolve and Commitment," *American Journal of Chinese Studies*, 21, June 2014, p. 84.

forces at risk, American attacks on PLA force elements could have a devastating effect on China's military options as the crisis escalates. Some of these measures could be undertaken from a distance: the United States could hold PLA mainland targets at risk even if China had a momentary advantage around Taiwan. And if China initially held the upper hand, Washington might have extra reasons to put mainland PLA targets at risk.

If the United States pursued some of the conventional military steps implied earlier and degraded China's military by attacking PLA forces situated on the mainland, (including through attacks on missile bases and command systems), then China would face a deteriorating correlation of forces. China's sense of vulnerability will be much greater than America's. There is more than a passing possibility that Beijing would feel it is time for making choices that mattered was closing in. Perhaps in anticipation of these American measures, the Communist Party leadership may have already decided that it is time to use "all options are on the table" language, hinting at nuclear possibilities. Hinting is about as far as things *might* go. Writing over a decade ago, admittedly when the distribution of military power was more strongly in America's favor, Baohui Zhang suggested that "the possibility of China threatening first use of nuclear weapons should not be ruled out when a real crisis in the Taiwan Strait makes U.S. military intervention seemingly unavoidable,"[41] which also reminds us that there is a difference between issuing a threat and carrying it out.

But once those American precision attacks have begun (and China's conventional and nuclear deterrence has failed to prevent such an intervention) the situation changes. If China's options to manage and escalate the conventional conflict seem to be getting scarcer because of the effects of American strikes—actual as well as anticipated—what remaining choices will Beijing have aside from crossing the nuclear threshold and putting an end once and for all to its no first use declaratory policy? This runs against the assessment that "there is no evidence that China envisages using nuclear weapons first to gain a military advantage by destroying U.S. conventional forces or to gain a coercive advantage by demonstrating its greater resolve in a conflict with the United States."[42] But this envisaging has not been occurring when China is losing a conventional war

[41] Baohui Zhang, "The Taiwan Strait and the Future of China's No-First-Use Nuclear Policy," *Comparative Strategy*, 27:2, 2008, p. 165.
[42] Fiona S. Cunningham and M. Taylor Fravel, "Dangerous confidence? Chinese views on nuclear escalation," *International Security*, 44:2, 2019, p. 83.

against the United States. And surely the possible targets for a nuclear attack by China would not be confined to the Strait, unraveling any remaining sense of a tacit agreement to limit the geographical confines of the conflict. Would Beijing consider nuclear attacks on US territories in the wider region—including Guam—if it really wanted to exercise some measure of intra-war deterrence (to make the costs of continuing too great for Washington to handle?) Would it want to hold hostage cities and other targets in the Pacific coast of the US mainland?

The hostage-taking scenario may seem farfetched. But if China judged that America's conventional attacks were sufficiently damaging to warrant the use of nuclear weapons, it would then be obliged to think ahead to what sort of American retaliation would ensue. Any such thinking would be bound to focus minds on the very significant asymmetry between China's and America's nuclear forces, and the absence of nuclear options on Beijing's part that might communicate intentions of fighting a limited nuclear war[43] (however preposterous that notion sounds). But should escalation dominance in such a situation be judged by capability and doctrine (which would favor the United States) or by desperation (which might favor China)?

At this point there is also an obligation to consider whether the United States might be the first of the two nuclear-armed states in this crisis to use nuclear weapons. There is the decades-old precedent of US nuclear threats against China in a Taiwan Strait crisis (which occurred several years before China itself had a nuclear arsenal). But the mid-1950s were the era of massive retaliation strategies, and America's nuclear weapons were not used. And more than half a century later, US decision-makers would also have some confidence that many of their military objectives—including knocking out PLA systems on the mainland—could be achieved by using advanced conventional systems (e.g., conventionally armed cruise missiles launched from offshore). Moreover, while some US attacking options would be vulnerable to China's pressure (including forces based in regional bases) the United States would retain long-range options (including bombers) that would be very hard for the PLA to reach.

But we need to ask whether the United States would use nuclear weapons first in a Taiwan Strait conflict if the conventional phase of that war was heading strongly in China's favor? In other words, if it looked like China had a good prospect of turning military outcomes in the Strait into a

[43] See Cunningham and Fravel, p. 86.

political victory: unification by force. Taiwan's future could head in almost any direction, including forceful absorption into China, without any obvious direct threat to America's own survival. Yet Taiwan's absorption would imply that Washington had been defeated by China in East Asia. America's reputation amongst regional allies which depend on it (e.g., Japan and Korea) would have been seriously affected. Japan's own security, including against fears of being trapped alongside a triumphant China, would be imperiled by the PLA's ongoing presence in a Beijing-controlled Taiwan. The temptation for nuclear proliferation in East Asia after America's failure to protect the interests of its allies would be strong. America's national security policymakers might argue that despite the enormous costs of using nuclear weapons, (and the moral opprobrium that would follow) at stake in choosing not to use them was the future of the East Asian equilibrium on which many United States vital interests depend.

What then of the less deliberate side of the nuclear ledger? Here I do not have in mind an entirely accidental nuclear war—one in which no obvious decision to proceed with hostile acts was involved. Instead there are risks in any close military-technical and doctrinal interdependence between the conventional and nuclear forces of participants in what begins as a limited war in the Taiwan Strait. The question here is a simple one about a complex situation: can either of the two sides (and especially the United States) put at risk the conventional forces of the other side (and especially China's) without also endangering the target country's nuclear forces? Endangering nuclear forces is not necessarily restricted to attacks on delivery systems and warheads—e.g., the nuclear armed variants of the PLA rocket forces. Also crucial are the command and control, intelligence, surveillance, and reconnaissance systems for these nuclear forces, without which their delivery to target may be compromised or prevented. At stake here is China's confidence that it retains nuclear options in the event of a significant American conventional attack and America's confidence that it can attack China's conventional capabilities without unintentionally putting at risk China's nuclear forces, creating more use them or lose them choices for the adversary.

This problem is not confined to considerations of a crisis in the Taiwan Strait. The late Desmond Ball and I argued a few years ago that any colocation of the PLA's conventional and nuclear systems could create significant escalatory hazards in a conventional war between China and

Japan, which brought in the United States as Japan's security guarantor.[44] Similar risks would be in play should some of the same mainland missile bases that China would use in conducting attacks against Taiwan allow for nuclear as well as conventional options. David Logan argues that while some of these comingling problems have been overstated and others remedied by China's military reforms, still more may be emerging.[45] P.W. Singer and Ma Xiu have noted that while it was assumed that "the PLA was at least separating its nuclear and conventional forces into distinct and geographically discrete brigades" the deployment of the intermediate range DF26 missile with both conventional and nuclear payloads portends a new and worrying point of instability.[46] If the very same missile offers nuclear as well as conventional options to China, the inadvertent escalation problem raises its dangerous head.

In a thoughtful exploration, Talmadge suggests in the event the United States attacked the capabilities that China was most likely to use in a missile bombardment across the Strait, China's leaders would still retain some of their most significant nuclear options (and the command and control systems that would permit their use).[47] What matters less, she argues, are the technical interconnections. What matters more is whether China's leaders believe (wrongly or rightly) that the United States had decided on a counterforce mission (conventional or nuclear) designed to disarm China. And this version of the nuclear temptation will grow for China's leaders, "as more and more of their conventional and nuclear or nuclear-relevant assets come under threat during a conventional war."[48] It needs hardly to be said that putting assets under threat is part of the modern American military philosophy. This would extend to targeting China's intelligence, surveillance, and reconnaissance systems, vital to PLA missile systems (and so reducing the threat to US forces) but also crucial to China's ability to know what was going on.

Given the analysis presented in the earlier portions of the current chapter, some early signs of this problem may appear before any violence occurs in the Strait if the United States and China are probing, testing, and putting on notice their respective command, control, communication, and

[44] Robert Ayson and Desmond Ball, "Can a Sino-Japanese war be controlled?" *Survival* 56:6, 2014, pp. 135-166.
[45] David C. Logan, "Are they reading Schelling in Beijing? The dimensions, drivers, and risks of nuclear-conventional entanglement in China," *Journal of Strategic Studies*, 2020, pp. 1-51.
[46] P.W. Singer and Ma Xiu, "China's ambiguous missile strategy is risky," *Popular Science*, 11 May 2020. https://www.popsci.com/story/blog-network/eastern-arsenal/china-nuclear-conventional-missiles/
[47] Talmadge, "Would China Go Nuclear?" p. 83.
[48] Talmadge, p. 87.

computer systems. China will already be scurrying to perceive America's intentions in the murky twilight zone between an escalating crisis short of fighting and the firing of the first (kinetic) shots. For example, what if China assesses that US cyber pressure on its military C4I systems puts at risk some of its nuclear options as well as some of its conventional systems? In an extreme case, might China conclude that it stands to lose access to some of its nuclear options in a crisis before any actual and physically obvious fighting begins? Escalatory pressures might then be building more quickly than the American side realizes well before any (conventional) shots are fired.

Reducing Escalatory Hazards: Some Policy Priorities

An essay such as this is necessarily speculative, and it is easy to let those speculations run wild. But it seems sensible to believe that China and the United States will do what they can to live up to the view that nuclear weapons are only weapons of the very last resort, if they are to be used at all. Nuclear war in the Taiwan Strait is not impossible. But it probably means first climbing the levels from tense calm to escalating crisis and coercive pressure, and then to escalating conventional armed conflict, before the fateful last threshold is crossed. This means, for example, that if Taiwan, China, and the United States can stop the escalation at any one of those earlier stages, nuclear use is especially improbable. There are plenty of moments when the agency of decision-makers can intervene. We don't have to let panic set in about the inevitability of panic setting in. By the same token, escalation is not bound to stop through some sort of automatic process. Neither should we assume that China and the United States can fight a conventional war "safely" in the Taiwan Strait because the fear of nuclear escalation puts a natural limit on how awful things can get. More importantly, China and the United States can't assume this either!

A lack of clarity around many of these firebreaks is bad news for those who have confidence in the operation of the stability-instability paradox. We don't know enough about what dynamics will play out in a really serious Taiwan Strait crisis to be confident that central deterrence (whatever that means today) will make a local war a guaranteed non-nuclear affair. It would be unwise for decision-makers in Washington to assume that China's No First Use declaratory policy creates a safe zone in practice for America's behavior *below* the nuclear threshold. Beyond that threshold, there is also the fascinating but unsettling disconnect between China's lack of confidence that war can be controlled once any nuclear weapons are used and American thinking that still finds a place for limited nuclear options.[49] The latter makes little sense if the other side believes full escalation is almost inevitable.

But there is some good news for those who think that political agency can outweigh strategic hazards. What may seem like a relentless pathway across multiple thresholds can be halted in its tracks by decision-makers who get their calls right. Of course, the best way for Taiwan, the United States, and China to avoid a Taiwan Strait crisis escalating to nuclear use is to avoid a crisis in the Taiwan Strait. However, that is more a hope than a policy recommendation at a time when China-Taiwan political differences are intersecting with greater China-US competition. At the other end of the scale, it might seem an excellent idea to engage China in a discussion about reducing the dangers of inadvertent escalation that stem from the conventional-nuclear connections in its newest missiles. But would Beijing welcome such a conversation if the outcome risked making it easier for a strong adversary to attack the PLA's conventional missile forces without running the risk of engendering a nuclear response? Does China really want to remove this ambiguity in its entirety?[50]

In between these very broad geopolitical settings and concrete military-technological realities, there are some middle ground escalatory dangers that may be subject to moderation. In particular this means that the two nuclear-armed participants in any future Taiwan Strait dramas have common interests which they *ought* to be considering.

- China and the United States need an honest conversation about what incentives can be brought to bear which encourage serious dialogue, including on arms control, in which Beijing becomes a more willing and fulsome participant.
- China and the United States need to be involved in discussions on bilateral nuclear arms control (even if an expanded START process does not appeal to Beijing, and even if a formal agreement is not achieved). This is one way of keeping the two great powers aware that they have a joint responsibility to reduce the chances of a crisis between them developing a nuclear dimension.

[49] See Cunningham and Fravel.
[50] On the logic of this ambiguity, see Singer and Ma.

- Crisis stability—and the dangers of crisis instability—needs to be a recurring subject in a renewed process of US-China strategic dialogue and involve military, diplomatic, and political leaders.
- Both China and the United States need to recognize the risks of the murky zone between escalating pressure and actual fighting in a regional contingency. They should be aiming for formal or informal rules of the game on what differentiates unthreatening information seeking from activities that put their forces at risk, including through cyber operations and other measures short of physical conflict.
- China and the United States need to have tacit understandings about shared no-go areas in a Taiwan Strait crisis including assets that if attacked would be likely to generate disproportionate retaliation. These tacit understandings (through convergent unilateral restraint) will become even more important if formal dialogue remains stifled.
- Taiwan and the United States need to identify what factors intensify the chances that an early and dangerous resort to force (by Taiwan or China) will occur in a Taiwan Strait crisis, and what this means for their understanding of America's role. This is arguably more important than a focus on the level of America's security commitment to Taiwan.
- Taiwan, the United States, and China have a common interest in all three actors ensuring that they have redundant C4I systems that allow them to maintain control during an escalating crisis and conventional conflict, reducing pre-emptive pressures. They should all signal their reluctance to put these systems at risk in an escalating crisis.

To move forward on most, if not all, of these priorities, there is a deeper requirement. It is unwise to expect China and the United States to leave their competition to one side. But it is responsible to expect them to recognize that they do have common interests in spite of that competition, and that some basic level of cooperation is required *to allow their competition to continue*.[51] The United States and China do not need to see themselves as friends or close partners. But they might wish to think of themselves as adversarial partners, a concept used by Coral Bell in depicting the limits to competition in US-Soviet relations.[52] Because even if their competition leads them into a

[51] This is taken from an argument about the superpower nuclear competition in Stanley Hoffmann, *The State of War*: *Essays on the Theory and Practice of International Relations,* (New York: Praeger, 1965), p. 155.
[52] See Coral Bell, *The Conventions of Crisis: A Study in Diplomatic Management*, (Oxford University Press for the Royal Institute of International Affairs, London and New York, 1971).

fight over the Taiwan Strait, China and the United States will retain a common interest (shared with Taiwan) in controlling the escalation that could come next.

Moreover, if they can push back together on the continuing deterioration in their great power relationship, they might also reduce the prospects of an especially hazardous Taiwan Strait crisis developing in the first place. The problem is that this may rely on the reverse taking place. Do the two great powers need to find themselves in a very dangerous Taiwan Strait crisis before they both recognize the urgency of enhanced communication, cooperation, and restraint?

13. Asymmetric WMD Threats: DPRK Nuclear, Cyber, and Bio-Chemical Weapons Capabilities

Lee Sang-Hyun

Introduction

The Democratic People's Republic of Korea or DPRK (informally, North Korea) maintains the world's fourth largest armed forces, with nearly 1.3 million active personnel, accounting for about five percent of the total population. More than six hundred thousand others serve as reserve soldiers. The DPRK's military power poses a constant threat to the security of Northeast Asia as well as South Korea, Korea, officially the Republic of Korea (ROK).

The regime spent an average of $3.6 billion annually on the military between 2007 and 2017, according to the US State Department. Although Pyongyang is outspent by its neighbors and adversaries in dollar-to-dollar comparisons and defense experts say it operates with aging equipment and technology, the regime's forward-deployed military position and missiles aimed at Seoul ensure that Pyongyang's conventional capabilities remain a constant threat to its southern neighbor.[1] The DPRK is qualitatively inferior to the ROK but has superior conventional forces in number.

The DPRK maintains a readiness posture capable of carrying out a surprise attack at any given time by positioning seventy percent of its ground force south of the Pyongyang-Wonsan line. The forward-deployed 170mm self-propelled guns and 240mm Multiple Rocket Launchers (MRLs), for instance, provide the DPRK with the capability for a large-scale and concentrated surprise fire targeted at the Greater Seoul Metropolitan Area.

[1] Eleanor Albert, "North Korea's Military Capabilities," Council on Foreign Relations, Backgrounder, updated November 16, 2020, https://www.cfr.org/backgrounder/north-koreas-military-capabilities

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More serious than conventional military force are various asymmetric threats posed by the DPRK. In general, asymmetric threats refer to the use of unexpected means and methods to neutralize the opponent's strengths and exploit weaknesses to prevent the other party from retaliating. DPRK's asymmetric threats consist of its active and increasingly-sophisticated nuclear weapons, ballistic missiles, bio-chemical weapons, and cyberattacks.

Since the succession of power in 2011, the DPRK has maintained the stability of the regime through reorganization and reshuffling of the whole state system. The regime is seeking a strategic change by adopting a new strategic line in 2018 by focusing all efforts on building a socialist economy, replacing the 2013 '*byungjin*' policy of simultaneously developing its economy and nuclear weapons.

The DPRK unilaterally withdrew from the Treaty on the Non-Proliferation of Nuclear Weapons in January 2003, is not a party to the Comprehensive Nuclear-Test-Ban Treaty, and has conducted six increasingly sophisticated nuclear tests since 2006. The DPRK is not a party to the Chemical Weapons Convention, and is believed to possess a large chemical weapons program. Despite being a state party to the Biological and Toxin Weapons Convention and the Geneva Protocol, evidence suggests the DPRK may maintain an offensive biological weapons program.[2]

The ROK maintains conventional forces that are qualitatively superior to those of the DPRK, but it cannot avoid relative inferiority in relation to the DPRK's asymmetric force advantages. In particular, it relies entirely on the U.S. nuclear umbrella for nuclear weapons, and Seoul, a densely populated area, is close to the border, making it vulnerable to DPRK's asymmetric threats.

DPRK's Asymmetric WMD Capabilities

1. Nuclear and Missile Threats

The DPRK declared 'completion of nuclear weapons program' in November 2017, and no nuclear development trend was detected during the reconciliation between the United States and the ROK

[2] Nuclear Threat Initiative, https://www.nti.org/learn/countries/north-korea/

from the following year. But it is pushing to upgrade its nuclear and missile capabilities again after the Hanoi talks broke down.

The DPRK has nuclear fuel manufacturing and enrichment facilities, nuclear fuel cycle facilities, nuclear reactors such as 5MWe graphite moderated reactors, and nuclear fuel cycle facilities such as a radiochemical laboratory (reprocessing facility) at Yongbyon Nuclear Science Research Center. It conducted a nuclear test at its nuclear test site in Punggye-ri by manufacturing nuclear weapons from plutonium produced at its Yongbyon nuclear facility. In addition to the disclosed Yongbyon nuclear complex and the Punggye-ri nuclear test site, the DPRK is also believed to have a number of unidentified nuclear facilities.

Nuclear weapons development is usually carried out in four stages: acquiring nuclear materials, manufacturing nuclear explosive devices, nuclear tests, and miniaturization of the warheads. First, the DPRK should secure enough fissionable material to produce nuclear weapons. To acquire nuclear fissile materials such as plutonium (Pu) and highly enriched uranium (HEU), plutonium production technology, reprocessing technology, and uranium enrichment technology are required. Second, manufacturing nuclear explosive devices is a step to assemble nuclear materials and detonators, and it is possible to declare nuclear possession at this stage without the need for reliability verification through nuclear tests. The DPRK officially declared its possession of nuclear weapons in February 2005 after the Geneva Agreed Framework was scrapped. Third, nuclear tests are necessary to verify the operation of nuclear explosive devices, improve their performance, such as nuclear fission conditions, and increase their power. To that end, the DPRK conducted six nuclear tests. The fourth stage is to miniaturize and lighten nuclear warheads (diameter less than 90cm, weight less than 1 ton) and secure the reliability of the means of delivery. Currently, it is believed to be at the fourth stage of its nuclear weapons development program. The DPRK regime claimed that it achieved standardization, miniaturization, and lightweight of nuclear warheads after its sixth nuclear test.

Experts estimate that the DPRK is believed to have twenty to sixty nuclear weapons and has recently come close to having ballistic missile capabilities capable of carrying nuclear warheads and striking the US mainland. The exact number of nuclear warheads held by the DPRK varies depending on the evaluation agency and experts, and about twelve additional nuclear warheads are expected to be produced annually. This is based on the production of a nuclear warhead (Pu 8 kg, HEU 20 kg) with an explosive yield of about 20 Kt, and depending on the analyst's choice of desired nuclear weapons explosive power attributed to the DPRK and the type and design of warhead, a realistic estimate of the DPRK's capacity and quantity of the warheads varies, depending on these assumptions.

To enhance its strategic attack capabilities, the DPRK has continuously developed nuclear weapons. It first gained access to nuclear materials in the 1980s after operating the 5MWe reactor located in the Yongbyon Nuclear Complex by reprocessing spent fuel rods. It is estimated to possess around 50kg of weapon-grade plutonium obtained from several rounds of reprocessing spent fuel rods. The DPRK is also believed to possess a substantial amount of highly enriched uranium (HEU), and its ability to miniaturize nuclear weapons seems to have reached a considerable level. The amount of enriched uranium that can be produced at the Yongbyon nuclear facility in 2010 is about two tons per year for 3.5 percent low-enriched uranium, and 40 kilograms per year for weapons-grade, highly enriched uranium, which can be used to fabricate two small nuclear weapons. However, assuming that the DPRK is hiding additional uranium enrichment facilities, the production capacity of highly enriched uranium increases further. As of the end of 2018, a reasonable estimate of the maximum North Korean HEU production capacity and inventory amounts to 200 kilograms and 980 kilograms per year, respectively.[3]

Table 1: DPRK's Nuclear Tests.

Sequence	Date	Location	Est. Yield
1	9 October 2006	Punggye-ri Test Site	0.7 - 2 kt
2	25 May 2009	Punggye-ri Test Site	2 - 5.4 kt
3	12 February 2013	Punggye-ri Test Site	6 - 16 kt
4	6 January 2016	Punggye-ri Test Site	7 - 16.5 kt
5	9 September 2016	Punggye-ri Test Site	15 - 25 kt
6	3 September 2017	Punggye-ri Test Site	70 - 280 kt

[3] Korea Institute of Nuclear Nonproliferation and Control (KINAC), *North Korean Nuclear Almanac 2020* (in Korean, 2020), pp. 39-41.

The DPRK's progression from the nuclear threshold to a heavily armed nuclear state with intercontinental reach is doing serious damage to the foundations of strategic stability in Northeast Asia by eroding confidence in the ability and will of the United States to fulfill its security guarantees to the ROK and Japan. While working for denuclearization, the United States, ROK, and Japan have also been working to adapt and strengthen deterrence so as to stay ahead of the emerging threat. The US nuclear umbrella, which was designed in very different security environments in 1991 and 2010, is increasingly outdated for the purpose of deterring the DPRK's nuclear threats. Hence, it must be modified to enable improved signaling of collective resolve to stand up to the DPRK's nuclear bullying. Some experts suggest that we should move toward a more NATO-like posture which is based on 'nuclear sharing' in Northeast Asia. At the same time, it is important to maintain an appropriate mix of nuclear and non-nuclear capabilities for deterrence, including missile defense.[4]

The DPRK has been focusing on strengthening its ballistic missile capabilities since it announced the completion of its nuclear weapons construction. After beginning the ballistic missile developments in the 1970s, it produced and fielded the Scud-B and Scud-C missiles with ranges of 300km and 500km, respectively, in the mid-1980s. In the late 1990s, it fielded the Rodong missile with a range of 1,300km and, later, the Scud-ER, which are Scud missiles with an extended range. In 2007, the DPRK fielded the Musudan missile with a minimum range of 3,000km without a test launch. Through these successive additions to its missile inventory, the DPRK has gained direct strike capabilities against the ROK and the surrounding countries of the Korean Peninsula.[5]

[4] Brad Roberts, "Living with a Nuclear-Arming North Korea: Deterrence Decisions in a Deteriorating Threat Environment," Stimson Center, 38 North Special Report, November 2020, pp. 14-15.
[5] Ministry of National Defense, Republic of Korea, *2018 Defense White Paper* (2018), pp. 32-33.

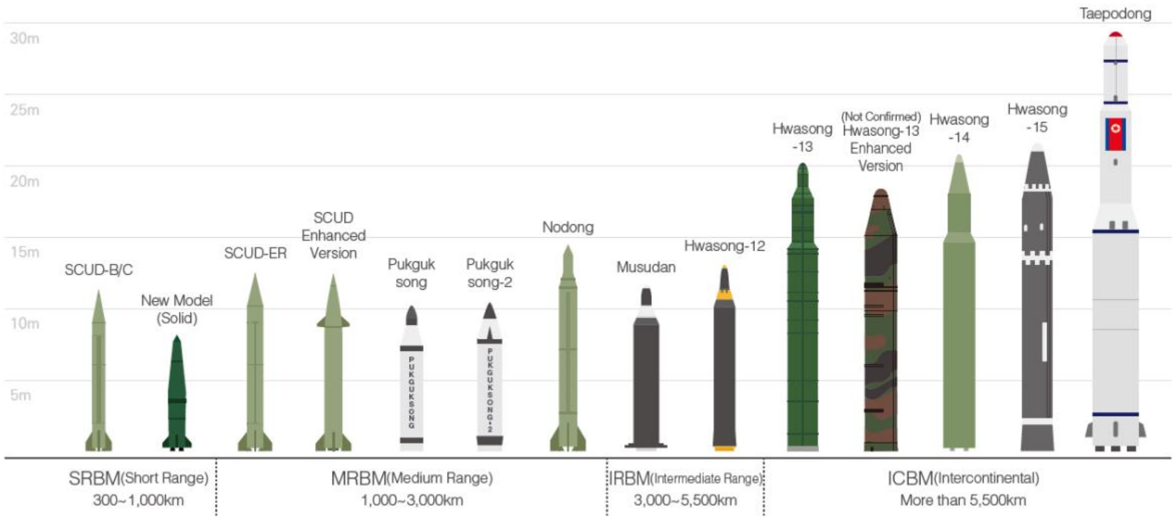

Figure 1: DPRK's Missiles in Inventory or Under Development.[6]

The DPRK's nuclear and missile capabilities are rapidly growing. The regime seems to be risking its national survival on nuclear and missile development, especially after the succession of power to Kim Jong-un.

Since the collapse of the Hanoi summit, the DPRK has intensively tested short-range missiles with a range of less than 1,000 kilometers on a total of sixteen occasions from May 2019 to August 2020. The KN-23 has a pull-up function that makes it move up again in the final stage of the flight, which is considered similar to the Russian Iskander missile, and is estimated to have a range of up to 600 kilometers. The KN-24, called the North Korean version of ATCAMS, can fire continuously and hit the entire Korean Peninsula with a range of up to 400 kilometers. KN-25 and KN-09, although the DPRK called them multiple rocket launchers, are considered to be short-range missiles in the sense that it is equipped with guided technology and shows ballistic missile flight trajectories. Unlike conventional Scuds and Rodong missiles, the KN-23 and KN-24 used solid fuel to enhance surprise attack capabilities and significantly improve the accuracy of target strikes. The liquid-fueled Scud and Rodong missiles are likely to be exposed by US intelligence assets before the launch, but KN-23 and KN-24 can be launched immediately, significantly improving their survivability and surprise launch capabilities. The DPRK's new guided weapons are also considered more difficult to intercept through the ROK-US missile defense system.

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[6] Ministry of National Defense, Republic of Korea, *2018 Defense White Paper* (2018), p. 34.

Although it is not yet certain whether these new short-range missiles can deliver nuclear warheads, experts say that it may be possible enough. Jeffrey Lewis, a US missile expert, evaluates that the KN-23 can be equipped with nuclear warheads. Another expert, Michael Elleman, estimates that the KN-24 is 700 to 850 mm in diameter and is capable of mounting a 60-centimeter diameter nuclear warhead.[7]

The DPRK's rapid progress on intercontinental ballistic missile (ICBM) and submarine-launched ballistic missile (SLBM) capabilities is also alarming. It unveiled new missile capabilities during its military parade on October 10, 2020, marking the 75th anniversary of the founding of the Korean Workers Party. In particular, the two newly introduced strategic weapons attracted the attention of experts. One is the 'Hwasong-16' ICBM and the other is the 'Pukguksong-4' SLBM. Hwasong-16, appears to be approximately 25-26 m long and 2.5-2.9 m in diameter—about 4-4.5 m longer and about 0.5 m larger in diameter than the DPRK's Hwasong-15 ICBM flight tested once in November 2017. Indeed, the new missile has been correctly characterized as the world's largest mobile ICBM—in part because countries with ICBMs generally seek to make their road-mobile ICBMs smaller so they can be more mobile and concealable. It is estimated that the new missile's launch weight at roughly 100,000-150,000 kg, compared to some 80,000 kg for the Chinese DF-41 solid-propellant, road-mobile ICBM and about 104,000 kg for the former Soviet SS-24 rail-mobile solid ICBM.[8]

The DPRK, which began developing SLBM in earnest in 2014, successfully test-fired the Pukguksong-1 and 3. It unveiled Pukguksong-4 at the military parade in October 2020 and introduced Pukguksong-5 at the military parade in January 2021. Although the Pukguksong-4 and 5 have not yet been tested, it is estimated that they will be deployed on a mid-sized submarine or a nuclear-powered submarine planned for the future. The DPRK's mid-sized submarines, which

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[7] Jeffrey Lewis, "Preliminary Analysis: KN-23 SRBM," June 5, 2019, James Martin Center for Nonproliferation Studies, https://nonproliferation.org/preliminary-analysis-kn-23-srbm/ ; Michael Elleman, "Preliminary Assessment of the KN-24 Missile Launches," 38 North, March 25, 2020, https://www.38north.org/2020/03/melleman032520/

[8] Vann H. Van Diepen and Michael Elleman, "North Korea Unveils Two New Strategic Missiles in October 10 Parade," 38 North, October 10, 2020, https://www.38north.org/2020/10/vdiepenmelleman101020/

were unveiled in July 2019, are expected to be able to carry at least 3-4 SLBMs, given the volume of drainage and the shape of the bridge's renovation.[9]

Although this is a new progress in the DPRK's overall capabilities, some analysts say that these SLBM missiles could provide only a marginal addition to the threat posed by the DPRK's much larger, increasingly longer range and much more survivable land-based ballistic missile force. When The DPRK revealed a new type of conventionally powered ballistic missile submarine (SSB), many media sources termed this a 'game changer' and their reaction verged on a hysterical atmosphere of fear. But, in fact, the DPRK's construction of a new-type SSB is far from new. We do not know either whether the DPRK will build SSB force of at least several boats, which would be required for a true second-strike capability. The new SSB appears to be based on the 1950s-vintage Soviet ROMEO-class diesel-electric submarine which are very noisy boats that are thus highly susceptible to acoustic detection while having only a limited ability to know that they are being tracked by enemy submarines. The new-type SSB almost certainly is substantially less survivable than the DPRK's land-mobile ballistic missile force, and it would be even more vulnerable if it were to be forward-deployed against the US West Coast or Hawaii. In this sense, the DPRK's new SSB is not an "existential threat" nor a "most menacing weapons" Kim Jong-un has that can get pretty close to the continental United States.[10]

The last hurdle that the DPRK has to overcome is to complete an ICBM that can strike the US mainland using atmospheric reentry vehicle technology. Advanced technologies such as ultra-precision flight posture control and composite materials are required to withstand the high heat (more than 7,000 degrees) and pressure caused by the warhead falling at a speed of more than Mach 20. In March 2016, the DPRK revealed the status of a test for a reentry vehicle, but from what is known by observers, it seems that they have not yet completed the technology. Another technology the DPRK is trying to strengthen its ICBM capability is multiple independently-targetable reentry vehicles (MIRVs). When the DPRK revealed Hwasong-16 during its October 10 military parade, many experts speculated that this missile, which is considerably larger than the

[9] Michael Elleman, "North Korea's Newest Submarine-Launched Ballistic Missiles, Same as the Old One?" 38 North, January 15, 2021, https://www.38north.org/2021/01/north-koreas-newest-submarine-launched-ballistic-missile-same-as-the-old-one/

[10] Vann H. Van Diepen, "Cutting Through the Hype About the North Korean Ballistic Missile Submarine Threat," 38 North, September 6, 2019, https://www.38north.org/2019/09/vvandiepen090619/

Hwasong-15, may be designed to carry multiple warheads and decoys to ensure the penetrability of America's missile defenses. Hwasong-16 will need to undergo flight trials conducted over a couple of years to validate its performance and reliability. Nevertheless, there is circumstantial evidence that the DPRK is developing MIRV technology. For example, it is likely that Hwasong-12, given the fact that it separated in three pieces as it entered the atmosphere in August 2017, was a post-boost vehicle (PBV) engine test, an important part of MIRV development.

Table 2. DPRK's Major Missile Inventory[11]

Category	Name	Range	Remarks
IRMBs, ICBMs	Musudan	3,000+ km~	Operational since 2016
	Hwasong-12	5,000+ km~	Test launch, May 2017
	Hwasong-14	10,000+ km~	Test launch, July 2017
	Hwasong-15	13,000 km	Test launch, Nov. 2017
	Hwasong-16	13,000+ km~	Revealed, Oct. 2020 parade
SLBMs, Submarines	Pukguksong-1	1,000km	Test launch, August 2016
	Pukguksong-3	2,000km	Test launch on a barge, Oct. 2019
	Pukguksong-4	2,000km	Revealed, Oct. 2020 parade
	Pukguksong-5	3,000km	Revealed, Jan. 2021 parade
	Sinpo class submarine, also called the *Gorae* (whale)	1,800ton displacement	Loaded with 1 SLBM, operational
	Mid-size submarine	3,000ton displacement	Loaded with 3-4 SLBMs, Shaft assembly complete
	Nuclear submarine	5,000+ ton displacement	SLBM capacity unknown, design phase
New Tactical (short-range) missiles	KN-23	600km	Test launch, May 2019, *aka* North Korean *Iskander*
	KN-24	400km	Test launch, Aug. 2019, *aka* North Korean *ATCAMS*
	KN-25	400km	Operational since July 2019, 'Super-large' multiple launch rocket system
	KN-09	250km	Continuously upgrading, first revealed in Oct. 2015, 300mm rocket artillery system

[11] Rearranged from Jungsup Kim, "North Korea's Tactical and Strategic Weapons Development: Recent Trends, Evolution of Doctrines, and Their Implications," Sejong Institute, *Sejong Policy Brief* (in Korean), March 23, 2021; other related information was collected from various sources by the author.

So, what will be the future expectations? It is highly likely that the DPRK will no longer pursue underground nuclear tests after six nuclear tests. It has not been confirmed whether there are more underground nuclear test sites other than Punggye-ri. But arguably the DPRK's 200kT nuclear test already reached and perhaps exceeded the limit on the size of a nuclear test underground, however, the possibility of an atmospheric nuclear test on land or at sea cannot be ruled out. While the first five nuclear tests were relatively small, the sixth one was more powerful than all the previous ones combined. Given these circumstances, it would be reasonable to say that the DPRK's nuclear development is now nearing completion.[12]

2. Cyber Threats

The DPRK's continuing economic difficulties have caused not only a lack of conventional war capability, but also a lax military discipline. It is difficult to maintain offensive conventional military capabilities against the ROK's superior armed forces. To overcome these difficulties, the DPRK has focused on developing North Korean-style strategies, tactics, and weapons systems, and among them, its cyber capabilities are potentially as potent as its nuclear and missile capabilities.

The DPRK has expanded its cyber capabilities, as manifested by the intensification of state-sponsored attacks from the DPRK or its agents that the world has witnessed in the last decade. Amongst the most blatant offensive cyber-attacks allegedly linked to North Korean-originated hacker groups are the Sony Pictures attack, the WannaCry attack, and the DarkSeoul attack, although the DPRK consistently denies any involvement with these attacks, or the damage suffered by them. The DPRK's cyber army consists of approximately 7,000 hackers, performing a wide range of activities including theft, denial of service (DDoS), espionage and sabotage.

In fact, the DPRK's cyber capabilities, including hacking, are considered world-class. Kim Jong-un had earlier stressed that "cyber warfare, along with nuclear weapons and missiles, is an all-round sword that guarantees the merciless striking capability of the Korean People's Army." This

[12] Korea Institute of Nuclear Nonproliferation and Control (KINAC), *North Korean Nuclear Almanac 2020* (in Korean, 2020), pp. 19-20.

was revealed during the National Assembly intelligence committee audit hearing by National Intelligence Service chief Nam Jae-joon.[13]

The DPRK's illegal cyber activities pose a serious security threat not only to the ROK but also to the international community. The DPRK does not hesitate to launch cyberattacks to secure cash as its long-standing sanctions have deepened its international isolation.

While the DPRK's illegal cyber activities in the past focused mainly on the theft of sensitive information, the DPRK's behavior has recently changed to cyber-financial theft. To this end, the DPRK has constructed cyberattack capabilities in more diverse and creative ways to generate revenues for regime survival, in addition to military and strategic purposes. Two main shifts in Pyongyang's cyber operations are observed: first, an increase in cyber-attacks aimed at financial gain; and second, a decrease in the visibility of cyber operations at espionage and information gathering.[14] The DPRK is very interested in cyber foreign currency earnings through hacking. It is difficult for the ROK to even calculate the amount of damage it suffered from the DPRK's cyberattacks.

After the hacking of Sony Pictures in November 2014, the DPRK's cyberattacks have expanded into political, military, and strategic targets, as well as seeking financial gains at the same time. The 2016 hacking cost Bangladesh Bank 81 million dollars and Chile National Bank 10 million dollars in 2019. The group that attacked the banks was identified as a hacker group called the Lazarus Group in the DPRK. Cyber security firm FireEye referred to Lazarus as 'Advanced Persistent Threats (APT)-38' and confirmed Lazarus was linked to the DPRK government or government-backed military units. Lazarus recently led the hacking of cryptocurrency, which resulted in losses of more than $500 million. It is suspected that in 2017 and 2018, it hacked mainly Korean bitcoin exchanges (Bithumb, Coinness, Youbit, and Yapizon) and attacked Japan's exchange stations, CoinCheck.[15]

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[13] *Joongang Daily*, November 5, 2013, https://news.joins.com/article/13048072

[14] Chong Woo Kim and Carolina Polito, "The Evolution of North Korean Cyber Threats," The Asan Institute for Policy Studies, Issue Brief, February 2019, p. 2.

[15] Sang-ho Lee, "North Korea's Cyberattack Capabilities and Cyber Fundraising," *Monthly North Korea* (월간북한), 2020.

A US internet security company Recorded Future analyzed in February 2020 that in the DPRK, where public internet access is prohibited, internet usage has increased by about 300 percent over the past three years. The report analyzed that the DPRK is making all-out efforts to mine, steal, and produce cryptocurrency such as Bitcoin, Lightcoin, and Moreno. In particular, the DPRK is believed to have mined more than ten times compared to the previous year by concentrating on Moreno. Moreno is known to be more anonymous than Bitcoin, and is easier to mine than Bitcoin, which is almost impossible to mine new.[16]

The DPRK reacts violently whenever reports of hacking and stealing of the DPRK's cryptocurrency are reported. Despite the DPRK's strong denials, it is almost certain that it uses the stolen cryptocurrency as a means of avoiding sanctions. It is clear that the DPRK, which has narrow channels of earning foreign currency due to sanctions, will strengthen its activities to earn foreign currency through hacking attacks on financial institutions around the world or taking away cryptocurrency. It is always possible however improbable that the DPRK will actually use nuclear weapons or short or intermediate range missiles against the ROK. But its cyber operations are far more effective and profitable. The DPRK is training a number of excellent hackers at very low cost who are able to exploit the huge and porous attack surfaces presented by its leading adversaries with their open societies and poor cyber-security practices. The DPRK's cyberattack capabilities present a far more realistic and immediate threat than its strategic asymmetric weapons such as nuclear and missile programs, with their massive research, development and deployment costs, or its conventional military, which requires enormous resources simply to maintain. In short, cyber forces are actually the DPRK's all-around, most effective asymmetric arsenal.

It is true that North Korean hackers can't do more direct damage than a nuclear weapon. However, the DPRK can unleash its hackers, even in peacetime, while keeping its nuclear-tipped arsenal in wait. It is also true that the DPRK isn't the only country that uses cyberattack capabilities for its national interest. In comparison with other US adversaries like Iran, Russia, and China, the DPRK's propensity to use its hackers for crime—robbing banks and emptying cryptocurrency wallets, according to US Department of Justice—is outstanding. For example, Iran used cyber capabilities to take aim at Saudi Arabia's oil production, and Russia has used cyber capabilities to unsettle states in its orbit, especially Georgia and Baltic states. Analysts indicate that Russia and

[16] Ibid.

Iran will do some disruptive cyber-attacks but less cyber-crime. China's cyber-warriors also overlap with cyber-criminal groups but have not done as much in the way of cyber disruption. The DPRK, in contrast, doesn't seem to respect those boundaries. It launched several disruptive attacks against the ROK, including a huge theft of military secrets of ROK's armed forces. The DPRK is also believed to be involved in the WannaCry ransomware attack, which infected tens of thousands of computers and sent several UK hospitals offline in 2017. Pyongyang's willingness to mix crime with state-directed cyberthreats makes it almost uniquely problematic.[17]

In response to increasing the DPRK's cybercrimes, US Department of Justice charged three North Korean individuals for stealing and extorting more than $1.3 billion in cash and cryptocurrency from banks and business around the world. According to the indictment filed in December 8, 2020, three defendants—Jon Chang Hyok, Kim Il, And Park Jin Hyok—work for the Reconnaissance General Bureau, the DPRK's military intelligence agency. The agency houses hacking units known by various names, including Lazarus Group and Advanced Persistent Threat 38 (APT38). The DPRK has previously denied being involved in hacking operations. The indictment builds upon 2018 charges brought against one of the alleged hackers in connection with the 2014 cyberattacks on Sony Pictures Entertainment. Three North Koreans, operating under several pseudonyms, were charged for conspiracy to commit wire fraud and bank fraud including destructive cyberattacks on entertainment companies, bank cyber-enabled heists, cryptocurrency heists, and ATM cash-outs. The indictment shows the degree to which the DPRK relies on cybertheft to obtain hard currency under the continuing United Nations and US sanctions, further isolated by a self-imposed coronavirus blockade. According to prosecutors, the hackers managed to steal at least $190 million, although nobody knows exactly how much was stolen. Prosecutors said the North Koreans were unable to get at least $1 billion of the $1.3 billion they targeted, mostly in banks.[18]

As the coronavirus situation worsens around the world, the DPRK is even attempting to hack into coronavirus information. It attempted to steal Covid-19 vaccine technology from the US

[17] Morten Soendergaard Larsen, "While North Korean Missiles Sit in Storage, Their Hackers Go Rampant," *Foreign Policy*, March 15, 2021, https://foreignpolicy.com/2021/03/15/north-korea-missiles-cyberattack-hacker-armies-crime/

[18] Ellen Nakashima, "U.S. accuses three North Koreans of conspiring to steal more than $1.3 billion in cash and cryptocurrency," *The Washington Post*, February 18, 2021.

pharmaceutical company Pfizer, according to South Korean intelligence officials. It is currently unclear what, if any, data was stolen. The ROK's National Intelligence Service reportedly briefed lawmakers about the alleged attack. According to the NIS briefing, the DPRK attempted to hack the servers of an ROK drug manufacturer to obtain technology information on the company's coronavirus vaccine and treatment.[19] In November 2020, Microsoft said at least nine health organizations including Pfizer had been targeted by state-backed organizations in the DPRK and Russia. It said North Korean groups dubbed Zinc and Cerium, and a Russian group nicknamed Fancy Bear, were responsible. While many of the break-in attempts failed, Microsoft warned at the time that some had been successful.[20] The DPRK closed its borders in January 2020 soon after the virus began to emerge in China; since then it has yet to report a single case of coronavirus.[21] But many public health specialists believe the DPRK is highly vulnerable to the pandemic and that it is desperately seeking zero cost ways to obtain vaccines so that it may resume domestic economic activity.

There is much evidence that the DPRK is engaged in various illegal activities in cyberspace. As long as the coronavirus pandemic continues and the DPRK's economic difficulties continue, the cyberattacks will also continue.

3. Biological and Chemical Threats

The ROK government maintains the DPRK began producing chemical weapons in the 1980s and currently holds a stockpile of an estimated 2,500–5,000T of chemical weapons. The ROK Ministry of Defense asserts that the DPRK is capable of cultivating and producing various types of biological agents, such as anthrax, smallpox, and pests.[22] In fact, not much is known about the DPRK's biological and chemical weapons programs. There have been no reports of transactions or proliferation of biological and chemical weapons involving the DPRK in recent years.

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[19] "N. Korea attempted to steal COVID-19 vaccine, treatment technology via hacking: NIS," *Yonhap News Agency*, February 16, 2021, https://en.yna.co.kr/view/AEN20210216008451315

[20] "North Korea accused of hacking Pfizer for Covid-19 vaccine data," *BBC*, February 16, 2021, https://www.bbc.com/news/technology-56084575

[21] "North Korea again claims zero COVID-19 cases after testing roughly 24,500 people," *NK News,* December 4, 2021, https://www.nknews.org/2021/04/north-korea-again-claims-zero-covid-19-cases-after-testing-roughly-24500-people/

[22] Ministry of National Defense, Republic of Korea, *2018 Defense White Paper* (2018), p. 34.

One strong reason to believe that the DPRK may still maintain a chemical weapons program is the assassination of Kim Jong-nam, the eldest son of deceased North Korean leader Kim Jong-il and the half-brother of Kim Jong-un. Kim Jong-nam was killed on 13 February 2017 when he was attacked with VX nerve agent at Kuala Lumpur International Airport, Malaysia. Four North Korean suspects left the airport shortly after the assassination and reached Pyongyang without being arrested. Other North Koreans were arrested but were released without charge. Two women, one Vietnamese, the other Indonesian, were charged with murder. They claimed they thought it was part of a TV show program. DPRK was relisted as a state sponsor of terrorism by the United States on 20 November 2017, with the assassination cited as one of the reasons.

As for the DPRK's biological weapons program, known information is even more limited. Many of the terms used by the US government in discussing the possibility that the DPRK and other countries are developing or possessing biological weapons are highly ambiguous. Also, there is a high degree of uncertainty about what the purported North Korean biological weapons program actually entails. There is a lack of consistency in the public assessments of the US and South Korean governments or between the assessments and the policy responses of those governments.

In the final analysis, the DPRK may once have had and may still be pursuing a biological weapons capability. It is also possible that it never moved beyond research and development of biological agents and the establishment of a biotechnical infrastructure that could support future biological weapons production. It is also possible that the DPRK program never moved beyond planning or, whatever its previous nature, the program has essentially ended. But one thing seems clear – nothing in the official public record to date indicates that the DPRK has an advanced biological weapons program, notwithstanding media reports to the contrary.[23]

Although there is a lack of recent evidence regarding the DPRK's biological and chemical weapons, we cannot rule out the possibility that it might use them in the worst-case scenario. In particular, the ROK's greatest threat is the attack from DPRK long-range artillery deployed along the DMZ with biological and chemical agent payloads. In fact, this case is more threatening than

[23] Elisa D. Harris, "North Korea and Biological Weapons: Assessing the Evidence," 38 North Special Report, November 2020, pp. 5-6.

nuclear weapons or ballistic missiles. ROK plans to use artillery radar to identify and destroy the source of the threat if the DPRK fires a long-range artillery, but there are fundamental limitations.

DPRK's Asymmetric Threats: Real or Contrived?

The DPRK claims that it has developed nuclear weapons because of the US hostile policy toward the DPRK and will continue to strengthen its nuclear deterrent capability to prevent the United States from invading the DPRK. In traditional nuclear deterrence theory, deterrence usually refers to the practice of discouraging or restraining other states from taking unwanted actions, such as an armed attack. It involves an effort to stop or prevent an action, as opposed to the closely related but distinct concept of 'compellence,' which is an effort to force an actor to do something—including stopping something that they are already doing.

The classic literature distinguishes between two fundamental approaches to deterrence. Deterrence by denial strategies seek to deter an action by making it infeasible or unlikely to succeed, thus denying a potential aggressor confidence in attaining its objectives—deploying sufficient local military forces to defeat an invasion, for example. Deterrence by punishment, on the other hand, threatens severe penalties, such as nuclear escalation or severe economic sanctions, if an attack occurs. These penalties are connected to the local fight and the wider world. The focus of deterrence by punishment is not the direct defense of the contested commitment but rather threats of wider punishment that would raise the cost of an attack.[24] This concept of deterrence can be applied mainly to strategic relations between powerful countries, but it is difficult to apply it to nuclear strategies of weak countries such as the DPRK. For this reason, various analyses have been made on the DPRK's intentions and postures related to its nuclear weapons.

Assessing the DPRK's nuclear threats, there are two kinds of threats posed by its nuclear weapons. One is the intended threat posed by the offensive nuclear doctrine, and the other is an unintended threat, such as a sudden collapse of the DPRK regime or preemptive use of nuclear weapons by misjudgment.

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[24] Michael Mazarr, "Understanding Deterrence," *RAND Corporation,* 2018 https://www.rand.org/content/dam/rand/pubs/perspectives/PE200/PE295/RAND_PE295.pdf, pp. 2-3.

According to Vipin Narang, an expert on nuclear strategy, new nuclear weapons states are generally likely to choose one of three types of nuclear strategies. The first is the strategy of using nuclear weapons for 'catalytic' purposes. This is when a new nuclear power uses nuclear weapons to bring its existing benefactor closer to its side. A state which adopts this posture has a small number of nuclear weapons but uses them to get a superpower—usually the United States—to intervene on its behalf. In this sense, the weapons are the catalyst that forces the stronger states to smooth over regional conflicts. It's a political strategy that's designed to strengthen the reliability of a superpower patron in a conflict to help the state and is only available to the regional powers.

The second is the 'asymmetric escalation' strategy. It refers to the use of nuclear weapons preemptively to force an end to a crisis or conflict or to gain political advantage. In this posture, a state deploys a nuclear arsenal to present a credible threat of a first nuclear strike, in response to a conventional, non-nuclear attack. This is explicitly designed to deter conventional conflict. Countries with this posture tend to delegate authority for a strike to certain military leaders—which may present problems for the rest of the world, since the procedures for using nuclear weapons may not involve many safeguards. The challenge is really command and control, safely managing its nuclear arsenal.

The third is the 'assured retaliation' strategy. It is a case in which a nuclear weapon is operated with the aim of avoiding a pre-emptive nuclear strike and ensuring a second nuclear strike with a surviving nuclear weapon. This posture exists when a state develops a sufficiently large and dispersed arsenal to be able to retaliate if it is the victim of a nuclear attack. This is the classic nuclear strategy where the state is developing nuclear weapons basically to assure the existence of the state. This strategy is exemplified by China and India. Having a secure second-strike capability is designed to deter nuclear use and coercion. The strategic drawback to this posture is that it sacrifices some deterrent power against conventional conflict. Enemies may assume that limited conventional battles are very unlikely to escalate and involve nuclear arms.[25]

There are mixed analyses on the DPRK's nuclear posture. The country is likely to threaten the use of nuclear weapons for catalytic purposes to induce China to intervene in the event of a serious

[25] Vipin Narang, Nuclear Strategy in the Modern Era: Regional Powers and International Conflict (Princeton: Princeton University Press, 2014).

regime threat from outside. The DPRK's nuclear strategy, however, is believed to be evolving toward securing a viable second-strike capability.

It is believed that the DPRK is struggling to develop SLBMs also to secure the ability for a survivable second-strike capability. It has conducted several rounds of cold-launching test of an SLBM. Whether successful or not, these efforts mean that the DPRK is trying to diversify its missile capabilities, threaten Japan beyond the ROK, protect missiles from the US first-strike attacks, and expand the foundation for retaliatory attacks on the ROK and Japan.

Given the power and number of warheads that the DPRK is developing, it is unlikely to opt for a strategy to concentrate all of its nuclear forces in the early stages of the war. It will pursue a strategy to strengthen its nuclear capability enough to withstand retaliation by the ROK-US combined forces after a limited surprise attack, thereby taking the initiative in the process of developing the situation and ending the situation in an advantageous position. Its most logical strategy is to end escalation by using nuclear threats after it caused considerable damage to the ROK with a surprise conventional attack and before the situation goes to next stage of escalation.[26]

Whatever the DPRK's intention is to use nuclear weapons, the DPRK's nuclear weapons pose a serious security threat not only to the ROK but also to all states in Northeast Asia. The ROK has no means of responding to the DPRK's nuclear weapons except for relying on the US nuclear umbrella. There is little possibility of developing nuclear weapons independently, at least in the foreseeable future. In this sense, the DPRK's nuclear program is an existential risk to ROK's security.

On the DPRK's threat perception, the United States shares a similar view. According to a report published by US Congress, House Armed Services Committee, the DPRK continues its unabated march toward full nuclearization under the leadership of Kim Jong-un. In July 2017, the DPRK successfully launched its first intercontinental ballistic missile, which is likely capable of striking the United States. Since then, it has continued to build and test increasingly sophisticated nuclear weapons and missiles, even as it suffers heavy sanctions by the international community. Of further concern, especially to US security partners ROK and Japan, is the DPRK's significant

[26] Kang Choi, "North Korea's Nuclear Threats: Challenges and Responses," Asan Institute for Policy Studies, Asan Report, September 2016, pp. 79-84.

production and stockpile of biological and chemical weapons. It also maintains an exceptionally large conventional military force, a significant threat to regional allies and US forces in the Pacific.[27]

On October 10, 2020, the DPRK celebrated the 75th anniversary of the founding of the Workers' Party of Korea (WPK), the country's ruling party. The occasion was celebrated in a grand way, with an unprecedented pre-dawn military parade. Thousands of uniformed military personnel marched through Pyongyang's renovated Kim Il-sung Square in perfect unison, trailed by scores of heavy military vehicles. Kim said that his nuclear weapons "will never be abused or used as a means for preemptive strike. He clarified, however, that if "any forces infringe upon the security of our state and attempt to have recourse to military force against us, I will enlist all our most powerful offensive strength in advance to punish them." This was a restatement of the DPRK's offensively oriented nuclear strategy, which reserves the right for nuclear first use to deter adverse military action against its territory or leadership.[28]

Regarding denuclearization talks, the DPRK's position is straightforward. It has consistently used the term "denuclearization of the Korean Peninsula" instead of "denuclearization of the North." It argues that the United States should completely eliminate its nuclear threat to the DPRK before removing the DPRK's nuclear threat. The elimination of the US nuclear threat directly refers to the dismantlement of its nuclear umbrella pledge. This leads to a ban on the import of strategic assets such as strategic bombers that fly to the Korean Peninsula every time the DPRK provokes a missile, and a suspension of ROK-US joint military drills. This is ultimately a demand that leads to the withdrawal of US troops from the ROK. Unless these demands are met, it seems improbable that the DPRK will ever denuclearize itself alone. For this reason, denuclearization negotiations between the United States and the DPRK are expected to be very difficult.

Regarding the DPRK's cyber threats, a tentative conclusion is that although its cyber operations are rather unsophisticated and of relatively rudimentary nature, it is rapidly becoming a real and existential threat to the international community. The DPRK's cyber capabilities are evolving and

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[27] U.S. Congress, House Armed Services Committee, "Future of Defense Task Force Report 2020," September 23, 2020, p. 25.

[28] Ankit Panda, "A Nuclear North Korea's Wake-up Call," *The Diplomat*, October 13, 2020, https://thediplomat.com/2020/10/a-nuclear-north-koreas-wake-up-call/

adapting day-by-day. Numerous government and private institutions around the world have been hit hard by North Korean hacking. The DPRK's cyberattacks have become more frequent in general as international isolation has intensified due to international sanctions.

Given these realities, how should the ROK respond to the DPRK's asymmetric threats? There are not many options for the ROK and the future prospects are not very bright. The DPRK is expected to continue to strengthen all of its possible military capabilities. In a report at the 8th Workers' Party Congress, Kim Jong-un ordered the DPRK's conventional military power to become more "high-tech, intelligent, precise, unmanned, high-performance, and lightweight." Regarding nuclear and missile power, Chairman Kim stressed the need to further strengthen nuclear power so that the DPRK can take more initiative in curbing its nuclear war. Kim Jong-un has disclosed the list of weapons he wanted: multiple independently targetable reentry vehicles (MIRV), hypersonic missiles, nuclear submarines, SLBMs, and military reconnaissance satellites—weapons being competitively developed by the United States., China, and Russia or being developed or bought by the ROK.[29] Given the long timelines—some of them decadal—of some of these objectives, one may infer that Kim Jong-un is planning to keep the nuclear arsenal for at least as long as his own leadership might last.

It is not easy to analyze the DPRK's intentions based on the asymmetric threat it poses. This is because it not only has standard WMD arsenals such as chemical, biological and nuclear capabilities, but also a cyberforce of real substance. It may not be appropriate, therefore, for the international community (including the United States) to apply to the DPRK lessons learned from negotiations dealing with various nuclear, cyber, and biochemical threats in other parts of the world. This inapplicability arises because the DPRK is a very unusual system. The DPRK which is ruled by Kim dynasty is *sui generis*. It is not like Iraq or Iran.

In late January 2021 US Defense Secretary Lloyd Austin stated that "Even as we address accelerating competition by China, we will ensure that we remain fully ready to respond to and

[29] Min Hong, "Analysis of the 8th Party Congress of WPK in North Korea (1): Strategic Basis," Korea Institute for National Unification, *Online Series*, January 15, 2021, https://www.kinu.or.kr/pyxis-api/1/digital-files/1d2bb338-30e8-4fe8-99f3-26640c01fc86

effectively deter nation-state threats emanating from Russia, Iran, and the DPRK."[30] He also noted that the DPRK is one of only a handful of countries that pose threats to the United States and its allies.

Austin explained, "We will seek to impose cost where necessary, while using all of our tools to lower the risk of escalation with our adversaries and respond to challenges below the level of armed conflict. We will continue to maintain credible deterrence against advanced threats, and we will right-size our mission around the world in a transparent and principled manner."[31] His remark is standard boilerplate, especially useless when applied to Pyongyang.[32]

Given these evidences, we can cautiously conclude that the DPRK's nuclear doctrine can be summed up as seeking minimum deterrence against the US while seeking deterrence by punishment that discourages provocative military actions through threats to impose unaffordable retaliation on its counterpart. Minimum deterrence requires securing a second strike capability that allows meaningful retaliation with residual nuclear power after a preemptive strike by the enemy. For this goal, strategic nuclear weapons should be able to destroy large cities and industrial facilities in the other country, so the key is to maintain the viability and retaliatory capability of early nuclear weapons. This posture is similar to the 'assured retaliation' posture, which, according to the Vipin Narang's classification, allows direct retaliation against adversaries—that is, the United States. For a strategy of minimum deterrence or assured retaliation to be established, the survival of the DPRK's nuclear arsenal and its ability to strike the US mainland are key, and its recent series of actions support this view. Although the DPRK declared 'completion of the construction of nuclear weapons' in late 2017, one cannot say that it has established a firm retaliation capacity against the United States in terms of nuclear military power. Therefore, the DPRK is expected to make continuous efforts to upgrade its nuclear and missile capabilities, at least for the time being.

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[30] "U.S. defense chief shortlists N. Korea as 'nation-state threat'," *Yonhap News Agency*, March 5, 2021, https://en.yna.co.kr/view/AEN20210305000600325

[31] Ibid.

[32] Doug Bandow, "Does North Korea Keep Lloyd Austin Up at Night?" *The National Interest*, March 20, 2021, https://nationalinterest.org/print/feature/does-north-korea-keep-lloyd-austin-night-180585

Conclusions

The asymmetrical threats posed by the DPRK are not only existential threats to the ROK, but they also undermine stability in Northeast Asia and pose global threats to the entire international community. The DPRK's nuclear capability is estimated to be near completion, with only the stage of weaponization remaining. As a means of delivering nuclear weapons, various ballistic missile capabilities are rapidly advancing. Cyber threat capabilities are mainly focused recently on cash extortion through illegal cyber activities as the DPRK's economic difficulties and international isolation deepens due to the spread of COVID-19 pandemic. However, cybercriminal capacity may also be deployed in cyberwarfare, and pose a real threat to US, ROK, and allied forces operating in Korea. In the case of biochemical weapons, there has been no clear activity or evidence recently, but there is also no evidence that the DPRK has scrapped these weapons programs. Thus, due to its extraordinary opacity, it poses a real threat to both nuclear and missile, cyber and biochemical weapons.

As time goes by, the DPRK will upgrade its nuclear and missile capabilities, and its nuclear threats will expand beyond the Korean Peninsula to a level that challenges regional and global security. The DPRK is unlikely to give up its nuclear program, which it believes is the best means to ensure the survival of its regime. It is also difficult to resolve the issue peacefully through dialogue and negotiations. If this conclusion is correct, then we should devise and implement strategies for the DPRK on the premise that the conflict will last a long time.

The DPRK will give up only if the cost of possessing nuclear weapons threatens the survival of its regime. Incentives such as economic aid and a peace treaty alone cannot induce nuclear renunciation. While leaving open the possibility of dialogue with the DPRK, the realistic response is to approach the DPRK with the premise that only omnidirectional and active pressure will change the DPRK's strategic calculus. A new strategy should be developed, therefore, to make the DPRK pay more and make it regret missed opportunities for dialogue and to prepare the way for further talks aimed at least at slowing if not reversing its accrual of WMD.

If the DPRK's nuclear capability is enhanced and its threatening rhetoric is further heightened, ROK's dependence on US strategic assets will further increase. As geopolitical conditions on the Korean Peninsula make it difficult to guarantee ROK's absolute security from DPRK attacks, it seems inevitable that the ROK will upgrade its offensive and defensive military capabilities while making full use of various US strategic assets—such as multi-layered missile defense networks, strategic bombers, Aegis destroyers, nuclear submarines, and nuclear aircraft carriers.

Regarding cyber threats, the ROK must keep a close watch on espionage activities to correctly estimate the DPRK's cyber capabilities. It must continuously adapt and build up capabilities to counter rapidly evolving cyber threats not only in the technical domain, but also through devising common responses with international partners.

The ROK could benefit from establishing closer collaboration, both on a bilateral and multilateral level, with countries that have experienced or become the victims of the DPRK cyber-attacks. Intelligence sharing can help all parties involved to overcome their security problems by addressing each other's cyber system weaknesses. Also, sharing the lessons the ROK has learned from its past with different countries will enhance its position in the international arena as an 'issue specific' security provider.[33]

It is very important to seek a military response to the asymmetric threat posed by the DPRK, but that is not enough. The ROK should strengthen its efforts to induce the DPRK into becoming a normal state in Northeast Asia via a peace process on the Korean Peninsula in the long run. While easing military tensions on the Korean peninsula, efforts should be made to build trust between the DPRK and its neighbors. In the end, the best way is to make it realize that threatening the ROK or neighboring countries with asymmetric threats will not pay off but will only hasten the end of the Kim regime.

[33] Chong Woo Kim and Carolina Polito, "The Evolution of North Korean Cyber Threats," The Asan Institute for Policy Studies, Issue Brief, February 2019, pp. 9-10.

Section 3

14. Great Power Risk Reduction Measures and Lessons for the Asia-Pacific

Dmitry Stefanovich

Introduction

Risk reduction is one of the major tasks the international arms control, non-proliferation, and disarmament community struggles with today. Risks in the nuclear domain are among the most threatening faced by humanity for the simple reason that nuclear weapons are the most destructive instruments of war ever deployed and seem to remain so for a long time.[1] If living under constant threat of nuclear devastation is unnerving, it is even more so when one learns from senior nuclear decision makers that it was sheer luck as much as good judgement that humanity has survived this long.[2] It is irresponsible to leave the matters of such importance and danger to luck, so some actual nuclear risk reduction measures have been developed and put in place, with different levels of success.

There is substantial research on the topic of nuclear risk reduction.[3] This paper focuses on practical takeaways and solutions.

[1] Other weapons of mass destruction are a great threat to humanity as well, however the immediate destructive power of nuclear weapons explosion (blast wave, radiation, fire) is simply unmatched by anything else ever created by people, not to mention the radiobiological effects and long-term contamination. Detailed information on nuclear weapons effects is available via the Atomic Archive project: https://www.atomicarchive.com/science/effects/index.html

[2] Interview with Robert McNamara, The National Security Archive, Accessed November 12, 2020, https://nsarchive2.gwu.edu/coldwar/interviews/episode-11/mcnamara2.html

[3] Example: Wan, Wilfred [ed]. 2020. "Nuclear Risk Reduction: Closing Pathways to Use" Geneva, Switzerland: UNIDIR, Accessed November 12, 2020, https://doi.org/10.37559/WMD/20/NRR/01

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The Evolution of Nuclear Power Learning

Great powers, which can be conveniently defined as "nations that figure most decisively in international affairs,"[4] unfortunately, tend to compete, and within such competition they regularly find themselves embroiled in major crises. Once nuclear weapons entered the equation, the consequences and risks of these crises grow dramatically. A number of flashpoints during the Cold War—Suez 1956, Berlin 1961, Cuba 1962, Yom Kippur War 1973, Able Archer 1983, and others—brought major military powers on the brink of actual warfighting, which could have easily involved nuclear weapons. Probably the major takeaway from the resolution of all these crises was the need to set up and preserve lines of communication at all times—either informal (for example, between Kennedy and Dobrynin in 1962) or formal (hotlines, and, ultimately, Nuclear Risk Reduction Centers, as well as deconfliction mechanisms). Although the parties involved still tended to behave in ways that exploited or carelessly incurred risk at times, the intention not to spiral toward nuclear war was clearly demonstrated most of the time.

Even after such major stand-offs, however, many countries retain a chronic habit of mirror imaging.[5] Everyone plans for the worst-case scenario and sees only malign intentions in the other, no matter what the actual declarations behind different military postures or actions. Worst of all, the wrong perceptions of the adversary's calculus may lead to counteractions that contribute to speeding up the arms race and increase reliance on 'hard' deterrence based on military capabilities, thereby undermining readiness to pursue joint security mechanisms to ensure national security.

One event that exemplified such logic was the 'missile gap' perceived by the US military and intelligence in the 1970s. At the time, the Americans believed that Soviet missile development (both in terms of quality and quantity) was focused on achieving counterforce capability so to destroy most of the US nuclear delivery vehicles in a disarming first strike. Declassified documents

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[4] "Great power," *Merriam-Webster.com Dictionary*, Merriam-Webster, Accessed November 12, 2020, https://www.merriam-webster.com/dictionary/great%20power

[5] Michael Krepon, "Mirror Imaging," Arms Control Wonk blog, June 24, 2019, Accessed November 12, 2020, https://www.armscontrolwonk.com/archive/1207629/mirror-imaging/

show that this was neither the intention nor the actual capability of the USSR, but the US military "counter-buildup" was started and contributed to increased tensions of the early 1980s.[6]

Today we have similar dynamics in play with regard to Russia's alleged but actually non-existent "escalate-to-deescalate" strategy, which is used as a reason by the United States to develop weapons like low-yield nuclear warheads for submarine-launched ballistic missiles.[7]

Yet another example is how the US missile defense developments, which are (as of today) still incapable of substantially undermining strategic nuclear retaliation from any country, drive the military in Russia, China,[8] and, to some extent, even the Democratic People's Republic of Korea (DPRK) to develop countervailing offensive nuclear weapons which in turn lead to more arms racing. Of course, the reason to engage in "sword on shield" competition is that there are no limits on enhancing the "shield," as was understood long ago, when the original ABM Treaty was signed. It is noteworthy that the now-adamant Russian belief in the "negative" link between strategic defensive and offensive weapons is also an example of "learning," as originally this was an American idea.

Eventually, 'proper' arms control treaties first limiting, and then reducing nuclear arsenals (including destruction of some weapon classes) came into being, and the most important concept jointly developed and understood by the end of Cold War was that of "strategic stability," based on the idea to "remove incentives for a nuclear first strike."[9] This core notion remains relevant even today, including in ongoing Strategic Stability Dialogue between Russia and the United States. As President Vladimir Putin disclosed back in November 2020, Russia's "proposals on devising a new "security equation," that "take into consideration all factors affecting strategic stability with a special emphasis on first-strike capability" were sent to American partners.[10] This

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[6] Pavel Podvig, "The Window of Vulnerability That Wasn't: Soviet Military Buildup in the 1970s—A Research Note"—A Research Note, *International Security*, 33:1, 2008, 118-138, Accessed November 12, 2020, https://doi.org/10.1162/isec.2008.33.1.118

[7] Konstantin Bogdanov, "Not-so-Nuclear War," Russian International Affairs Council, March 10, 2020, Accessed November 12, 2020, https://russiancouncil.ru/en/analytics-and-comments/analytics/not-so-nuclear-war/

[8] Ankit Panda, ("On 'Great Power Competition'" (Nuclear Risk Reduction Policy Brief No. 1). Geneva, Switzerland: UNIDIR, 2020, Accessed November 12, 2020, https://doi.org/10.37559/WMD/20/NRR/02

[9] Soviet-United States Joint Statement on Future Negotiations on Nuclear and Space Arms and Further Enhancing Strategic Stability, 1990-06-01, Accessed November 12, 2020, https://bush41library.tamu.edu/archives/public-papers/1938

[10] Meeting with senior Defence Ministry officials, heads of federal agencies and defence industry executives, November 10, 2020, Accessed 12 November 2020, http://en.kremlin.ru/events/president/news/64392

proposal remains standing and was re-iterated in April 2021, and, hopefully, negotiations can include other nuclear weapon states as well.[11]

Formal and Informal US-Soviet Rules of the Road

As prefigured previously, one of the most important ways to manage great power competition is to establish a framework of deconfliction formats and communication channels.

The content of existing agreements[12] on the prevention of dangerous military activities can be distilled into three main areas of action:

- incident prevention
- assured communication
- help in the event of an incident

The types of dangerous military activities addressed by such measures, as a rule, include the following:

- entry of military personnel and/or equipment of the one party into the national territory of the other party, due to *force majeure*, that is, as a result of unintentional actions;
- the use of a laser in such a way that it can harm the personnel or damage the equipment of the armed forces of the other party;
- hindering the actions of the military personnel and/or equipment of the other party in a way that may cause harm to personnel or damage to equipment;

[11] "As the leader in the creation of new-generation combat systems and in the development of modern nuclear forces, Russia is urging its partners once again to discuss the issues related to strategic armaments and to ensure global stability. The subject matter and the goal of these talks could be the creation of an environment for a conflict-free coexistence based on the security equation, which would include not only the traditional strategic armaments, such as intercontinental ballistic missiles, heavy bombers and submarines, but—I would like to emphasize—all offensive and defensive systems capable of attaining strategic goals regardless of the armament." Presidential Address to the Federal Assembly, April 21, 2021, Accessed April 23, 2021, http://en.kremlin.ru/events/president/news/65418

[12] For example, 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, Accessed November 12, 2020, https://2009- 2017.state.gov/t/isn/4791.htm

- interfering with control networks,[13] which may harm personnel or damage equipment of the armed forces of the other party.

The parties are obliged to undertake measures such as those in the US-Soviet 1989 agreement for the prompt "termination and resolution of peaceful means, without resort to the threat of use of force, or any incident which may arise as a result of dangerous military activities."[14] It is useful to note that while Russia has concluded several relevant bilateral agreements with the United States, similar documents have been drawn up and signed by Russia with numerous other countries, including Greece, Canada, and the Republic of Korea.

In the agreements between the Soviet Union and other countries (mainly NATO members) on the prevention of incidents on the high seas and in the airspace above it, the parties assumed the following obligations:[15]

- stay at a sufficient distance;
- avoid any manoeuvres that impede action or create a hazard;
- adhere to the standard or other mutually agreed signals;
- not undertake simulation attacks by turning guns, launchers, torpedo tubes, and other types of weapons in the direction of the oncoming ship of the other party, not throw any objects in the direction of the oncoming ships of the other party, and not use searchlights or other powerful lighting means for illuminating the bridges of oncoming ships of the other party;
- share relevant information on collisions, property damage incidents, or other incidents at sea between ships and aircraft.

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[13] This part actually provides some kind of a blueprint for future agreements addressing cyberwarfare and electronic warfare.

[14] Agreement Between the Government of The United States Of America and the Government of the Union of Soviet Socialist Republics on The Prevention Of Dangerous Military Activities, signed January 12, 1989, text at: https://www.jstor.org/stable/20693340?seq=1

[15] More details can be found, for example, in the European Leadership Network Policy Brief "Managing Hazardous Incidents in the Euro-Atlantic Area: A New Plan of Action" by L.Kulesa, T.Frear and D.Raynova, November 2016, https://www.europeanleadershipnetwork.org/wp-content/uploads/2017/10/ELN-Managing-Hazardous-Incidents-November-2016.pdf, Accessed April 23, 2021.

Another document, which is even more closely related to the topic of nuclear risk reduction, is the Agreement on the Prevention of Nuclear War between the USSR and the United States.[16] Despite its high-level goal, however, this agreement is a typical example of a boilerplate set of measures to reduce risk that largely reiterate existing commitments under international law. According to this document, the parties undertake to "refrain from the threat or use of force against the other Party, against the allies of the other Party, and against other countries in circumstances that may endanger international peace and security." In the event of a risk of nuclear war, they undertake the following obligations: "Acting in accordance with the provisions of this Agreement, [to] immediately proceed to urgent consultations with each other and make every effort to prevent this risk" and to inform the "UN Security Council, the UN Secretary General and the governments of allied or other countries on the progress and results of the consultations."

It is noteworthy that the recently released "Basic Principles of State Policy of the Russian Federation on Nuclear Deterrence"[17] to some extent follow the steps of the aforementioned Agreement when it states (at page 20):

> The President of the Russian Federation might, if necessary, inform the military-political leadership of other states and/or international organizations about the Russian Federation's readiness to use nuclear weapons or about the decision taken to use nuclear weapons, as well as about the fact that nuclear weapons have been used.

It seems that the array of international agreements in the field of preventing military incidents between the signatory countries is a valuable tool. Concurrently, the agreements leave room for interpretation and, in some cases, even provide arguments for the escalation of rhetoric, indicating the extremely provocative nature of the actions of one side or another in a military confrontation.

[16] Agreement Between the United States of America and The Union of Soviet Socialist Republics on the Prevention of Nuclear War, US Department of States, Archived Content, Accessed November 12, 2020, https://2009-2017.state.gov/t/isn/5186.htm

[17] Basic Principles of State Policy of the Russian Federation on Nuclear Deterrence, Accessed November 12, 2020, https://mid.ru/ru/foreign_policy/international_safety/1434131/?lang=en

Bringing in Other States: the NPT Regime

The world does not consist only of the great powers. For many countries who do not otherwise rise to great power status, nuclear weapons capability is viewed as an "entry ticket" to enter the great power club. The Nuclear Non-Proliferation Treaty (NPT) was established to address this challenge. The NPT regime itself was and remains mostly related to the reduction of the risk of nuclear proliferation, not the risk of the use of nuclear weapons. However, its Article VI, providing for nuclear disarmament, as well as (what is often forgotten) general disarmament,[18] of course contributes to the nuclear risk reduction as well.

At the same time, the four countries outside of the NPT regime that possess nuclear weapons complicate nuclear war risk management, but they also present opportunities for local and regional risk reduction measures because they are—or should be—universally applicable.

The most significant nuclear risk reduction architecture is that proposed in the so-called P5 format, that is, between and among the five permanent (and nuclear-armed) members of the UN Security Council. Regular meetings and statements by the "NPT-legitimated" nuclear weapon states contribute to greater understanding between these five countries and help to develop or at the very least discuss some joint initiatives.[19] Moreover, some of the official P5 statements positively affect the nuclear risk reduction process, for example, the one made in the year 2000 on de-targeting:

> Emphasizing the essential importance of cooperation, demonstrating and advancing mutual trust among ourselves, and promoting greater international security and stability, we declare that none of our nuclear weapons are targeted at any State.[20]

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[18] Treaty on the Non-Proliferation of Nuclear Weapons (NPT), Accessed November, 12 2020, https://www.un.org/disarmament/wmd/nuclear/npt/text

[19] The European Leadership Network contributes to this process a lot, for example, Accessed November 12, 2020, https://www.europeanleadershipnetwork.org/the-p5-process/

[20] Letter dated 1 May 2000 from the representatives of France, the People's Republic of China, the Russian Federation, the United Kingdom of Great Britain and Northern Ireland, and the United States of America addressed to the president of the 2000 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Accessed November, 12, 2020, https://documents-dds-ny.un.org/doc/UNDOC/GEN/N00/411/96/pdf/N0041196.pdf?OpenElement

Of course, nuclear de-targeting in itself is a big challenge in terms of verification, and, given the current level of technological development, "re-targeting" probably can be done in a matter of minutes. Nonetheless, such statements highlight the inclination of the great powers to reduce the risk of nuclear war and send the positive, risk-reducing signals to the international community. Thus, it is most welcome that de-targeting was re-iterated by the P5 in January 2022, together with the joint statement affirming that "a nuclear war cannot be won and must never be fought."[21]

Nuclear Taboo, the ICJ Ruling, and the LOAC

So far, the nuclear taboo, understood as the non-use of nuclear weapons in warfighting, has stood for the last seventy-six years, and it is augmented with an almost universal cessation of nuclear tests.

However, this nuclear taboo is more of a customary phenomenon rather than a legal one. In 1996 the International Court of Justice (ICJ) rendered its Advisory Opinion on the legality of the threat or use of nuclear weapons,[22] which emphasized the controversial nature of the problem in question: while there are no explicit prohibitions on the nuclear weapons, their characteristics make the Law Of Armed Conflict (LOAC) challenging to apply, especially in relation to the protection of civilians and avoidance of unnecessary suffering to the combatants.

Nevertheless, some nuclear armed states declare adherence to the LOAC in their declaratory policies. Still, this raises the question about the proportionality, and whether such thing can be achieved if the nuclear threshold were in fact to be crossed by nuclear use.

Currently, it seems, a new direction of research is being developed, which focuses on 'responsible' or accountable nuclear arsenals.[23] One of its aims is to find a way to establish limits to the destructiveness of nuclear weapons in possession of every state. This might have the opposite

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[21] Joint Statement of the Leaders of the Five Nuclear-Weapon States on Preventing Nuclear War and Avoiding Arms Races, January 03, 2022, Accessed January 12, 2020, https://www.whitehouse.gov/briefing-room/statements-releases/2022/01/03/p5-statement-on-preventing-nuclear-war-and-avoiding-arms-races/

[22] Legality of the Threat or Use of Nuclear Weapons, Accessed November 12, 2020, https://www.icj-cij.org/en/case/95

[23] George Perkovich, Toward Accountable Nuclear Deterrents: How Much is Too Much?, February 11, 2020, Accessed November 12, 2020, https://carnegieendowment.org/2020/02/11/toward-accountable-nuclear-deterrents-how-much-is-too-much- pub-80987

results, however, because if there is no threat of regional (if not global) extermination from nuclear war, some decision makers might become more eager to use nuclear weapons in conflict, that is, break the nuclear taboo. In the worst case, only one nuclear weapon might be used, and when the dust settles and the sky has not fallen, other nuclear weapons states may become more inclined to use nuclear weapons.

One way to reinforce the nuclear taboo is to act at the level of declaratory doctrine. To this end, nuclear armed states should commit to a multilateral version of the Reagan-Gorbachev statement that the nuclear war cannot be won and must never be fought.[24] Such initiatives have been in place for some time[25] and are finally fruitful.[26]

Rules of the Road: Counter-NC3, Strategic ASW, Cyber and Space Warfare

The previous section argued that rules of the road in the nuclear domain should be continuously developed and refined. As mentioned earlier, deconfliction agreements and hotlines are imperfect, but they help to reduce risks, including nuclear risks. Unrestrained competition is bad for everyone, no matter what some former US officials had claimed.[27]

There are some domains where such competition is exceptionally damaging for strategic stability, and such off-road behavior should be tightly constrained by what one might term "rules of the road." One of those would be the threats toward nuclear command, control, and communications (NC3) systems that ensure that a nuclear armed state can retaliate under any circumstance (the basis of strategic stability) while also ensuring that nuclear weapons are never used by mistake. The nuclear great powers have all invested in upgrading the reliability and survivability of their

[24] Joint Soviet-United States Statement on the Summit Meeting in Geneva, November 21, 1985, Accessed November 12, 2020, https://www.reaganlibrary.gov/archives/speech/joint-soviet-united-states-statement-summit-meeting-geneva

[25] Lewis Dunn, William Potter, Time to Renew the Reagan-Gorbachev Principle, Arms Control Today, March 2020, Accessed November 12, 2020, https://www.armscontrol.org/act/2020-03/features/time-renew-reagan-gorbachev-principle

[26] Joint Statement of the Leaders of the Five Nuclear-Weapon States on Preventing Nuclear War and Avoiding Arms Races, January 03, 2022, Accessed 12 Jan, 2020, https://www.whitehouse.gov/briefing-room/statements-releases/2022/01/03/p5-statement-on-preventing-nuclear-war-and-avoiding-arms-races/

[27] "U.S. prepared to spend Russia, China 'into oblivion' to win nuclear arms race: U.S. envoy," *Reuters,* May 21, 2020, Accessed 12 Nov. 2020, https://www.reuters.com/article/uk-usa-armscontrol-idUSKBN22X2LS

NC3 in recent years,[28] the imperative that flows from the possible degradation or complete loss of the NC3 system is to pre-delegate nuclear use authority to the lower echelons of command, with obvious risks of the potential loss of control at critical junctures that might actually cause a nuclear war.

Nevertheless, for military planners it might seem extremely useful to target precisely command and control nodes and centers to limit the warfighting capabilities of the adversary. In case of conventional conflict. such planning might have some deterrent effect. When nuclear weapons and nuclear deterrence are added to the equation, however, the threat of 'decapitation' becomes a grave concern for any actor.

One of the most sensitive dimensions of strategic stability is the relative vulnerability of the sea-based nuclear deterrence. Anti-submarine warfare (ASW) on a strategic level can increase SSBN (ballistic missile-carrying submarines) vulnerability. SSBNs are considered the most survivable 'leg' of the nuclear triad by most countries. If the highest military-political leadership is concerned with the survivability of its nuclear arsenal, such concerns might lead such leaders to 'launch early,' that is, resolve the 'use it or lose it' paradox. As of today, however, it is hard to label ASW capabilities as totally undermining the survivability of the sea-leg of the nuclear triad. The bigger challenge lies in developing reliable and robust 'general purpose' naval capabilities to support SSBN operations. Possible technological breakthroughs in ASW (machine learning, big data, networks of unmanned vehicles, etc.) are indeed possible, but, as in other domains, the development of the submarines themselves (and operational concepts) never stops as well.

Currently, some nuclear powers and their allies consider cyberspace and outer space to be operational and/or warfighting domains. Although the destructive power emanating from these domains is often over-stated, extending confrontation between nuclear weapons states is a challenge in its own right to strategic stability. All nuclear-armed and nuclear-ally states recognize that cyberweapons are a threat to their NC3 systems, and some have declared that such an attack

[28] For example, Russia's president made such a claim at his Meeting with heads of Defence Ministry, federal agencies and defence companies, "Meeting with heads of Defence Ministry, federal agencies and defence companies," President of Russia Official Website, November 11, 2020, Accessed November 12, 2020, http://en.kremlin.ru/events/president/news/64396

may result in nuclear retaliation. It is therefore urgent to seek joint solutions that can put the most crucial elements of the nuclear decision-making infrastructure away from the 'crosshairs.'[29]

Collapse of Cold War Arms Control and Resurgent Nuclear Modernization

The Cold War framework is now almost completely collapsed. New people with short or no memories of the risks or strategic arms control are in charge, and there are many more actors involved. Gone are the Anti-Ballistic Missile and Intermediate-range Nuclear Forces Treaties due to the US withdrawal. The Conventional Forces in Europe Treaty is in limbo and the Open Skies Treaty might not survive 2021. The extension of the New START to 2026 under the Biden Administration as proposed by the Russian government is a welcome riposte, as it has helped to reduce Russian and American strategic nuclear forces and keep those limited, but it might be not enough to hold back the tide of the coming arms race.

Also, none of these treaties explicitly addressed the Asia-Pacific region, and a resurrection of arms control might start from there. In general, there is a substantial deterioration of arms control frameworks and a shift from joint security measures and transparency to 'hard' deterrence and ambiguity. New nuclear weapons, delivery systems, and platforms are being developed, although it is yet unclear if these systems will disrupt strategic stability.

The modernization itself might not be inherently something bad: as long as nuclear weapons remain in the arsenals, it is better to have them in good shape, rather than rusting away. Nevertheless, the landscape of mutual nuclear (and non-nuclear) deterrence and vulnerabilities is getting more and more complicated to manage, and therefore the nuclear risks are on the rise.

Shift to Complex Nuclear Risks

Currently there are nine nuclear weapon states, and they can be separated in different 'baskets' in several ways. One way is to group them into the five NPT-NWS basket (China, France, Russia,

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[29] Dmitry Stefanovich, "Russia's Basic Principles and the Cyber-Nuclear Nexus," *European Leadership Network*, 14 July 2020, Accessed November 12, 2020, https://www.europeanleadershipnetwork.org/commentary/russias-basic-principles-and-the-cyber-nuclear-nexus/

the United Kingdom and the United States), the two South Asian nuclear-armed states basket (India and Pakistan) and a third 'special cases' basket (Israel and the DPRK).

But there are other ways to categorize them, for example, by "deterrence equations." The combined nuclear forces of the United States, the United Kingdom, and France deter Russia, and vice versa; China is engaged in nuclear deterrence vis-à-vis the United States and India; India vis-à-vis China and Pakistan, etc. Such way of framing grounds the otherwise abstract concept of growing nuclear risks, including those related to miscalculation and/or misperception, in global and regional insecurities.

In all these cases, the type of risk and the level of common understanding of the shared risk can differ between nuclear adversaries. The P5 'Glossary of Key Nuclear Terms'[30] is a good start to overcome these differences, but it is extremely limited. Its long overdue update was finally completed in late 2021.[31] Relatively professional discussions on doctrines also take place only within the P5 process and rarely on a military-military basis.

Some rather recent initiatives (for instance, Creating an Environment for Nuclear Disarmament (CEND)[32] and the Stepping Stones Approach[33]) are trying to find a broader way for the discussion on nuclear weapons (and disarmament) related challenges, but it remains to be seen how successful those can be, especially given their self-avowed incrementalism.

Fortunately, many top officials in nuclear weapons states recognize the challenge and argue that we need to continue the search for nuclear arms control and risk reduction formats that involve all nuclear weapon states.

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[30] P5 Glossary of Key Nuclear Terms, Accessed November 12, 2020, https://www.pircenter.org/media/content/files/13/14313989580.pdf

[31] P5 joint communiqué, 3 December, 2021, Accessed January 12, 2022, https://cd-geneve.delegfrance.org/IMG/pdf/communique_p5.pdf?2488/9bb0569676c7583cdd9a9434539f9c0a22533ff4

[32] See https://www.state.gov/key-topics-bureau-of-international-security-and-nonproliferation/

[33] See Paul Ingram and Maxwell Downman, "Stepping Stones to Disarmament," The British American Security Information Council (BASIC), April 2019, https://basicint.org/wp-content/uploads/2019/05/Stepping-Stones-Report-WEB-1.pdf

Possible Nuclear Risk Reduction Measures in Asia-Pacific

Before addressing the actual risk reduction measures, it is important to define once again what types of risks are managed by such measures. Of the range of possible risks that might lead to nuclear war, two stand out. The first is those that involve any use of nuclear weapons resulting in nuclear explosions. Such uses can be deliberate, accidental, or mixed (because of miscalculation, misinterpretation, etc.). The second is nuclear use by non-state actors, including terrorists.

Given the multi-layered, multi-dimensional state of nuclear affairs, and the complicated global and regional military-political landscapes in which nuclear weapons are deployed, the future seems grim. Yet, because of past crises that generate a pull-demand for risk reduction measures, some of the tools needed today are already available. The challenge is to make a good use of them.

CATEGORY	RISK REDUCTION ACTIVITIES	SAMPLE PROPOSALS
Doctrine	Commitment of non-use or threat of use	- Reaffirm Reagan-Gorbachev statement; convention on prohibition of use
	Lessened role of nuclear weapons in security policies	- Scaling back of modernization programmes; deterrence alternatives
	Declaratory policies on avoiding nuclear use	- "No first use", "sole purpose (is to deter/defend)", "(weapon of) last resort"
	Ban on classes of nuclear weapons or delivery systems	- Lower-yield, dual-capable, e.g. nuclear-armed cruise missiles, IRBMs
	Extension of negative security assurances	- Binding legal agreement, eliminate caveats against WMD use
	Establish principles around nuclear weapons possession	- Develop common lexicon, code of conduct or on nuclear responsibility
Strategy	Protection of nuclear-related technological systems (C3I)	- Agreement on non-cyber interference, respect space assets (e.g. non-attack)
	Agreement not to attack nuclear-related facilities	- Military and/or civilian, with regular list exchange (e.g. South Asia)
	Reductions in numbers of deployed weapons	- Withdrawal, put into central storage, or disassemble
	Restrictions on the nature of deployment	- In geography (submarine proximity) and type of system (mobile launchers)
	Changes to deployment patterns and alert status	- Removal from prompt-launch status
Operations	Strengthen human assessment and decision-making	- 'Dual phenomenology' to verify or refute early warning data
	Physical separation of nuclear weapons	- Nuclear from conventional; de-mating from delivery vehicles
	Mechanisms to delay, disrupt, or deactivate launch	- Silo barriers, safing switches, de-targeting, redundancies
	Enhance safety and security of weapons and materials	- Global materials security system, interdiction of illicit transfers
	Address provocative military practices	- Reconnaissance flights, missile flight tests, buzzing practices
	Pre-notification of actions susceptible to misinterpretation	- Of missile tests, military exercises, deployment
Transparency	High-level dialogues on pertinent issues	- Strategic stability, nuclear risk/threats, nuclear security
	Information exchange on pertinent issues	- Doctrines, capabilities, exercises, weapons hosted
	Communication in crisis situations	- Hotlines, early warning centers, transparency of operations
	Notification of nuclear-related incidents	- Accidents at sea, theft or loss of control of weapons or materials, cyberattack
	Systematized risk assessment and/or analysis	- Database of past incidents, sharing of best practices

Figure 1. Summary of compiled ideas, proposals, and recommendations to reduce the risk of nuclear weapon use.[34]

[34] "Nuclear Risk Reduction: The State of Ideas," Wilfred Wan, UNIDIR, April 2019, Accessed November 12, 2020, https://www.unidir.org/publication/nuclear-risk-reduction-state-ideas

A great deal of research is underway on nuclear risk reduction that provides options for possible implementation (figure 1).[35]

What is needed now is to refine these ideas and tailor them to current and future circumstances while political will is mustered to implement them. It is also important to keep in mind that there are no perfect, universal solutions (although sets of best practices are always useful). Nuclear nations have different nuclear command, control, and communications architecture, technological, and political culture, possible levels of transparency and attitude to ambiguity, as well as risk-taking ability and appetite. Finding the measures that work across these differences will rule out some approaches that work perfectly for one adversary but not sufficiently well for the other to adopt. “Sufficiently” workable to two or more antagonists party to a given measure might be a key attribute of the most realistic measures.

The expert community must be patient and polite—and at the same time ambitious. It is a truism that the ultimate nuclear risk reduction can be achieved through universal nuclear disarmament—but this, in turn, must be linked with a “conventional disarmament” (as written in the NPT’s Article VI), and, eventually, total pacification of the Earth—a far reaching ideal agenda that has little, likely zero prospect of realization in the near future.

Nevertheless, “moonshots” in the nuclear risk reduction are not something to be afraid of, and widening the scope of the analysis to include totally new types of risk reduction measures might help. Even the best ideas will take some time to take effect. Serious goals can and should be put on the table, as well as outlining detailed and feasible steps to achieve those.

It is useful therefore to think about nuclear risks in the most practical terms. For example, there are US nuclear weapons in Europe.[36] The airbases where those weapons are located are probably more vulnerable than the ones on US soil, including to an attack by non-state actors (activists have

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[35] See, for example, C. Brustlein, “Strategic Risk Reduction between Nuclear-Weapons Possessors, Proliferation Papers,” *IFRI,* No. 63, January 2021 https://www.ifri.org/en/publications/etudes-de-lifri/proliferation-papers/strategic-risk-reduction-between-nuclear-weapons

[36] Hans M. Kristensen, “U.S. Nuclear Weapons In Europe, Briefing to Center for Arms Control and Non-Proliferation,” November 1, 2019, Accessed November 12, 2020, https://fas.org/wp-content/uploads/2019/11/Brief2019_EuroNukes_CACNP.pdf

been able to gain access to these bases in spite of security systems although they never reached the vaults where B61 nuclear bombs are stored. [37]

At the same time, these nuclear bombs make the countries that feel that they are the likely target for such weapons (that is, Russia) nervous—and they threaten the host countries in turn, probably with both nuclear and conventional weapons.

What can be achieved to reduce such risks? The easiest step might be to provide more transparency about missions for these weapons. A next good step can be to de-couple the nuclear weapons from actual dual-capable aircraft basing, thus, to some extent, achieving symmetry with the way Russia stores sub-strategic nuclear weapons at "central storages" away from actual battle units.[38]

Will such steps reduce risk? Definitely. Is it feasible? Technically, assuredly so:[39] But politically, these measures face severe political obstacles, there being too much political capital invested by different countries and NATO as a whole protecting this "nuclear sharing" arrangement as something crucial for allied coherence.[40]

Another practical example is Russia, which employs a concept of non-nuclear deterrence in its military doctrine.[41] This concept is advertised as a measure to reduce reliance on nuclear weapons, and, intuitively, should reduce nuclear risks. But is such reduction actually achieved? From what the Ministry of Defense says and shows in its presentations, non-nuclear deterrence is based on essentially dual-capable systems. In a crisis it is quite possible that faced with dual-use ambiguity,

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[37] David Brennan, "EU Politicians Break Into Air Base Holding American Nuclear Bombs to Protest Weapons Stockpiling," *Newsweek,* 2/20/19, Accessed November 12, 2020, https://www.newsweek.com/nuclear-weapons-air-base-europe-belgium-green- politicians-disarmament-protest-1336908

[38] Pavel Podvig, Javier Serrat, "Lock them Up: Zero-deployed Non-strategic Nuclear Weapons in Europe," Accessed November 12, 2020, https://unidir.org/files/publications/pdfs/lock-them-up-zero-deployed-non-strategic-nuclear-weapons-in-europe- en-675.pdf

[39] For example, a set of possible options of gradual or full withdrawal of the US nuclear weapons from Europe without undermining 'NATO cohesion,' and even providing some role for the dual-capable aircraft of NATO countries currently involved in the 'Nuclear Sharing' is listed in Kamp, Karl-Heinz, and Robertus CN Remkes. "Options for NATO nuclear sharing arrangements." *Reducing Nuclear Risks in Europe: A Framework for Action* (2011): 82.

[40] Jessica Cox, "Nuclear deterrence today," *NATO Review,* 08 June 2020, Accessed November 12, 2020, https://www.nato.int/docu/review/articles/2020/06/08/nuclear-deterrence-today/index.html

[41] Alexander Yermakov, Dmitry Stefanovich, "Is Non-Nuclear Deterrence Possible?, Russian International Affairs Council," June 30, 2020, Accessed November 12, 2020, https://russiancouncil.ru/en/analytics-and-comments/analytics/is-non-nuclear-deterrence- possible/

any probable adversary will treat these as nuclear-armed weapons and will respond accordingly, possibly with escalatory conventional or actual nuclear first use. Of course, in the end there is a chance that such ambiguity might lead to crisis resolution without actual warfighting, but the risk of adversarial misinterpretation and the risk reduction measure actually compounding risk exists.

Can such negative outcomes be avoided? First, it must be said that non-nuclear deterrence understood as methods of imposing severe military costs on aggressors without going nuclear is here to stay and is a mainstay now of all the nuclear armed great powers. Long-range precision conventional weapons are both better suited and more usable to wage war than nuclear weapons Thus, the risk that use of long-range non-nuclear weapons, depending on their targets and the adversaries' sensor systems, might swiftly lead to nuclear retaliation is real. In Russia's 'nuclear doctrine' mentioned earlier, for example, this conventional-nuclear cascade is specifically mentioned, "The conditions specifying the possibility of nuclear weapons use by the Russian Federation are as follows: arrival of reliable data on a launch of ballistic missiles attacking the territory of the Russian Federation and/or its allies."[42]

Given the state of nuclear arsenals in Asia, and especially in Northeast Asia, the idea of non-nuclear deterrence, nuclear-conventional "entanglement," and how non-nuclear armament—especially disruptive technologies—affect nuclear risk reduction should be a major topic of consultations, as every country pursues such capabilities.

Last but not the least, it is crucial to consider risks associated with further nuclear reductions of delivery systems or actual controls on warheads. On the face of it, reducing the number of weapons should make it easier to ensure that nuclear weapons are never used by mistake and, therefore, to reduce nuclear risk. Conversely, reducing the number of fielded nuclear weapons may make a situation less stable because the belief in the reliability of their second-strike capabilities might decrease within the leadership of both the possessor and the probable adversary. This perception depends on many factors, not just the absolute numbers. Although the number of warheads that each side has relative to those of the adversary that must be targeted is an important determinant

[42] Basic Principles of State Policy of the Russian Federation on Nuclear Deterrence, paragraph 19a, Accessed November 12, 2020, https://mid.ru/ru/foreign_policy/international_safety/1434131/?lang=en

of these perceptions, making *mutual* reductions is almost a prerequisite for level-dependent risk reductions to work. It is important to distinguish between nuclear risks and risks related to any war or armed conflict, as sometimes explicit nuclear threats might prevent breakout of hostilities.

Long-run Strategic Arms Control Futures

Although the prospects for arms control might seem grim, there are good options that can be pursued. First and foremost, arms control itself must be "re-branded" as mainly an instrument to enhance national security (through transparency and decreased spending, etc.), not something generally good and positive. With that in mind and given the rather deep asymmetries between nuclear and non-nuclear strategic arsenals and postures in different countries, the approach to resume nuclear arms control should be two-fold: First, all factors affecting strategic stability should be defined and agreed upon through consultations. Such consultations can start in several bilateral formats, then switch to P5 fora, and eventually involve other nuclear weapon states and regional powers.

Second, areas of possible "control" should be defined in these discussions. One of those relates to NC3 systems, or rather, agreements to not target NC3. However, this commitment might be challenging due to military considerations. If one prepares for war, degrading adversary command, control, and communications becomes a primary mission. Nevertheless, if there is an agreed understanding that the states involved do not want and will not try to win in a nuclear war, such agreement can be achieved.

In the P5 context, there is one single element that all five countries possess: the sea-based leg of the nuclear triad, that is, SSBNs. Of course, SSBNs in each case differ in terms of numbers, sophistication, range, homeporting, and deployment. But there is room to agree on two things: limit the number of 'boomers' on patrol so other countries will not be concerned with possible decapitating or disarming strike with depressed trajectory submarine-launched missiles fired from a short distance offshore and arriving in a few minutes below early warning radars. Such a limit on deployment at sea would keep the ultimate retaliatory capability intact and also limit the development and deployment of long-range ASW capabilities. This might be more challenging but also have an even higher risk reduction payoff due to the potency of ASW on perceptions of boomer-owning countries of their vulnerability to a disarming nuclear first-strike. As a first step, countries might consider formalizing the existing practices, without reducing anything—effectively agreeing not to increase the number of platforms at sea at any given time. The cost of doing so would be increased visibility of some SSBN 'deterrence patrol' operations that might become correspondingly more vulnerable to countermeasures, as the adversary will be able to tailor their naval posture in terms of numbers and geography to the fixed and transparent numbers of SSBNs. But that cost may be a small price to pay for the overall risk reduction thereby achieved. In the long run, risk reduction and arms control measures are likely to follow the same pattern: start with declarations of numbers (or doctrines) then proceed to transparency and some unilateral confidence-building measures, thereafter set some limits and, eventually, agree on reductions with concomitant verification mechanisms to follow. This standard Cold War formula, however, is precisely an area with some room for innovation: it seems almost impossible to replicate traditional bilateral approaches in multilateral formats. Yet the Asia-Pacific region is certainly where multilateral measures may be most useful and needed.

One of the easiest possible wins in the region can be a development of a multilateral long-range missile launch notification regime, which is still absent from the realities of today. There are several bilateral regimes (e.g., between Russia and the United States, between Russia and China, between India and Pakistan) with some exemptions, and there is an existing multilateral voluntary data exchange framework within the Hague Code of Conduct. Best practices from all of these formats can be put to good use in the Asia-Pacific region (which can be both narrowed to 'Northeast Asia' or extended to the Indo-Pacific). Moreover, given the ever-growing capabilities of the national Early Warning Systems in the region, there is a possible technical layer providing a kind of verification capability for such multilateral notification regime (land-based Missile Attack Warning System layer in Russia completed the upgrades and is now the "Voronezh" radar network, which is being augmented with multi-band capability; space-based layer of the Missile Attack Warning System—"Tundra" satellites of the "Kupol" system; Russian support and assistance in developing the Chinese Early Warning system development; well-established network supporting the US Missile Defense with input from Japan and South Korea).

Another important domain where much can be done with rather limited 'political' costs, not to mention actual costs in terms of required resources, is the establishment of hardened multilateral hotlines between the capitals of the region. This is hardly a new idea, but there is still room for improvement. Before diving into technical details, a proper Track I discussion on the list of topics that will be covered by such hotlines is needed. For some countries this might be a good way to limit the level of hostility with regard to patrols by long-range aviation (heavy bombers, anti-submarine aircraft, etc.) coming near one's airspace (or into the artificial "Air Defense Identification Zones," which are a provocation in itself). Others might be more concerned with the so-called Freedom of Navigation Operations. Nevertheless, having a dedicated communication network (which can be also used for transmission of notifications mentioned in the previous paragraphs) will be useful for everyone involved—if not to reduce the hostility itself, but definitely to reduce the risks of misperceptions and have an instrument to raise concerns. Also, as this would be a secure communication channel with limited access, it can be an effective tool to de-politicize possible incidents and solutions.

Finally, one of the most important factors is the political will of the decision makers in every capital involved. Agreeing to any arms control-like measures always comes with a risk of domestic opposition raising concerns about 'surrendering national interests.' To limit such risks the task of paramount importance is to find the right labels for any of the relevant measures, that would be explicitly linked to enhancing both national and international security rather than some goodwill gestures for the future of humanity.

Conclusion

Risk reduction, deconfliction, incidents prevention, arms control—all these concepts and efforts are not new. But those are not easy as well. The number and scope of threats to global peace and security (including those of apocalyptic scale) are hardly decreasing. Under such circumstances, it is a paramount responsibility of national leadership, as well as public, to continue the efforts focused on limiting and reducing the risks of major military conflicts, as those can easily spiral out of control and lead to nuclear use with the most dramatic consequences.

15. Trilateral Strategic Confidence Building Measures in Southern Asia

Feroz Hassan Khan

Introduction

The China-India-Pakistan strategic triangle is emerging in an era of great power competition wherein power rebalancing is shaping Asia's strategic alignments. While literature and publications on the China-India rivalry in Asia and the India-Pakistan conflict are in abundance, the implications of triangular relations involving the three nuclear armed countries—China, India, and Pakistan—are few and far between. Scholars find the China-India rivalry somewhat enigmatic; both countries engage economically but compete strategically. Except for one major war in 1962, generally, military crises between China and India have been less sporadic, more contained, and amenable to de-escalation through bilateral diplomatic means.[1] In contrast, the India-Pakistan nuclear dyad is much more deeply complicated and one of the most challenging and dangerous regional conflicts. The two have fought three major wars, engaged in numerous military crises, and remain at the brink of crises. The advent of nuclear weapons in South Asia ought to have induced efforts toward conflict resolution instead of an arms race imbibed with both countries investing heavily in conventional and nuclear arsenals.

Given cross-border terrorist attacks and militaries jockeying for better tactical or operational positions along contested borders in the mountainous trijunction of three nuclear-armed countries, the frequency of crises is increasing along the China-India border as well as along the India-Pakistan Line of Control (LoC) in disputed Kashmir region. At the trijunction of three nuclear-armed countries, the potential of major regional military crises—either between India and

[1] Jeffery Gettleman, Sameer Yasir and Kari Kumar, "India and China Faceoff Again at Border as Troops Move In," *New York Times,* August 31, 2020, https://www.nytimes.com/2020/08/31/world/asia/india-china-troops-border.html

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Pakistan or China and India —is increasing, and it could escalate to a major conventional war and nuclear catastrophe.

At the system level, the evolving balance of power in Asia affects regional stability in South Asia. China's meteoric economic growth has catapulted it to great power status, and Beijing is investing heavily in its military to project power, exert influence, and protect energy sources and commercial shipping lanes, particularly in the Indian Ocean. Hand-in-hand with Beijing's expanding power is its growing confidence to uncompromisingly assert its claims on disputed territories on China's periphery. Prominent among these are the entire Indian province of Arunachal Pradesh and the Aksai Chin area—adjoining China's volatile Tibet and Xinjiang provinces. Recalling India's defeat in the 1962 war with China, Indian security managers observe these developments with alarm.

Meanwhile, China-Pakistan relations are closer than ever. They are cooperating on a host of development projects collectively known as the China-Pakistan Economic Corridor (CPEC), which includes infrastructure expansion, defense research and development, and support for Pakistan's civil nuclear energy program. New Delhi interprets the China-Pakistan partnership as a deliberate effort to encircle and contain India and as a wedge driving India and Pakistan further apart. While China-Pakistan relations deepen and expand, India-Pakistan and China-India relations are deteriorating.[2] The United States has been a key provider of economic and military aid to Pakistan, but now Islamabad fears that its strategic relevance to the United States is waning with the US shift from war against terror in Afghanistan to the great power competition in the Asia-Pacific theater, part of which would be luring India as bulwark against rising China.

In the meantime, China is advancing its Belt and Road Initiative (BRI) and influencing regional countries as part of its peripheral diplomacy and furthering its network of economic and strategic hubs. The appealing BRI promises combined with the technological revolutions, create new grounds for competition, including digital connections between individuals, societies, and governments in an unprecedented manner. Consequently, smaller regional countries feel

[2] Two recent publications highlight the emerging triangular strategic balancing and power rivalry in South Asia. See Jeff M. Smith, *Cold Peace: Sino-Indian Rivalry in the 21st Century* (Lanham, MD: Lexington Books, 2014); Andrew Small, *The China-Pakistan Axis: Asia's New Geopolitics* (New York: Oxford University Press, 2015).

pressured to choose between major power centers in Asia.[3] Strategically located countries, like Pakistan, acquire bargaining power to leverage their land and sea connectivity in exchange for strategic alignment and new technology transfers. These major shifts in international affairs significantly affect threat perceptions, diplomacy, application of military force, and public expectations of government performance.

Though China and India are engaged in strategic competition and have had few bilateral security confidence-building-measures (CBMs), bilateral trade between them is near US$100 billion, and both engage diplomatically in various multilateral forums and organizations. In contrast, India and Pakistan currently have numerous CBMs, negligible trade, and virtually no engagement. Worse, while the frequency of India-Pakistan military crises is increasing, there are few bilateral mechanisms for crisis prevention, no structural off-ramps for crisis de-escalation, and no agreed framework for nuclear risk reduction.

This paper examines the prospects of triangular CBMs between China, India, and Pakistan as a means of developing a common agenda for weapons of mass destruction (WMD) nonproliferation and disarmament strategies. In the first section, the paper traces the history that led to the triangular strategic construct. The second section explores an appraisal of respective nuclear doctrines and develops a threat perception matrix. The third examines the existing risk reduction measures and existing CBMs, and the fourth section assesses prospects of triangular CBMs and proposes strategic restraint arrangements and risk reduction measures. Finally, the concluding section assesses strategic futures, draws major conclusions, and offers recommendations for a common agenda for the Asia-Pacific regarding the risk of nuclear war in the Pakistan-India-China triangle.

Strategic Triangle: A Historic Appraisal

Perspectives differ as to whether the China-India-Pakistan conflict constitutes a triangular strategic construct in Southern Asia. According to some, China-India and India-Pakistan are two

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[3] International Institute of Strategic Studies, *Strategic Survey 2019: An Assessment of Geopolitics* (London: Routledge Taylor and Francis, 2019), 12.

separate and asymmetric dyadic strategic rivalries with differing sources, objectives, motives, and drivers. However, both sets of rivalries are enduring in nature and are characterized with ideological underpinnings, territorial claims, and power asymmetry.[4] China and India have differing governing ideologies—the former is an authoritarian system while the latter is a pluralistic democracy. In essence, the China-India rivalry exists at three levels. At the system level, two historic civilizations are rising as major powers in the 21st century and competing for power and influence in Asia. At the regional level, they have territorial claims and disputed border alignments, which is a legacy of the previous colonial era. At the domestic level, the two have different models of governance and political traditions. Both are affected by ethnonationalism, which has hardened attitudes overtime, making compromise difficult for both.[5]

From the Chinese perspective, India and Pakistan are neighbours to its two most volatile provinces—Tibet and Xinjiang—abutting the Himalayas and Karakorum ranges. In 1949, China invaded Tibet and knocked on the doorsteps of South Asia. Aksai Chin links Tibet with Xinjiang, which is critical for China; India claims part of the state of Jammu and Kashmir (Ladakh region), which is also claimed by Pakistan.[6] China rejects India's former North-East Frontier Agency (now Arunachal Pradesh) and considers it to be part of Tibet (Southern Tibet). Both Aksai Chin and Arunachal were the battlegrounds in the 1962 war between China and India and subsequent border clashes, including the recent one in 2020. Since then, India has seen China as its main rival, though India's policy toward China at various times has vacillated between appeasement and aggression.

In 1954, India and China agreed on the *Panchsheel* principles to govern their bilateral relations.[7] India's security policy, manifested in the famous slogan *Hindi-Chini Bhai Bhai* (India and China

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[4]According to Paul, "Enduring *rivalries* are defined as conflicts between two or more states that lasts more than two decades with several militarized inter-state disputes punctuating relationship in between." T. V. Paul, ed., *The India- Pakistan Conflict: An Enduring Rivalry* (New York: Cambridge University Press, 2005), 3.

[5]Arunabh Ghosh, "India-China Border Conflict: An Analysis of India-China Row Must Acknowledge Dramatic Growth of Ethno-Nationalism," *Quint Newsletter*, June 19, 2020.

[6] In June 2020, China and Indian military forces clashed in Galwan Valley in Eastern Ladakh area. In 2017, another border clash occurred in Doklam area, which is at the junction of Bhutan, India, and China. https://www.thequint.com/voices/opinion/india- china-border-history-relationship-military-rise-of-ethno-nationalism-modi-govt-xi-jinping

[7] In 1954, Prime Zhou En Lai and Prime Minister Jawaharlal Nehru jointly established *Panchsheel*, the Five Principles of Peaceful Coexistence: mutual respect for sovereignty and territorial integrity; mutual nonaggression; noninterference in each other's internal affairs; equality and mutual benefit; and peaceful coexistence. Cited in

are brothers), was to bandwagon with China; however, it soon ran into trouble because both failed to resolve the border dispute inherited from the colonial era. Moreover, when China cracked down in Tibet, the spiritual leader Dalai Lama escaped and found refuge in India. Border disputes and the Tibet issue led to a series of China-India border crises, which laid the foundation for China-India rivalry. Until 1998, China's dominance outweighed India's aspirations to compete with China as a peer. Even after the 1998 nuclear tests, India's attempt to seek parity with China did not yield desired results immediately. India began to seriously countenance contesting China almost a decade after the nuclear tests, especially after the United States and India cemented a budding strategic partnership manifested in the U.S.–India nuclear deal in 2008 whereby the United States began encouraging India to claim its status as the Asian counterweight to rising China.

Despite historical, cultural, and social commonalities between them, the India–Pakistan rivalry is fundamentally ideological and much more antagonistic than relations between China and India. The India-Pakistan conflict dates to British colonial rule of the subcontinent when the rulers fanned communal problems between Hindus and Muslims to consolidate the British raj. Before departing, the British partitioned the subcontinent into India—a secular, pluralistic democratic state with a Hindu majority (with many ethnicities, religions, and languages)—and Pakistan, the creation of which was based on the demand that Muslims on the subcontinent constitute a separate Muslim nation-state in a geographically contiguous area. India's rejection of this notion is the root of the rivalry.[8] This ideological disagreement is compounded by contested territorial claims and rooted in the core dispute of Kashmir (a Muslim majority state). For over seven decades, the non-resolution of the Kashmir dispute and other inherited cross-border problems between India-Pakistan and China-India have resulted in wars, crisis, and the collapse of peace process and myriad agreements signed between all three countries.[9]

Jingdong Yuan, "Beijing's Balancing Act: Courting New Delhi, Reassuring Islamabad," *Journal of International Affairs* 64, no. 2 (2011), http://www.jstor.org/stable/24385533

[8]Of late, under the Modi regime, the rise of Hindutva and religious discrimination (especially against Muslims) has undermined India's democratic credentials and led to violent communal clashes. In turn, this vindicates the Pakistani two-nation theory and fuels further tensions within the subcontinent.

[9]This essay uses the terms "Indian administered Kashmir" and "Pakistan administered Kashmir" rather than more politically sensitive terms such India occupied Kashmir or Pakistan occupied Kashmir. The Chinese administered portion of the state of Kashmir is Aksai Chin area and Shaksam Valley that China and Pakistan settled in 1963;

In short, the dialectic of India and Pakistan as two opposing states has created an ideological power struggle in South Asia region, wherein India seeks domination of the Indian subcontinent, and Pakistan resists it as an anathema to its sovereign existence. Pakistan relies on external and internal balancing to contest India's domination. Externally, it seeks alliance or strategic partnerships. Internally, it relies on conventional military and nuclear weapons for national survival and security.

Pakistan is the weakest leg of the triangular dynamics in Southern Asia. Situated at the confluence of three geopolitical powerhouses (Russia, China, and India) and at the crossroads of South and Central Asia, Pakistan is both blessed and cursed by geography. Faced with acute domestic crises and regional threats, alliance politics have come naturally to Pakistan. For example, in the 1950s, the United States offered it partnership in Western-led alliances in the Cold War. Whereas the United States sought to "contain" the communist axis between the Union of Soviet Socialist Republics (USSR) and People's Republic of China, Pakistan's prime objective was to survive and balance against its arch-rival India. These fundamental cross-purposes and disconnect in the strategic objectives of the United States and Pakistan resulted in disenchantment with each other that gradually waned their alliance.

The 1962 China-India Himalayan border war brought Pakistan and China together with India as the common enemy and set in motion the triangular dynamics in the South Asian conundrum.[10] Realizing that alliance with a distant great power (that is, the United States) might not be of help when in trouble with India, Pakistan sought a special relationship with China, a neighbouring rising power. The 1965 and 1971 India-Pakistan wars over Kashmir and East Pakistan, respectively, cemented the China-Pakistan relations, especially after the latter war led to Pakistan's dismemberment and Bangladesh's birth.[11]

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however, India rejects the settlement, lays claim to the area, and considers the settlement illegal. This area now links China and Pakistan via Gilgit-Baltistan (Pakistan administered Kashmir).

[10]Pakistan and China quickly settled their border problems immediately after the India-China war. In March 1963, Pakistan and China agreed to delineate the border between China's Xinjiang province and Gilgit-Baltistan. Division of Pakistan administered Kashmir (Azad Kashmir). India protested the agreement blaming Pakistan for ceding Kashmir territory to China that India has continuously claimed. See Garver, *Protracted Contest.*

[11]Small, The China-Pakistan Axis.

Triangular Nuclear Contest

China, India, and Pakistan began their respective nuclear programs a decade apart from each other with the previously mentioned undercurrents affecting the decisions to go nuclear. Each of the three have experienced national humiliation, abandonment of allies, and have a strong sense of national identity or prestige of power associated with nuclear weapons.[12] China's quest for nuclear weapons began in the 1950s after the Taiwan Straits military crisis (Quemoy-Matsu conflict) with the United States. Long memory of centuries of colonial exploitation, humiliation at the hands of Japanese occupation in the 1930s–1940s, and the Soviet Union's abandonment of China at the peak of Cold War, reinforced China's determination to acquire a sovereign nuclear deterrent and ever since self-reliance became the foundation of the Chinese nuclear policy.

Like China, India is determined to revive its lost pride and take what it perceives as its rightful place in the world. Believing itself to be the inheritor of the British raj and imbibed with the premonition of past glory, India staunchly believes nuclear weapons confer prestige in world politics and this feeds its ambition of achieving great power status. India refused to sign the nonproliferation treaty (NPT) when it came into force and conducted its first nuclear test in 1974, which laid the foundation of nuclear competition in South Asia.[13] India's nuclear test in 1974 galvanized the Pakistani nuclear program, shifting it decisively from a hedging capability into a full-scale nuclear weapons program.[14] In addition to sharing centuries of Muslim rule with India in the subcontinent, Pakistan is the only nuclear-armed Muslim country today and very proud of its struggle of attaining independence and achieving nuclear capability against significant

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[12] Feroz Hassan Khan, Eating Grass: The Making of the Pakistani Bomb, Stanford University Press, 2012: 7-10

[13]Chinese nuclear tests happened two years after India's humiliating defeat in 1962 border war. The defeat continues to have a huge psychological impact on India's national security and its approach to nuclear proliferation. See Jacques C Hymans, The Psychology of Nuclear Proliferation: Identity. Emotions, and Foreign Policy (New York: Cambridge University Press, 2006), 171.

[14] In the 1970s, there were other developments at the nexus of China, India, and Pakistan region that affected policies in this critical Cold War period. A series of coups in Afghanistan transpired throughout the decade and culminated in the USSR's invasion of Afghanistan. The Islamic Revolution in Iran overthrew the shah of Iran and crises between United States and Iran began. Each of these developments brought Pakistan into the eye of the storm and catapulted its strategic significance, which impacted U.S.-Pakistan relations both positively and negatively.

obstacles and nonproliferation challenges. Pakistan staunchly believes nuclear capability is at the core of its sovereignty, national security strategy, and survivability.

Nuclear Doctrinal Dissonance

After acquiring nuclear weapons, China, India, and Pakistan adopted minimal deterrent strategies. All three, however, have continued to advance their deterrence capabilities regardless of their spoken intent. For instance, China need only have a credible minimal deterrent to deter India but concerns over U.S. advances, especially in ballistic missile defense (BMD), have forced China to question whether its retaliation would be assured. Presently, India is seriously considering decoupling its nuclear policy with separate pledges for China and Pakistan. There is ongoing debate within India about keeping its first use option open against Pakistan (possibly in response to Pakistan's full spectrum deterrence posture) while maintaining a nuclear no first use policy against China.[15] India's increasingly diversified strategic force posture and historical plans threatening to preemptively snuff out Pakistan's nuclear facilities,[16] regardless of its rhetoric focusing on China and marginalizing the Pakistani threat, suggest otherwise. Try as it might, India cannot seem to de-hyphenate itself from Pakistan.[17]

From the Chinese perspective, South Asia is a secondary focus, and the nature of the India-Pakistan crisis-ridden relationship especially, distracts China from its primary focus on threats on its eastern seaboard (East China, Taiwan, South China Seas). China borders four nuclear states: Russia, India, Pakistan, and the DPRK. In addition, Japan and the ROK are under the extended deterrence of the United States. In China's threat perception, U.S. pressure to contain China is increasing, and, consequently, Beijing's primary focus is on the shifting nature of its strategic relations with the United States. China's nuclear relationship with India is a new driver affecting Chinese strategic thinking.

China's nuclear policy has been to maintain a "lean and effective" force posture based on self-reliance, an emphasis on no-first use doctrine, and minimum deterrence force posture sufficient

[15] Christopher Clary and Vipin Narang, "India's Counterforce Temptations: Strategic Dilemmas, Doctrine, and Capabilities," *International Security* 43, no. 3 (Winter 2018/19): 7–52,https://doi.org/10.1162/ISEC_a_00340
[16] Khan, *Eating Grass,* 230.
[17] Small, *The China-Pakistan Axis*, 32, 47–65.

to pose risks of second-strike. China seems to be shifting from this posture to a more assured, second-strike capability. Its primary reliance on medium and intermediate range delivery systems is moving toward intercontinental ballistic missiles (ICBMs, both road-mobile and silo-based), multiple independent re-entry vehicles (MIRVs) missiles, and nuclear-powered submarine launched ballistic missiles (SLBMs).[18] These transformations have induced strategic anxiety in India, which has embarked on its own strategic modernization program, which in turn has affected Pakistan. Consequently, a strategic chain reaction in Asia drives competition and shifts in doctrines and nuclear strategies.

After the 1998 nuclear tests, in a letter to President Clinton, India Prime Minister Atal Bihari Vajpayee justified India's nuclear test decision on the perception of the twin threat posed by China and Pakistan. India's declared doctrine includes three key elements:

1. Building and maintaining a *credible minimum deterrence* force posture that will remain dynamic and subject to threat conditions and change in environment.
2. A policy of *no-first use* and massive retaliation in response to first nuclear strike on India's territory or Indian forces anywhere.
3. India's right to *retaliate with nuclear weapons* in response to chemical and biological attack on India or Indian forces anywhere.[19]

It is quite clear that India's declared doctrine is flexible in interpretation, fluid in force goals, and conditional on a no-first-use policy. A no-first-use pledge is an unambiguous commitment that nuclear weapons will never be used unless the country suffers a first nuclear attack. However, India imposed two qualifiers to this policy. First, if India's military forces suffer nuclear attack "anywhere," it reserves the right to retaliate with nuclear response. India's second qualifier is nuclear retaliation against chemical or biological attack on Indian forces—again— anywhere. The term "anywhere" implies deterrent protection for the Indian military if it invades a neighbouring country should that country retaliate with nuclear weapons.

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[18] Eric Heginbotham et al., *China's Evolving Nuclear Deterrent: Major Drivers and Issues for the United States*, RR-1628-AF (Santa Monica CA: RAND Corporation, 2017), https://www.rand.org/pubs/research_reports/RR1628.html

[19] "The Cabinet Committee on Security Reviews operationalization of India's Nuclear Doctrine," Ministry of External Affairs, Government of India, January 4, 2003, https://bit.ly/3jrRvgG

India's credible minimum deterrence posture is dynamic; "minimum" includes ICBMs, SLBMs, MIRVs—or anything either China or Pakistan introduces in their inventory. The credibility of India's threat of "massive retaliation" is also questionable, given the tightly coupled geography of the subcontinent.[20] India's military conceived a concept of limited war under the nuclear umbrella and refined its operational concept to launch a sudden cross-border military operation purportedly in response to terror attack in which India believes Pakistan is complicit. Colloquially referred to as Cold Start, this combined land/ air operations concept calls for shallow maneuvers across Pakistan using intense firepower to inflict maximum destruction and to terminate a war on India's terms without crossing Pakistani nuclear threshold.

Pakistan nuclear policy is the opposite of India's and China's policy. Pakistan has decided not to declare any official nuclear doctrine and adopted a policy of deliberate ambiguity. However, Pakistan is not entirely opaque in its declaration on nuclear use. Several publicly declared statements from leaders and interviews and speeches from serving officials of Pakistan Strategic Plans Division (SPD) have explained the contours of Pakistan's nuclear doctrine. Pakistan nuclear doctrine is explicit that its nuclear weapon capability is India-specific and retains the options of nuclear first use as last resort to deter a major conventional war.

Like that of India, Pakistan's "credible minimum deterrence" posture has no fixed ceiling and is dynamic to respond to qualitative and quantitative threat (from India). Pakistan has also declared four criteria that would determine its decision on nuclear use: loss of territory, destruction of armed forces, strangulation of economy (naval blockade), and domestic instability.[21] These thresholds are deliberately ambivalent and clearly intended to deter the Indian military and to offset conventional asymmetry with India. In answer to India's Cold Start, Pakistan has introduced battlefield nuclear weapons with a short range of 60 kilometers and announced its

[20] For example, were Pakistan to use battlefield nuclear weapons against invading Indian forces on Pakistani soil, Pakistan considers it inconceivable that India would "massively retaliate," which would veritably mean causing "unacceptable damage" to India itself.

[21] Paolo Cotta-Ramusino and Maurizio Martellini, "Nuclear Safety, Nuclear Stability and Nuclear Strategy in Pakistan," interview with Khalid Kidwai (Como, Italy: Landau Network-Centro Volat, 2002), https://pugwash.org/2002/01/14/report-on-nuclear-safety-nuclear-stability-and-nuclear-strategy-in-pakistan/

nuclear capability will counter a full spectrum of threats at the tactical, operational, and strategic levels.[22]

The doctrinal disconnect between China, India, and Pakistan has created an arms race in Southern Asia. While China and India maintain a no-first-use policy and Pakistan refuses to pledge a no-first use commitment, all three are engaged in strategic modernization that includes entanglements of dual-use delivery capabilities in missiles and aircraft. By creating greater ambiguity in warheads, the distinction between warfighting and deterrence is further blurred.

Given that three interconnected nuclear capable countries are locking horns at the confluence of disputed territory of Kashmir in South Asia, it is imperative to construct an architecture of strategic restraint regime that ensures deterrence stability. In the next sections, I examine the efficacy of existing structures of risk reduction or conflict management following which I propose a strategic restraint regime for larger stability and balance in Southern Asia.

Analysis of the Existing Peace Agreements and Confidence Building Measures

The absence of adequate peace and security architectures and risk reduction mechanisms between the two South Asian dyads is a major concern and a cause for fragile stability. Given the frequency and intensity of crises between Pakistan and India, the probability of limited war escalating into a deeper war is far greater than one between China and India. Generally, the border between India and China had remained dormant for almost three decades until the Doklam (2017) and Ladakh (2020) border crises erupted. Furthermore, India and China have a good track record of deescalating crises through political engagement, but they have made no progress toward settling the bilateral disputes.

India views China as a strategic rival and competes with China to achieve strategic parity. In any tactical conflict with China, India's policy is to diffuse the crisis through diplomatic engagement. For its part, China dismisses India's threat perception and gives little countenance to any notion

[22] Feroz Hassan Khan, "Going Tactical: Pakistan's Nuclear Posture and Implications for Stability," *IFRI Proliferation Papers, No. 53*, September 2015, French Institute of International Relations at https://www.ifri.org/en/publications/etudes-de-lifri/proliferation-papers/going-tactical-pakistans-nuclear-posture-

of strategic parity with India. China's policy is to develop good relations with India and with all of India's neighbours through economic investments, including its BRI.

In contrast, India views Pakistan more in tactical terms; its current policy is to diplomatically isolate Pakistan and bear down with its military preponderance in response to alleged asymmetric use of proxy forces and its resistance to challenge India's hegemonic ambitions in South Asia. India is prepared to challenge Pakistani nuclear deterrent and engage Pakistan into a debilitating arms race, hoping that Pakistan would strategically exhaust itself. On its part, rather than getting entrapped in an arms competition with India, Pakistan has deepened its strategic partnership with China to balance against India. Over the past several years, India has perceived China and Pakistan as a collusive threat, which means that in any tactical conflict against either China or Pakistan, India's response could be on worse case assumption that could potentially move tactical level crises into a strategic dimension.[23]

For all these reasons, it is necessary that China, India, and Pakistan undertake a trialogue as soon as possible. Nuclear armed states acting on exaggerated threat perceptions raise domestic fears and public expectations for national security. As in all previous crises in the Southern Asia, domestic political circumstances will likely remain the proximate cause for crisis escalation. Media hype during recent crises in the region riles up public emotions, wherein political expectations are expressed in terms of winning or losing. Decision makers in democracies come under intense pressure to explain what kind of concessions political leaders made to the adversary for crisis de-escalation. Of late, during a crisis, public pressure on political and military leadership pushes each country into deeper commitment traps than the policymakers would have otherwise desired.

Conversely, public expectations may greatly increase the stakes in peace and conflict resolution. Hopes peak when a dialogue process is making positive strides and all sides are

[23] Snehesh Alex Phillip, "Don't Try Any Misadventure amid India's Tensions with China, CDS Rawat," *The Print* (New Delhi), September 3, 2020, https://theprint.in/defence/dont-try-any-misadventure-amid-indias-tensions-with-china-cds-rawat-warns-pakistan/495246/. Also see Rajat Pandit, "Two Front War is Real Scenario, Says General Rawat," *Economic Times*, July 18, 2018, https://economictimes.indiatimes.com/news/defence/two-front-war-is-a-real-scenario-says-general-bipin-rawat/articleshow/56324336.cms

engaged in innovating new CBMs. Public opinion thereby amplifies the dark and light moods that affect political leaders and complicates their task amid delicate negotiations.

Both dyads have made several attempts to create a peace and security framework to dampen the competition and build trust and CBMs. An examination of the past and existing arrangements reveals those measures that have been adopted indicate desire amongst all three states for durable peace and security and public demand to eschew violence and defuse crises.

Peace and Security Attempts: China and India

Panchsheel

India emerged from the post-colonial world as the largest country in South Asia, and its first Prime Minister, Jawaharlal Nehru, set the principles of India's foreign policy objectives in the context of the Cold War by declaring that "a deliberate policy of friendship with other countries goes farther in gaining security than almost anything else."[24] Despite being criticized for appeasing China, Nehru remained firm on his vision. Along with Chinese Premier Zhou Enlai, he signed the Five Principles of Peaceful Coexistence, or *Panchsheel*, in 1954. Nehru's vision became the central pillar of India's stated foreign policy philosophy: non-aggression, non-interference, peaceful coexistence, mutual respect, and mutual benefit in all interactions.[25] The 1962 war derailed the *Panchsheel* foundations of India-China relations. For several years after the 1962 war, smaller scale China-India border skirmishes sporadically continued until the mid-1970s and a brief standoff in 1986–1987.[26] China-India relations accelerated between 1988–1996 after Prime Minister Rajiv Gandhi paid a visit to China. After this visit, the two nations held five summits that resulted in two major agreements that laid the foundations of China-India peace prospects.

[24] Jawaharlal Nehru, *India's Foreign Policy: Selected Speeches, September 1946–April 1961* (New Delhi: Publications Division, Ministry of Information & Broadcasting, Government of India, 1961), 79, http://archive.org/details/indiasforeignpol00nehr
[25] Priya Chacko, *Indian Foreign Policy: The Politics of Postcolonial Identity from 1947 to 2004* (New York: Routledge, 2013).
[26] The last border military exchange was in 1975 (Sikkim). In 1979, Atal Bihari Vajpayee, then Indian foreign minister visited Beijing, which was the first visit in post Mao era. Another military standoff occurred in 1986–1987 in the Sumdorong Chu valley (Wangdung area). The border crisis stepped up again after Modi regime took power in 2014.

India-China Border Agreements: 1993 and 1996

On September 7, 1993, Prime Ministers Narasimha Rao and Li Peng signed the "Agreement on Maintenance of Peace and Tranquility along the Line of Actual Control (LAC)" at Beijing's Great Hall of the People. This agreement was acclaimed as the "first major conventional arms control agreement between two Asian countries without any role played by third countries."[27] This China-India agreement comprises nine articles that developed joint consensus to resolve the boundary question "through peaceful and friendly consultations."[28] Both agreed to keep border military presence "to a minimum level compatible with the friendly and good neighbourly relations," not to "undertake military exercises in mutually identified zones beyond agreed levels," and to "give the other notification of military exercises" along the border.[29] Under the agreement, both sides were required to initiate a process to "appoint diplomats and military experts to formulate, through mutual consultations, implementation measures for the present agreement."[30] The establishment of a group of experts made this CBM inherently dynamic and progressive and also provided a process to address frictions. In essence, this agreement provides space for the political leadership of China and India to focus on improving bilateral their relationship.[31]

In November 1996, India and China signed a second CBM agreement that comprised twelve articles during President Jiang Zemin's visit to New Delhi. Many analysts consider the agreement to be a veritable "no-war pact."[32] This agreement included additional military CBMs and specifically pledged that "neither side shall use its military capability against the other

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[27] Swaran Singh, "China-Indian CBMs: Problems and Prospects," *Strategic Analysis*, 20, no. 4 (July 1997) 543–559, https://www.idsa-india.org/an-jul-4.html
[28] Singh, China- India CBMs.
[29] Singh, China- India CBMs.
[30] Singh, China- India CBMs.
[31] Singh, "China-Indian CBMs;" Waheguru Pal Singh Sidhu and Jing-dong Yuan, "Resolving the China-Indian Border Dispute: Building Confidence through Cooperative Monitoring," *Asian Survey* 41, no. 2 (2001): 351–376, https://library.fes.de/libalt/journals/swetsfulltext/14218788.PDF
[32] "Agreement between the Government of the Republic of India and the Government of the People's Republic of China on Confidence-Building Measures in the Military Field Along the Line of Actual Control in the India-China Border Areas," Peacemaker UN, 1996, https://peacemaker.un.org/sites/peacemaker.un.org/files/CN%20IN_961129_Agreement%20between%20China%20and%20India.pdf

side."[33] Besides reaffirming commitments "to speed up process of clarification" and commence "exchange of maps indicating their respective perceptions...as soon as possible" (Article X),[34] the 1996 agreement also provided principles of "mutual and equal security" and mutual understanding on military forces deployments of such considerations and "parameters such as the nature of terrain, road communications, and other infrastructure and time taken to induct/de-induct troops and armaments."[35] An important element of the agreement pertained to *categorizing offensive weapons* to which both sides agreed to prioritize withdrawal and "exchange data on the military forces" to reduce deployments.[36] A major CBM in the China-India agreement was to "avoid holding large scale military exercises involving more than one division (15,000 troops) in close proximity to the LAC." Both sides agreed to inform the other side on the "type, level, planned duration and areas of exercise" if it involved more than a brigade (5,000 troops) and de-induct "within five days of completion" and provide clarifications to the other whenever either side sought. Yet another important CBM in the 1996 agreement included prohibition of any use of "hazardous chemicals, conduct blast operations or hunt with guns or explosives within two kilometers" of the LAC, unless it is "part of developmental activities" in which case the other side shall be informed "through diplomatic channels or by convening a border personnel meeting, preferably five days in advance."[37]

The 1996 border mechanism agreement required both sides to "strengthen exchanges and cooperation between their military personnel and establishments," designate points for border meetings, establish "telecommunication links" between these border points, and establish "step-by-step medium and high-level contacts between the border authorities."[38] China and India agreed to cooperate with each other on any land or air intrusions "because of unavoidable circumstances like natural disasters" and "extend all possible assistance" to each other.[39]

[33] Peacemaker UN, "Agreement."
[34] Peacemaker UN, "Agreement."
[35] Peacemaker UN, "Agreement."
[36] The offensive weapons included armoured tanks, infantry combat vehicles, artillery guns (including howitzers) with 75 mm or bigger calibre, mortars with 120 mm or bigger calibre, surface-to-surface missiles, surface-to-air missiles. In addition, two agree that no combat aircraft which "include fighter, bomber, reconnaissance, military trainer, armed helicopter and other armed aircraft" shall be allowed to fly "within ten kilometers" of the Line of Actual Control (LAC) "except by prior permission" from the other side. Peacemaker UN, "Agreement."
[37] Peacemaker UN, "Agreement."
[38] Peacemaker UN, "Agreement."
[39] Peacemaker UN, "Agreement."

Finally, both agreed to establish a "China-India joint working group" on boundary questions and to commence "mutual consultations" to implement the agreement.[40]

The comprehensive character of the 1993 and 1996 agreements generated an atmosphere of peace and amity in which the People's Liberation Army-Air Force (PLAAF) and Indian Air Force (IAF) attempted to create a code of conduct and began improving relations, that is, the IAF invited PLAAF officers to visit).[41] In the same spirit, the Indian and Chinese navies also began initiatives to build confidence and remove suspicions and doubts. There were suggestions for joint naval exercises, and India invited China's envoy to visit the Indian naval base at Port Blair in Andaman and Nicobar.[42] By the mid-1990s, China and India had normalized relations and clearly desired a peaceful resolution of border disputes and intent to engage in economic activities, turning Asian rivalry into healthy competition. China was surprised when India cited China as a principal reason for its decision to conduct nuclear tests in 1998, which underscores that the China-India issues are deeper than the apparent warming of relations manifested in the two border agreements.[43]

The China-India border crises in 2017 (Doklam) and Ladakh (2020) indicate that, despite existence of structure to prevent violence and crisis escalation, the two peace agreements are insufficient for settlement of conflict. It seems even more surprising that India and China went into a military crisis in summer 2020, when in January 2020, both countries had agreed to establish a military-to-military hotline between India's director-general military operations (DGMO) and China's Western Theatre Command.[44] It is unclear if the hotline was established when the Ladakh crises occurred, but it is clear that the China-India relationship is undergoing

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[40] Peacemaker UN, "Agreement."
[41] "Officers of PLAAF Have Been Visiting Indian Air Force Bases," *Times of India*, December 22, 1995, quoted in Swaran Singh, "Sino-Indian CBMs: Problems and Prospects," Institute for Defence Studies and Analyses, accessed November 5, 2020, https://www.idsa-india.org/an-jul-4.html
[42] Singh, "China-Indian CBMs."
[43] Indian Prime Minister Atal Bihari Vajpayee's letter to U.S. President Bill Clinton also alleged China-Pakistan nuclear cooperation as another reason for India decision to conduct nuclear tests. "Nuclear Anxiety; India's Letter to Clinton on the Nuclear Testing," *New York Times*, May 13, 1988, https://www.nytimes.com/1998/05/13/world/nuclear-anxiety-indian-s-letter-to-clinton-on-the-nuclear-testing.html
[44] Shaurya Karanbir Gurung, "New India-China Military Hotline to Become Operational between DGMO and Western Theatre Command," *Economic Times*, January 11, 2020, https://bit.ly/3jtqDx3

a downward spiral at a time when India-Pakistan tensions on the LoC in Kashmir continue to heat up following India's suppressive measures in Kashmir since August 2019. Lately, with the backdrop of the India-Pakistan military crisis in 2019 and the China- India crisis in 2020, Indian military leaders are more concerned about a two-front collusive threat from China and Pakistan. India's current policy is to decouple its dealing with China and Pakistan by reaching China diplomatically to diffuse the crisis but isolating and not engaging with Pakistan. India's policy is counterproductive, however, because it is only bringing China and Pakistan closer.

Peace and Security Attempts: India and Pakistan

The history of peace attempts between India and Pakistan begins immediately after partition and their war over Kashmir. The 1948 Kashmir war ended by dividing the Jammu and Kashmir state between India and Pakistan, and after their military forces ceased operations, they established the Cease-fire Line (CFL). Both sides entered into the Karachi Agreement of 1949 that established the code of conduct of the militaries at CFL—pending the final resolution of Kashmir under United Nations Security Council resolutions.[45] After the 1971 War, India and Pakistan signed the Simla Accord in July 1972 and, since then, the CFL became the LoC in Kashmir.

This accord brought a decade of peace throughout the 1970s; however, from the 1980s onward, India and Pakistan have undergone a series of military crises.[46]

Non-Attack on Nuclear Installations and 1991 Military CBMs

In December 1985, Pakistani President Zia-ul Haq visited New Delhi and concluded agreement in principle on "non-attack on nuclear installations," which was eventually formalized under Prime Ministers Benazir Bhutto and Rajiv Gandhi in December 1988. Both prime ministers also

[45] One of most durable India-Pakistan treaty was agreed under aegis of World Bank in 1960 known as Indus Water Treaty, which standardizes river water distribution from Kashmir into Pakistan's Indus water basin. "Fact Sheet: The Indus Waters Treaty 1960 and the Role of the World Bank," June 11, 2018, World Bank, https://www.worldbank.org/en/region/sar/brief/fact-sheet-the-indus-waters-treaty-1960-and-the-world-bank

[46] India and Pakistan differ in interpretation of the forum on Kashmir. Pakistan insists Kashmir remains a dispute under United Nations Security Council resolutions to be resolved after a plebiscite. India is adamant that the council's resolutions are superseded by the 1972 Simla Agreement, which binds the two countries to settle all disputes bilaterally.

agreed to establish a "hotline."[47] While a hotline between the two prime ministers did not materialize, the two militaries established hotlines at their respective military headquarters known as the DGMOs (Director Generals of Military Operations) that have been functional since 1990. Importantly, the military structures of India and Pakistan are similar compared to those between China and India, and in the India-Pakistan case there is regular DGMO exchange every Tuesday.

Not long after prime ministers Benazir Bhutto and Rajiv Gandhi made their agreement in December 1988, a new crisis erupted in Kashmir in the summer of 1989. This crisis again brought India and Pakistan close to another war. Over the next year, the crisis was diffused through U.S. intervention, which underscores the lack of any bilateral mechanism to end crises between the two. While relations between India and Pakistan remained strained as the Kashmir uprising was on all-time high, both countries agreed to several military CBMs in 1991.[48] In April 1991, India and Pakistan signed two military agreements in New Delhi "prior notification of military exercises" and " prevention of the violation of Airspace."[49] Taken together, the 1991 Military CBMs, DGMOs hotlines, and the Karachi Agreement of 1949 on LoC on Kashmir provide both countries with robust understanding to regulate and clarify the code of conduct of the two militaries. Yet, as is the case between China and India, the military CBMs between India and Pakistan have proven insufficient to prevent numerous military crises between the two.

Vajpayee Initiatives: The Lahore Agreement (1999) and Islamabad Declaration (2004)

In the mid-1990s, India's Prime Minister Inder Kumar Gujral took a bold initiative of reaching out to India's neighbors to resolve conflicts; the new cordial approach became famously known as the Gujral Doctrine. In this new spirit of forging regionalism, Pakistani Prime Minister Nawaz Sharif agreed to hold a "composite dialogue" on all issues affecting peace and security in the

[47] The hotline is a quick, reliable, and ever-ready communication link available to the leaders particularly in a military emergency. "India and Pakistan Agree Not to Hit nuclear plants, *Los Angeles Times*, January 1, 1989, https://www.latimes.com/archives/la-xpm-1989-01-01-mn-289-story.html

[48] "Confidence Building and Nuclear Risk-Reduction Measures in South Asia," Henry L Stimson Center, June 14, 2012, https:/www.stimson.org/2012/confidence-building-and-nuclear-risk-reduction-measures-south-asia/

[49] Two military CBMs were the Agreement on Advance Notification on Military Exercises, Maneuvers, and Troop Movements and the Agreement on Prevention of Airspace Violations and for Permitting Overflights and Landings by Military Aircraft.

region.[50] Gujral's successor, Prime Minister Vajpayee, refashioned Gujral's policy with an aggressive diplomacy towards neighbours, particularly with Pakistan, adding pragmatism and greater zeal to regional peace initiatives. After the nuclear tests, while both India and Pakistan were under nuclear sanctions, Prime Minister Vajpayee took a dramatic step of riding on a bus across the border into Pakistan and brought a peace initiative, which was signed between the two leaders as the famous "Lahore Declaration 1999."[51] By far, the Lahore Declaration of February 1999 is the most comprehensive agreement between India and Pakistan, the significance of which is all the greater because it was conducted after the 1998 nuclear tests and embedded both sides' best hope for peace and security on nuclear subcontinent. Within a few months, however, this dramatic peace initiative derailed on the heights of Kargil when India and Pakistan fought a short war in the summer of 1999. The Kargil crisis raised international concerns of nuclear conflagration in South Asia and shook the trust embedded in the 1991 military CBMs and high promise of the Lahore Declaration.

Nevertheless, Indian Prime Minister Vajpayee continued to pursue peace throughout his tenure from 1998–2004. In this period, Vajpayee again took the initiative of inviting President Pervez Musharraf, the architect of the Kargil war in 1999, to a summit in Agra in summer 2001, but the two sides failed to reach an agreement. Violence in Kashmir has continued to derail peace efforts throughout the post nuclear test period. A terror attack on the Indian parliament in December 2001 resulted in a 10-month military standoff between Pakistan and India in 2001–2002, which ended with a ceasefire agreement on LoC in 2003. Just before Vajpayee's term came to an end, he visited Islamabad for a meeting of the regional organization South Asian Association for Regional Cooperation (SAARC) and reached an agreement, the Islamabad Declaration, in January 2004, that included peaceful resolution of conflict.

Vajpayee's successor, Manmohan Singh, continued peace efforts with President Musharraf through backdoor channels for nearly four years. During this period, India and Pakistan came close to agreement on conflict resolution over Kashmir and informally agreed on a roadmap of

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[50] "Analysis of Pak- India Composite Dialogue, *IPRI Newspaper article*, September 2015, Islamabad Policy Research Institute at https://ipripak.org/analysis-of-pak-india-composite-dialogue/

[51] "Lahore Declaration," Nuclear Threat Initiative, last updated February 21, 1999, https://www.nti.org/education-center/treaties-and-regimes/lahore-declaration/

Kashmir solution, which became known as the Musharraf formula. Once again, New Delhi and Islamabad failed to bring to fruition the understanding both leaders had reached privately.[52] Since then, India and Pakistan have drifted so far apart that bringing them back onto a peaceful track is a colossal undertaking.

Trilateral Strategic Restraint Regime

The historic Lahore Declaration of 1999 included the Lahore Memorandum of Understanding (MOU), which laid down the basis of potential peace, security, and CBMs. As mentioned previously, India and Pakistan have a long track record of negotiating CBMs but lacked mechanisms for implementation.[53] One of the key reasons for failure to construct a security regime in South Asia is the continuing distrust between India and Pakistan and lately between China and India. Instead of reassuring the countries involved, CBMs lose effect when forward military deployment, unending violence, and aggressive military posturing continues.

Unpacking the China-India and India-Pakistan agreements reveals the nature of CBMs negotiated in the 1990s were similar, but India's approach to dealing with China is different than with Pakistan. Karan Sawny, an Indian scholar, observes,

> With China, India has had positive experiences with forces pulled back and tensions eased. India believes this is so because there is greater political will and common desire to normalize relations in the case of China but not so in the case with Pakistan.[54]

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[52] Khurshid Mahmud Kasuri, Neither a Hawk Nor a Dove: An Insider Account of Pakistan's Foreign Relations Including Details of the Kashmiri Framework (New York: Oxford University Press, 2015), 297–353.

[53] The Karachi Agreement of 1949; Simla Accord of 1972; Lahore Agreement of 1999; and Islamabad Accord of 2004 are some of the impressive bilateral accords. The Lahore MOU seeks developing mechanism for the implementation of existing CBMs.

[54] Karan R. Sawny, "The Prospects for Building a Peace Process Between India and Pakistan," in *Conflict Resolution and Regional Cooperation in South Asia*, Pervaiz Iqbal Cheema and Imtiaz H Bokhari, eds. (Islamabad Policy Research Institute 2004): 32–40.

Apart from political will, India's and China's force deployments against each other have been far less threatening and non-violent until 2017 and 2020 compared to India and Pakistan along the LoC in Kashmir and international border, which involves cross-border firing and casualties.

Trilateral Strategic CBMs

In 1998 after the nuclear tests, Pakistan introduced the concept of establishing a regional strategic restraint regime (SRR) between India and Pakistan as a foundation of a peace and security architecture as the best way to ensure strategic stability. To date, Pakistan continues to offer India the SRR, which comprises three interlinked propositions: conflict resolution process, conventional force restraints, and nuclear restraints. Under this concept, the first leg envisages a political process of engaging in an uninterrupted process of dialogue until a negotiated resolution to the India- Pakistan conflict could be found. Progress on such steps would ensure a friendly and peaceful environment as envisaged in the premise of all previous agreements. The second leg proposes a conventional restraint arrangement, which includes subsuming the existing military CBMs and nuancing it into formal conventional restraint agreements such as the creation of low military force zones along the border, the identification of offensive forces, and the process of notification. The third leg proffers a formalized nuclear restraint agreement, recognizing the existing state of non-deployed nuclear force postures between India and Pakistan. The nuclear restraint includes limits on strategic weapons deployments and development as well as prevention of arms racing, such as missile development restraints on payload ranges, mutual understanding not to mate missile frame with live warheads, agreement not to produce or acquire submarine launched ballistic missile (SLBMs), and halt developing or deploying missile defense. Such a regime would prevent accidental launches, increase the safety coefficient in nuclear operations, and simplify nuclear management. In essence, the SRR would formalize deterrence stability through a South Asian version of mutually understood mutually assured destruction.[55]

[55] Khan, *Eating Grass*, 296–301.

India has continually rejected the proposal citing other security concerns (China) and national objectives; India therefore refuses to bind itself bilaterally with Pakistan. Also, India does not want restraints on its conventional force because it has preponderance over Pakistan but not against China. Pakistan therefore refuses to agree on nuclear restraint and retains its nuclear-use option to offset conventional force asymmetry.

Over two decades have passed since the SRR was originally proposed. Now that India fears a China-Pakistan collusion, a trilateral SRR is needed that includes China as well. A new framework involving political, economic, and strategic commitments from all three states, which takes into consideration the new geopolitical shifts and technological innovations, is becoming essential for stability.[56]

I propose that China, India, and Pakistan consider a new strategic restraint framework that involves five legs, including:

1. a process of two separate sets of conflict resolution;
2. economic progress and interdependency;
3. conventional force restraints including deployment limits and low force zones;
4. nuclear restraint arrangement involving doctrinal assurance, and non-alerting status; and
5. establishing a modernized nuclear hotline at the level of head of state.

The new quadrangle of conflict resolution, economic progress, conventional and nuclear restraint is the best way forward.

Principles for Creating Conditions for Strategic CBMs

In the case of China and India, the 1993 and 1996 Agreements include principles and mechanisms and, similarly, in the case of India and Pakistan, the Military CBMs of 1991 and the Lahore Declaration of 1999 provide precedents and a framework for structuring mutual agreements—either bilaterally or at some stage—trilaterally. It is important that highest-level

[56] In the new proposal, I have added economic progress to conflict resolution as fourth element along with conventional and nuclear restraints. Also See Feroz Hassan Khan, "Strategic Restraint Regime 2.0," in Michael Krepon and Julia Thompson eds., *Deterrence Stability and Escalation Control in South Asia* (Washington D.C.: Henry L Stimson Center, 2014), 161–174, https://www.stimson.org/wp-content/files/file-attachments/Deterrence_Stability_Dec_2013_web_1.pdf

civil and military leaders identify the most urgent issues of peace and security and agree on mechanisms to settle these issues. Furthermore, if leaders use economic liberalization measures as a primary instrument of upgrading interstate relations, economic stakeholders and constituencies will have incentives to maintain a climate of cooperation and investment. Emergence of interdependent economic networks and reliance on cross-border trade will transform the region from the existential security-centric relationship into one that is more of an economic-centric relationship.

Should economic and trade imperatives displace traditional security priorities, the China- India-Pakistan confluence in Southern Asia could emerge as a hub of trading states instead of a hub of separatism, terrorism, and territorial disputes. Pakistan is geographically positioned to play a pivotal role in providing outlets and inlets for both Indian and Chinese trade. Should China, India, and Pakistan develop mutual trust and collective will to eschew security-centric thinking and prioritize trade, the regional and global markets are ready for a paradigm shift at the fulcrum of Central, South West, and South Asia.

Just as there is a symbiotic relationship between conventional and nuclear deterrence, so too are conventional force and nuclear force CBMs interlinked. When countries face asymmetric threats from superior conventional forces, they rely on nuclear deterrence to offset the imbalance. India faces a similar asymmetric situation with China just as Pakistan sees asymmetry with India. Though China and India have pledged not to use nuclear weapons, India's security concerns are far from being alleviated. Rather, India now sees twin threats from China and Pakistan. One way to resolve this conundrum is for China, India, and Pakistan to consider five broad principles that are derived from previously agreed principles that all three states had signed in separate agreements:

- Create a befitting political environment with less tensions and amenability for peace and security.
- Refrain from the use of sub-conventional strategies and assure each other that force would not be used to resolve problems.
- Recognize that conventional force balance and physical posture of respective militaries directly affect nuclear deterrence posture.
- Agree to establish institutional mechanisms to tackle crisis-triggering events at the

onset of crisis as the best way to prevent crisis escalation.

- Consider creating a trilateral framework that is unbiased from the consideration of other countries' threat assessments.

Formal Trilateral Conventional Arms Control Agreements

As explained elsewhere in this paper, the doctrinal priorities of each of the three countries are different. India insists on negotiating a no-first use doctrinal agreement without any restrictions on conventional force. Pakistan is unlikely to agree to this "without shifts in the conventional balance of forces, requiring CBMs to demonstrate non-hostile intent."[57] China in any case has no interest in bilateral discussions on nuclear issues with India (or Pakistan). But as explained above, all three countries have agreed already to some form of conventional force CBMs with each other. Therefore, the best way forward to guarantee non-use of nuclear weapons is to evaluate the existing conventional force CBMs of the 1990s and transform them into a formal conventional force arms control agreement between China, India, and Pakistan and including shifts in technological maturations of present times.

Some of the key overlap between 1993/1996 China-India Agreements and 1991/ Lahore MOU are as follows:

- Consensus to resolve all disputes through peaceful and friendly consultations.
- Military presence at borders to an agreed upon minimum level compatible with nature of terrain, road communications, and infrastructure.
- Categorize offensive/strike forces and offensive weapons and identify low force zones and agree to limits of military exercises and timings for notification to all.
- Exchanges of military force data and establishment of leadership and military hotlines.
- Formulation of joint working groups to review, clarify, and resolve all issues under the agreements under guidance from civil and military leaderships.

[57] Dalis Dassa Kaye, Talking to the Enemy: Track Two Diplomacy in the Middle East and South Asia (Santa Monica, CA: Rand Corporation Study, 2007).

Military Doctrines

Army. Lately India has nuanced its Army's proactive doctrine (Cold Start) land operations to include *surgical strikes* involving special forces and combined land-air cross-border strikes.[58] The Pakistan army announced the *Comprehensive Response Doctrine* and its nuclear establishment laid out the *full spectrum deterrence* concept. The respective Indian and Pakistani concepts reduce confidence if not entirely contradict the existing CBMs. The conventional force and nuclear force doctrines of both countries are seemingly disconnected and deliberately ambiguous, which can induce escalatory pressures during crisis. A sustained discussion on "security concepts"—as ordained in the Lahore declaration of 1999—is now important. China is now part of the equation, especially since India believes that China and Pakistan are actively collaborating against India.

Air Force. Given that the India-Pakistan crisis in February 2019 involved the two air forces, future crises are expected to be air-centric. Further, though India considers China as its principal threat, the majority of IAF activity and bases are on its western border, which increases the force readiness of the Pakistani air bases. It is about time to review the existing bilateral CBMs and discuss trilateral air force CBMs merging the 1991 and 1993/96 agreements.

Navy. China, India, and Pakistan may consider including incidents at sea analogous to the agreement between the Soviet Union and the United States. The Chinese, Pakistani, and India navies operate in international waters and in the absence of agreed protocols, rules of engagements and maritime communications have a potential for unintended maritime crisis.

Given that India has introduced a sea-based nuclear deterrent and that Pakistan is fielding nuclear weapons aboard a diesel submarine, both of which complicate strategic stability, agreeing to an 'incidents at sea agreement' between all parties has become extremely important.[59]

Joint Military Working Groups. As explained above, in the 1996 agreement, India and China had already agreed on a joint working group to redress border issues. It is time for all three states

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[58] Arka Biswas, *Surgical Strikes and Deterrence Stability in South Asia*, ORF Occasional Paper No. 115 (New Delhi: Observer Research Foundation, 2017), 7.
[59] Muhammad Ali, "Maritime Issues Between Pakistan and India: Seeking Cooperation and Regional Stability," (master's thesis, Naval Postgraduate School, 2012), 1-4.

to upgrade their military-to-military interactions to the highest level and create a dedicated channel of conversations between the military chiefs. For such an institutional arrangement, I propose that the military chiefs create military working groups comprising civil and military senior leaders to discuss issues on boundaries/ borders, revive and subsume existing CBMs and eschew military operations and activities that defeat the purpose of existing CBMs, and negotiate new military CBMs.[60] New CBMs should include emerging disruptive technologies such as cyber, artificial intelligence, autonomous weapons, and the possibility of entanglement of dual-use delivery means.

Non-Deployment of BMD and MIRVs. Another area where all three countries could agree to stall vertical proliferation of delivery means is to pledge not to deploy ballistic missile defense systems or multiple warhead missiles, which are deemed strategically destabilizing.[61] China, India, and Pakistan could formalize agreements of reporting to each other their respective peacetime garrisons of strategic missile units and expand flight testing notifications of all types of missiles including ballistic missiles, cruise missiles, MIRVs, space-launched vehicles, and sea-based missiles.

Shanghai Cooperation Organization and SAARC. In a recent article the respected Indian scholar Manpreet Sethi has suggested that China, India, and Pakistan formalize low-level alert levels that formalize the existing state of arsenals in all three countries and suggested all nuclear-armed states adopt such an agreement.[62] In 1998, when Pakistan originally proposed the SRR, it offered formalizing the existing non-alert status between India and Pakistan into a recessed nuclear posture. Endorsing Sethi's proposal of formalizing non-alert status,[63] I suggest that all

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[60] Feroz Hassan Khan, "Break the Impasse: Direct Talks Between Army Chiefs" in Michael Krepon, Travis Wheeler and Liv Dowling eds., *Off Ramps from Confrontation in Southern Asia* (Washington D.C: Henry L Stimson Center, May 2009) 154- 161 at https://www.stimson.org/wp-content/files/file-attachments/OffRamps_Book_R5_WEB.pdf

[61] For analysis of the cascading effect of missile defense, read Michael Krepon, "Missile Defense and the Asian Cascade," in *Nuclear Risk Reduction in South Asia*, ed. Michael Krepon, 237–270 (New York: Palgrave Macmillion, 2004).

[62] Manpreet Sethi, *Complexity of Achieving Strategic Stability in Southern Asia: An Indian Perspective*, Policy Brief No. 90 (Oslo: Norwegian Institute of International Affairs, 2020), https://www.nupi.no/nupi_eng/Publications/CRIStin-Pub/Complexities-of-Achieving-Strategic-Stability-in-Southern-Asia-An-Indian-Perspective

[63] Manpreet Sethi, *Complexity of Achieving Strategic Stability*.

three countries should start discussing this proposal of creating a framework on institutionalizing a non-alert arrangement in a specific geographic zone.

The Shanghai Cooperation Organization (SCO) could be the starting point for such a discussion where at least four major powers—Russia, China, India, and Pakistan—are members states. I propose declaring Southern Asia (including South Asia, Central Asia, Tibet, and Xinjiang) as a low-alert zone. Although short of a nuclear weapons-free zone, any agreements covering territories of SCO and SAARC states would be significant CBMs.

Trilateral Agreement of Non-attack on Nuclear Installations and National Command System. The 1988 India-Pakistan non-attack on nuclear installations agreement could be extended to include China. This extension would not only redress one of India's major concerns, but I also propose that the scope of the existing India-Pakistan non-attack agreement be expanded to include non-attack on nuclear command, control, and communication (NC3) including cyberspace. A trilateral non-attack agreement on nuclear installations and NC3 along with formalization of a low-alert status suggested above, would be a monumental CBM that would give much resilience to Asian stability.

Dedicated Political and Military Hotlines. Once a series of strategic restraint agreements are formalized between the three countries, I recommend a dedicated hotline between the prime ministers and foreign offices. Current hotlines between Indian and Pakistani military headquarters do exist, and they have been very useful during peacetime with routine clarifications and following standard bureaucratic protocols. The existing hotlines between land-based military forces should be expanded to involve air and naval command centers as well.

Military hotlines can help deflate pressures during border crises and complement political and diplomatic hotlines to de-escalate military confrontation.

To reach any understanding on the above proposals, I suggest that the best forum to initiate such a dialogue process would be the SCO where all three countries are members. A peace process under the watch of the highest leadership in each capital is now becoming important. Meanwhile, all three states must include eschewing the asymmetric strategies against the other in letter and spirit of the SCO, whether it be in Xinjiang; Kashmir, Tibet, Baluchistan/ Khyber Pakhtunkhwa; Arunachal Pradesh, or anywhere else.

China Removes Objections. China's insistence of not discussing nuclear issues with India has been overtaken by geopolitical shifts, strategic modernization, and technological maturation. China should reconsider its policy and initiate a trilateral strategic dialogue with India and Pakistan to redress India's "collusive threat" perceptions, remove impediments in implementing existing CBMs, and discuss new CBMs—especially the implications of new technologies on strategic stability. Discussing strategic issues with India and Pakistan would not confer status to the two non-NPT states but is necessary for stability in Asia. Russia and the United States respectively ought to encourage such an initiative.

India Removes Objections. In the same vein, India must now give up its policy of objecting and resisting international community mediation in this conflict-laden and crisis-ridden region. The international community now has stakes in the triangular nature and technological complexities of the conflict. For its part, the international community should no longer defer to India's objection to external peace-brokers, whose role is necessary in forging Asian stability.

Role of International Players

The international community can play a major role first in recognizing that emerging threat perceptions of tri-junction of South Asia warrant attention. It is time that the international community, especially the five nuclear weapons states, accept nuclear subcontinent as an existential reality. India and Pakistan must be brought into the folds of the nuclear world order so they can undertake obligations and stakes in the non-proliferation regime.[64]

Renegotiate and Expand Intermediate-Range Nuclear Forces to Asia. After 30 years of strategic arms control, the United States and Russia were unable to extend the Intermediate-

[64] India is a member of three export control regimes: the Missile Technology Control Regime, the Australia Group, and the Wassenaar Arrangement. Both India and Pakistan are vying for membership in the Nuclear Supplier's Group. See Feroz Hassan Khan, "Burying the Hatchet: The Case for a 'Normal' Nuclear South Asia," *Arms Control Today*, 46, no. 2 (March 2016), https://www.armscontrol.org/act/2016-03/features/burying-hatchet-case-%E2%80%98normal%E2%80%99-nuclear-south-asia

Range Nuclear Forces (INF) Treaty that was one of the epic arms control agreements in the Cold War. Apart from differing interpretations between Russia and the United States, one of the rationales was that the former treaty did not include China. The INF treaty is open for renegotiating. Should China agree to negotiate, I propose that India and Pakistan be included in the discussion. It would make no sense that three major powers renegotiate terms of new INF and not include affected countries in South Asia.

Expanding the Asian Missile Regime. Separate missile notification agreements between the United States and Russia, China and Russia, and India and Pakistan already exist. The 2005 India-Pakistan flight pre-notification agreement is an important CBM, but it is limited to ballistic missiles only. It does not include the additional families of missiles, including cruise missiles, hypersonic cruise, and MIRVs that are now or likely to be in the inventory of both South Asian nuclear-armed states.

American scholar Frank O'Donnell has proposed a novel CBM of integrating the missile flight-test notification between five nuclear states: United States, Russia, China, India, and Pakistan.[65] Endorsing O'Donnell's proposal, I suggest expanding the flight-testing to included space launch vehicles (SLVs) outside of which all missile tests must be notified in several stages. As a first step, I propose bringing India and Pakistan into the existing Russia-China missile agreement that would be best discussed under the aegis of SCO.[66] Further, India, Pakistan, and China should also be brought into a new version of "non-interference with national technical means" clause that are embedded in the US-Soviet/Russia treaties. The 1988 United States-Russia pre-notification agreements could be integrated into this unified missile regime. The merger of the three pairings would go a long way in stabilizing not only the trilateral region but also cover all of Asia.

Trilateral Asian ABM Treaty. One of the key elements of assuring strategic stability in the first nuclear age has been the creation of mutual vulnerability and assured retaliation through the

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[65] Frank O' Donnell, "Launching an Expanded Missile Flight-Testing Regime," South Asian Voices, October 19, 2019, https://southasianvoices.org/launching-an-expanded-missile-flight-test-notification-regime/#easy-footnote-%20bottom-6-11560

[66] China and Russia have only committed to inform each other of flight-tests of ballistic missiles with a 2,000 km plus range and a trajectory approaching their border. Donnell, "Launching an Expanded Missile."

survivability of nuclear forces in the face of a nuclear first strike. Manpreet Sethi and Happymon Jacob, two established scholars from India, have suggested a trilateral anti-ballistic missile treaty that would reduce vertical proliferation and increase confidence in stability.[67] In 1998, Pakistan had proposed a bilateral anti-ballistic missile treaty between India and Pakistan (as part of its SRR proposal). Now both China and India have embarked in acquiring ballistic missile defenses and Pakistan is the only one that has thus far not indicated pursuing it, which makes one country vulnerable and tilts the offense-defense balance in Southern Asia. A trilateral discussion on Asian ABM involving all three countries is now important.

Multilateral Naval CBMs. All three countries have significant maritime concerns since concepts such as "Indo-Pacific Region" and "Maritime Silk Road" have emerged. In addition, naval modernizations, port and harbor developments (Gwadar, Hambantota, etc.), and associated maritime activities are causing anxieties in all countries in South Asia. Most important of all are concerns arising with the introduction of sea-based strategic deterrents. The comingling of conventional and nuclear capable systems in the Indian Ocean and the absence of any professional interaction of those responsible for operating these nuclear forces is a huge void. India, China, and Pakistan need an agreed framework to discuss concepts of operations, rules of engagements, command and control issues, etc., and to commence discussions on new naval CBM activities and the roles of navies in the new strategic environment in the Indian Ocean.

Conclusion

Since the rise of the Narendra Modi and Xi Jinping as leaders in India and in China respectively, the triangular conflict in South Asia has intensified. For the past three decades India and Pakistan engaged in cross-border military crises, military mobilizations, and standoffs. The intensity and frequency of cross-LoC military crises (including air force combat) also increased in the past five

[67] Sethi, *Complexity of Achieving Strategic Stability*; Happymon Jacob, "Time to Consider A Trilateral Asian ABM Treaty," South Asian Voices, June 18, 2019, https://southasianvoices.org/time-to-consider-a-trilateral-asian-abm- treaty/. Also see Khan, *Eating Grass*.

years. As analyzed previously, the China-India and India-Pakistan rivalries are unlikely to resolve given continued border tensions and contested maritime interests in the Indian Ocean.

Nevertheless, there are *three* potential strategic futures in South Asia:

The first future involves *intensification of the China-Indian border tensions* that engulfs the India-Pakistan conflict over Kashmir, which leads to a broader escalation into maritime domain. A second future is one in which *relative status quo is maintained* with all sides failing to agree on any negotiable position on conflict resolution but informally understanding not to escalate conflict into a broader war. Such future leaves open sporadic border skirmish and continuing tensions between the three countries but no serious prospect for issue resolution. A third future could become possible should all three countries reach some form of *modus vivendi and proactively seek cooperation*. Such a future would lower tensions and commence dialogue leading to a sustained peace process.

The trilateral strategic restraint proposal advanced above is only feasible if the third future materializes. All sides could then agree to a grand bargain to finally settle the disputed border regions on common denominator and develop shared maritime interests in the Indian Ocean. All three sides have core interests in combatting terrorism and maintaining free trade in the global commons along with good reason to cooperate in multilateral forums on a wide range of global and regional issues. The possibility of such a cooperative future would most probably happen only with the facilitation of other major powers.

To achieve such a level of trust and confidence seems a long way away today, even though China, India, and Pakistan share a clear mutual interest in maintaining strategic stability and recognize the costs of conflict and benefits of cooperation. They have had shared differences for decades, which makes it very challenging for their leaders to seize the moment and take initiatives for cooperation—especially since all countries are experiencing the impact of Covid-19. To jump-start such a future, I suggest that India–China and India–Pakistan commence separate bilateral dialogues to consider the above strategic CBMs. In the next stage the three should commence a trialogue on the agreed bilateral CBMs and merge them into a comprehensive trilateral agreement.

Unfortunately, entrenched cognitive biases and low probability of visionary of like-minded leadership emerging at the same time in all three states makes such a positive future unlikely in the short term. The most likely future is one of continuing the current trajectory of land/air cross-border skirmishes and maritime competition while seeking cooperation in areas wherever possible. In sum, the three countries would be competing as well as seeking cooperation on lowest common denomination—somewhere between the *status quo* and increased competition with strategic balancing and deepening alliance.

16. Is a Nuclear Domino in Northeast Asia Real and Inevitable?

Chung-in Moon

Introduction

"How Dark Might East Asia's Nuclear Future Be?" This is the title of a working paper on nuclear domino in Northeast Asia published by the Nonproliferation Policy Education Center in 2016. Its editor Henry Sokolsky sent a chilling message: "Long considered unlikely, the prospect of South Korea and Japan getting nuclear weapons and China and North Korea significantly ramping up their arsenals has become the next big worry."[1] In this regional nuclear equation, the key factor is the DPRK's nuclear rush that can easily trigger a nuclear domino in Northeast Asia by driving Japan and South Korea to go nuclear. Both Japan and South Korea have an enormous latency to turn their civilian nuclear programs into nuclear armament. They possess both fissile materials that can be enhanced to weapons-grade and the technological capabilities to do so. The nuclear domino thesis in Northeast Asia became more pronounced as Donald Trump hinted at the inevitability and possibility of Japan and South Korea going nuclear in his interview with the *New York Times* on March 27, 2016.[2]

Five years after Sokolski's warning, the nuclear situation in the region seems to have worsened. In 2017, the DPRK undertook its sixth nuclear testing and test-fired 15 ballistic missiles, including Hwasung-15, an intercontinental ballistic missile (ICBM) aimed at the U.S. mainland. President Donald Trump responded to the moves by threatening to totally destroy the North at his U.N. General Assembly speech in September 2017. According to Bob Woodward's book, *Rage*, Trump

[1]Henry Sokolski, ed. *How Dark Might East Asia's Nuclear Future Be?* (Washington, D.C.: Nonproliferation Policy Education Center, August 26, 2016), Working Paper 1601: 1. http://www.npolicy.org/article.php?aid=1322&rt=&key=Ian%20Easton&sec=article&author=

[2] "Transcript: Donald Trump Expounds on His Foreign Policy Views," *New York Times,* March 26, 2016, https://www.nytimes.com/2016/03/27/us/politics/donald-trump-transcript.html

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deliberated a nuclear strike against the DPRK.[3] Crisis escalation was averted by a series of diplomatic developments, two inter-Korean summits and the first DPRK-U.S. Singapore summit in June 2018. But the failure of the second U.S.-DPRK Hanoi summit in February 2019 has led to a protracted stalemate. The unresolved DPRK nuclear quagmire continues to haunt South Korea and Japan.

The ROK government has been prudent in favoring a negotiated settlement through diplomacy, but conservative politicians and pundits have been advocating the development and possession of independent nuclear weapons. For them, the logic of 'nuclear for nuclear' is the only viable way to cope with DPRK threats. Otherwise, they argue that Seoul should seek the re-deployment of American tactical nuclear weapons and/or NATO type nuclear sharing. Public opinion in South Korea rather strongly supports the pursuit of nuclear weapons. Tokyo's reactions have been equally worrisome. Departing from the long-time tradition of 'nuclear taboo,' some Japanese politicians and opinion leaders began to raise the possibility of nuclear options. A dangerous vicious cycle of the nuclear dominoes in Northeast Asia seems on the horizon.

This essay aims at unraveling the dynamic nature of the nuclear domino phenomenon in Northeast Asia primarily focusing on the DPRK, South Korea, and Japan. The first section examines the DPRK's nuclear/missile threats as its trigger. The second looks into South Korea's public debates on nuclear options ranging from independent nuclear weapons development to the re-transfer of American tactical nuclear weapons and the NATO style nuclear sharing. Public opinion on nuclear weapons will also be analyzed. The third section will trace how developments on the Korean peninsula have affected Japan's public debates on nuclear weapons and underlying public opinion. Finally, it will examine whether the nuclear domino phenomenon in Northeast Asia is real and suggest ways to prevent the advent of nuclear entanglement.

Assessing DPRK Nuclear and Missile Threats

Of five legitimate nuclear weapons' states, three (the United States, Russia, and China) are competing in Northeast Asia, but an amazing strategic stability has prevailed in the region since 1970 that can be attributed to the combination of nuclear deterrence, the fear of mutually assured

[3] Bob Woodward, *Rage* (New York: Simon & Schuster, 2020): 71.

destruction, and the Non-proliferation Treaty (NPT) regime. Nonetheless, the DPRK's nuclear ambition has trembled the region's strategic landscape. After the first successful test launching of an ICBM in November 2017, Pyongyang officially declared that it has completed its nuclear forces.

Since the second nuclear crisis in 2002, the DPRK has made steady progress in its nuclear weapons capability.[4] It now has nuclear facilities, fissile materials (both plutonium and highly enriched uranium), and 30 to 60 warheads. It is estimated that the DPRK can increase its nuclear arsenal by six to twelve warheads per year.[5] Its delivery capabilities have also remarkably improved. North Korea now possesses twenty types of short (Scud-B and C, KN-23) and intermediate ballistic missiles (Nodong) and ICBM (Hwasong-15) as well as SLBM (Bukguksong series), of which fifteen can carry nuclear warheads.[6] The DPRK is also known to have miniaturized its warheads, making them smaller and lighter. Pyongyang has conducted six rounds of nuclear testing, culminating in the successful testing of a hydrogen bomb on September 3, 2017.

The NPT regime does not allow the recognition of the DPRK as a nuclear weapons state, but the indicators above exemplify that it has completed the process of nuclear weaponization. Kim Jong Un's remarks at the Eighth Party Congress of the Korea Workers' Party (KWP) on January 12, 2021, alarmed the world. He stated that the DPRK has successfully developed tactical nuclear weapons by mastering their miniaturization and standardization. He also added that it has acquired

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[4] As to the overview of the DPRK's nuclear capabilities, please refer to Bruce W. Bennett, Kang Choi, Myong-Hyun Go, Bruce E. Bechtol, Jr., Jiyoung Park, Bruce Klingner, Du-Hyeogn Cha, ***Countering the Risks of North Korean Nuclear Weapons*** **(Santa Monica:Rand/Asan, 2021)** https://www.rand.org/pubs/perspectives/PEA1015-1.html; Open Nuclear Network, "Analysis of the results of the 8th Congress of the Workers' Party of Korea: (February 021) https://www.oneearthfuture.org/program/open-nuclear-network/publications/8th-congress-workers%E2%80%99-party-korea-1; Patrick Cronin, *Fear and Insecurity: Addressing North Korean Threat Perception* (Washington, D.C.: Hudson Institute, 2021) https://www.hudson.org/research/16752-fear-and-insecurity-addressing-north-korean-threat-perceptions ; Peter Hayes and Chung-in Moon (eds.), "Special Issue: Breaking the Nuclear Deadlock in Northeast Asia: Rethinking the North Korean Nuclear Crisis," *Korea Observer* Vol. 47, No. 4 (Winter 2016); Shane Smith, "Alternative North Korean Nuclear Futures," in Sokolski, op. cit.: 41-50.

[5] Siegfried Hecker estimates six per year, whereas the RAND Corporation/Asan report twelve per year. See *38 North*, "Estimating North Korea's Nuclear Stockpiles: An Interview With Siegfried Hecker," April 30, 2021. https://www.38north.org/2021/04/estimating-north-koreas-nuclear-stockpiles-an-interview-with-siegfried-hecker/?utm_source=Stimson+Center&utm_campaign=6b91e4ff50-38N_RSS_AUTOMATED&utm_medium=email&utm_term=0_15c3e20f70-6b91e4ff50-46310277&mc_cid=6b91e4ff50&mc_eid=ed6f75f703; RAND/Asan, op.cit.: 36-38.

[6] See RAND/Asan Report, op. cit. p.30, table 3.1.;Missile Defense Project, "Missiles of North Korea," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified November 30, 2020, https://missilethreat.csis.org/country/dprk/

the largest hydrogen bombs. In addition, extra-large scale multiple rocket launchers, news cruise missiles (KN-23), and multiple independently retrievable vehicles (MIRV) were introduced. It is worthy to note in Kim's remarks that the DPRK will be developing hypersonic gliding vehicles, military reconnaissance satellites, and nuclear-powered submarines. These cutting-edge weapons might be on Kim's wish list to balance new weapons procurements in the United States and South Korea.[7]

Equally troublesome is the DPRK's assertive behavior since the failed Hanoi summit. Instead of testing strategic weapons that threaten the U.S. mainland, the DPRK test fired short-range missiles such as KN-23 (range 600 km, equivalent of Russian Iskander), KN-24 (range 400 km, equivalent of ATAKIM), KN-25 (400 km, mega caliber multiple launchers), and KN-09 (250 km, large caliber multiple launcher) sixteen times between May 2019 and August 2020, all of which aim at South Korea and American military bases there. The DPRK also test fired the submarine-launched ballistic missile (SLBM) Bukguksong-3 on the barge in October 2019 and Bukguksong-4 (2,000 km) in October 2020 and displayed Bukguksong-5 (3,000 km) at the military parade in January 2021. At a military parade in October, 2020, Hwasong-16 (range 13,000km) was also shown.[8]

Given the mix of new strategic and tactical weapons, Pyongyang's intention seems twofold. Whereas Hwasong-15 and 16 are for securing a minimum deterrence through second strike capability targeted at the U.S. mainland, short-range ballistic and cruise missiles and SLBMs are designed for a tactical deterrence by denial against South Korean forces, American forces in Japan and South Korea, and U.S. reinforcement forces.[9] Furthermore, Kim Jong Un's instruction at the Eighth Party Congress to make tactical nuclear weapons operational has alerted Japan and South

[7] Jina Kim, "Analysis of the 8th Party Congress and Implications for National Security and Foreign Affairs," Korea Institute of Defense Analysis, Kugbang Rondan No. 1835 (21-3), January 19, 2021 (in Korean). https://www.kida.re.kr/frt/board/frtNormalBoardDetail.do?sidx=382&idx=1895&depth=3&lang=kr

[8] Jungsup Kim, "Assessing North Korea's Nuclear and Missile Threats: An Update," a paper presented at an international joint seminar on "Assessing Northeast Asia Nuclear Domino," the APLN-Sejong Institute, May 14, 2021 (in Korean).

[9] See Jungsup Kim, Ibid; Kim's analysis of the DPRK's motives is sharply contrasted with that of the RAND/Asan report which cites the preservation of Kim Jong Un's regime, achieving Korean unification in its terms, and seeking a new power status in the region as principal motives behind the DPRK's pursuit of nuclear weapons. See RAND/Asan Report, op. cit: 3-4. But this premise seems troublesome at least on two accounts. First, the DPRK is the monolithic Suryong (Leaders) system and, thus, theoretically speaking, its leadership is not concerned about internal challenges to regime security. Second, the DPRK recently amended the preamble of KWP's by-law regarding the goal of unifying the South under its terms, implying the abandonment of its united front strategy.

Korea. Indeed, North Korea's nuclear/missile capabilities are currently posing 'existential' threats to Japan and South Korea.

South Korea's Responses: Seek Independent Nuclear Armament

Facing nuclear/missile threats from the DPRK, the South Korean government has taken a firm position. At a National Assembly speech on November 1, 2017, President Moon Jae-in assured that South Korea will not seek nuclear weapons not only because the United States is providing a credible nuclear umbrella to the South,[10] but also because Seoul's pursuit of a nuclear path can invalidate the 1992 Joint Declaration on the Denuclearization of the Korean Peninsula as well as derail its efforts to denuclearize the Korean peninsula peacefully.[11]

Defying the government position, however, conservative politicians and opinion leaders have raised strong voices in favor of independent nuclear weapons.[12] There are two schools, teleological and instrumentalist. The teleological school emphasizes 'nuclear sovereignty' based on the logic of 'nuclear for nuclear' and seeks nuclear armament regardless of American stance. One of its proponents argues that "countries without nuclear weapons are not truly independent one"[13] and nuclear weapons are the only way to cope with the DPRK's nuclear threats and to survive the harsh Northeast Asia's strategic reality. For them, nuclear weapons are the end in itself.[14] For the

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[10] Since the establishment of the ROK-U.S. Combined Forces Command in 1978, the United States has affirmed extended deterrence to South Korea. After the DPRK undertook its first nuclear test on October 9, 2006, then Defense Secretary Donald Rumsfeld reassured extended deterrence including its nuclear umbrella to South Korea. At present, the ROK and the United States jointly operate the Extended Deterrence Strategy and Consultation Group through which convention and nuclear extended deterrence is discussed.

[11] On Moon Jae-in's Korea Peace Initiative, please refer to Chung-in Moon and John Delury (eds.), *Bridging the Divide: Moon Jae-in's Korea Peace Initiative* (Seoul: Yonsei University Press, 2019).

[12] "Voices demanding nuclear armament are on the rise," BBC News Korea, September 26, 2017. https://www.bbc.com/korean/news-41377195 (in Korean); Robert Einhorn and Duyeon Kim, "Will South Korea Go Nuclear?", *The Bulletin of Concerned Nuclear Scientists*, August 2016, https://thebulletin.org/2016/08/will-south-korea-go-nuclear/

[13] Gap-je Cho, "Two Reports' Shock: American experts' assessment of nuclear armament capabilities in Japan and South Korea," *Monthly Chosun,* May 2016 (in Korean). http://m.monthly.chosun.com/client/news/viw.asp?nNewsNumb=201605100035&form=MY01SV&OCID=MY01SV

[14] Mong-jun Chung, "In front of North Korean nuclear threat, what can we do?" http://blog.naver.com/globalmj/220613981473/; Interview with Cho Gapje, "Nuclear for nuclear is the best deterrence, balance of terror should be realized,"" Kim Jong-bae's program, *TBS*. February 23, 2016. http://tbs.seoul.kr/news/newsView.do?seq_800=10137770&typ_800=12; "Tae-woo Kim argues ' nuclear armament for self-defense should be open'" *Yonhap News*, February 1, 2017.

instrumentalist school, however, an independent nuclear armament is conditional. If nuclear deterrence is credibly secured by an American nuclear umbrella through either the re-deployment of its tactical nuclear weapons or a NATO-style nuclear sharing, there is no need for an independent nuclear path. If not, they argue, South Korea should go nuclear independently.[15] The teleological school seems a minority, whereas the instrumentalist school a majority. Nevertheless, both schools advocate South Korea's nuclear latency, posing a serious concern.

Politicians from the conservative opposition party constitute the core of the teleological school. Won Yoo-cheol, then floor leader of the ruling Liberty Korea Party, the staunchest advocate of nuclear weapons development, argued that "we cannot borrow an umbrella from a neighbor every time it rains. We need to have a rain coat and wear it ourselves."[16] He even suggested that South Korea should withdraw from the NPT to guard our own destiny. After the Moon Jae-in government was inaugurated in May 2017, a number of leading conservative opposition politicians followed his suit. Kim Jong-in, then leader of the conservative opposition People Power Party stated that "unless North Korea abandons its nuclear weapons, we should think about having nuclear armament."[17] Oh Se-hoon, another opposition party leader and currently Seoul City Mayor, also echoed a view that "unless we take the extreme measures [i.e., nuclear armament], the North will not change."[18] This is a general sentiment among conservative politicians.

Some conservative opinion leaders have been campaigning the pro-nuclear posture. For example, a staunch conservative hardliner Song Dae-sung argues that "without nuclear weapons, we will become a slave of North Korean nuclear. Nuclear balance of terror is the only way to deal with

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https://www.yna.co.kr/view/AKR20170215054700004; Dae-jung Kim, "South Korea's nuclear weapons, it is well worthy of debating," *Chosun Ilbo*, February 7, 2011 (all in Korean). https://www.chosun.com/site/data/html_dir/2011/02/07/2011020701994.html?form=MY01SV&OCID=MY01SV

[15] Nakgyu Yang, "Redeployment of tactical nuclear weapons revisted," Asia Gyeongje, September 19, 2020 (in Korean). https://www.asiae.co.kr/article/2020091810214441111; Eun-cheol Lee, "Cho Kyung-tae's nuclear armament proposal is drawing attention," *Busan Ilbo*, July 31, 2019 (in Korean). http://www.busan.com/view/busan/view.php?code=2019073119381781177

[16] Requoted from Henry Sokolski, ed. *How Dark Might East Asia's Nuclear Future Be?* (Washington, D.C.: Nonproliferational Education Center, August 26, 2016), Working Paper 1601, p. 88. http://www.npolicy.org/article.php?aid=1322&rt=&key=Ian%20Easton&sec=article&author=

[17] Il-hoon Hyun, "Kim Jong-in, 'if North Korea does not give up nuclear, we should deliberate on nuclear armament," Joongang Ilbo, November 25, 2020 (in Korean). https://news.joins.com/article/23929344

[18] Min-woo Kim, "Oh Se-hoon who joins nuclear armament says 'unless we take an extreme measure, the North will not change," *Chosun Biz,* June 19, 2020. https://biz.chosun.com/site/data/html_dir/2020/06/19/2020061901282.html

North Korea."[19] Chosun Ilbo, the leading conservative daily, has been openly supporting nuclear armament through its editorials. Kim Dae-jung, its senior editorial advisor, went further by claiming the DPRK nuclear threat will eventually lead to Japan's nuclear armament, leaving South Korea as the only country without nukes in the region. That will be a nightmarish scenario. According to his line of reasoning, South Korea's internal debates on the development and possession of nuclear weapons will send a warning to China, while serving as an effective card to resolve the DPRK nuclear problem. He has then been proposing to place the nuclear armament issue as a major agenda for the general election and the presidential election.[20] Jeong-hoon Lee, a senior journalist with *Donga Daily*, concurs with him, but points out that nuclear weapons are inconceivable without nuclear sovereignty that in turn requires an autonomy from the United States with regard to uranium enrichment and reprocessing of spent fuel rods.[21]

Even some anti-nuke liberals have changed their stance. After the DPRK's sixth nuclear testing in 2017, Bae Myong-bok, a well-known liberal columnist, advocated the nuclear path as a useful leverage to denuclearize the DPRK.[22] Another liberal, Chung Seong-jang, a leading North Korean specialist, also claimed that South Korea should have its own nuclear weapons to create a balance of power on the Korean peninsula and in the region. The DPRK will not give up its nuclear weapons, and a nuclear balance of power is the only way to cope with the DPRK nuke. He contended that South Korea should reemerge as a credible middle power with nuclear weapons that can prevent the outbreak of war, leading to a peninsular and regional peace through a balance of power.[23] Worrisome is that debates on nuclear weapons are no longer considered taboo. It is tantamount to opening the Pandora's Box.

Apart from the DPRK's nuclear and missile threats, there are several other factors that drive South Korea's public debates on nuclear armament. The growing skepticism of the U.S. extended nuclear

[19] Jin-yeo Park, "Report on the publication ceremony of Dr. Dae-sung Song's Book, 'We should also have nuclear weapons'," *Dailian*, August 24, 2016 (in Korean). https://www.dailian.co.kr/news/view/586835/?sc=naver

[20] Dae-jung Kim, "We should have nuclear weapons," Chosun Ilbo, January 29, 2019 (in Korean). https://www.chosun.com/site/data/html_dir/2019/01/28/2019012802626.html

[21] Seoul's hard lobbying notwithstanding, Washington currently does not allow the South Korea's back end of nuclear fuel cycle in accordance with the ROK-U.S. Civil Atomic Energy Cooperation Accord. See Jeong-hoon Lee, *South Korea's Nuclear Sovereignty* (Seoul: Geulmadang, 2013) (in Korean).

[22] Myong-bok Bae, "Korean Peninsula peace through nuclear balance," *Joongang Ilbo*, September 17, 2019 (in Korean). https://news.joins.com/article/23578701

[23] Seong-jang Chung, "Trump's redeployment of tactical nuclear weapons vs. South Korea's independent nuclear armament," *Ajugyeongje,* March 6, 2017. https://www.ajunews.com/view/20170305161349769

deterrence mattered. Chung Mong-joon, an influential politician and the founder of the Asan Institute for Policy Studies, coined the term 'torn nuclear umbrella' to describe his lack of trust in an American nuclear umbrella. He also suspected that the United States will not sacrifice Los Angeles for Seoul.[24] The skepticism has intensified as a result of Trump's rhetoric and policy. During his presidential campaign, he suggested he would allow Japan and South Korea to go nuclear. And his transactional handling of the alliance after the election heightened concerns in Seoul and Tokyo that he might withdraw American forces any time. The nuclear option was raised as a fallback strategy in the absence of American conventional and nuclear deterrence.[25] Such thinking is not new. President Park Chung-hee sought a nuclear weapons development when the Nixon administration decided to reduce and even withdraw American forces from South Korea in the early 1970s. An argument that alliance is more important than non-proliferation mandate and that Japan and South Korea should be allowed to seek nuclear weapons as a way of countering China threats has also contributed to precipitating the public debates.[26]

Equally critical is the reassessment of South Korea's nuclear weapons capability.[27] In 2016, Charles Ferguson, then president of the Federation of American Scientists, estimated that South Korea has up to 4330 bombs' worth of plutonium at the Wolsong site, assuming a conservative estimate of about 6 kg plutonium for a first-generation fission device.[28] Suh Kune-yul, a controversial professor of nuclear engineering at Seoul National University, went further by stating that "South Korea has plutonium enough to produce 5,000 nuclear warheads of 100 kiloton. If we (South Korea) decide to stand on our own feet and put our resources together, we can build nuclear weapons in six months with the investment of one billion dollars."[29] There is a wishful thinking

[24] Mong-jun Chung, op. cit.

[25] Sang-eun Bae, "Former Foreign Minister Min-soon Song says 'withdrawal of American forces will heighten demands for independent nuclear armament," News 1, December 6, 2019 (in Korean). https://www.news1.kr/articles/?3787092; Chosun Ilbo Editorial, "if South Korea is armed with nuclear weapons, there is no need for American forces," Chosun Ilbo, November 13, 2019 (in Korean). https://www.chosun.com/site/data/html_dir/2019/11/12/2019111203527.html?form=MY01SV&OCID=MY01SV

[26] Elbridge Colby, "Choose Geopolitics Over Nonproliferation." *National Interest.* (February 28, 2014). https://nationalinterest.org/commentary/choose-geopolitics-over-nonproliferation-9969

[27] See Gap-je Cho, "Two Reports' Shock: American experts' assessment…," op. cit.

[28] Charles D. Ferguson, "How South Korea Could Acquire and Deploy Nuclear Weapons," in Henry Sokolski (ed.), op.cit., p.70. An irony here is that Ferguson gave the figures in order to warn South Korea's moves toward nuclear armament, but conservative hardliners interpreted them in an opposite way.

[29] Hee-seok Park, "Interview with Kune-yul Suh, who says 'we can have nuclear weapons in six months if we invest one trillion won…" *Monthly Chosun*, September 27, 2017 (in Korean).

that South Korea can follow the Israeli path. Being a democracy, South Korea can persuade the United States and international society to allow its nuclear armament through active lobbying. Such false anticipation is widely shared among them.[30]

But going nuclear is not an easy enterprise. There are a myriad of obstacles.[31] The NPT regime and subsequent international sanctions can profoundly cripple the South Korean export economy and its civilian atomic industry. The nuclear venture can also invite fierce American opposition, severely damaging the ROK-U.S. alliance. Despite Seoul's conservatives' wishful thinking, Washington will compel Seoul to give up its nuclear moves not only because of risks of nuclear proliferation, but also because of expected loss of control over South Korea. Indeed, as Chosun Ilbo's editorial points out, "there is no raison d'etre for the U.S. to maintain its forces in South Korea if Seoul acquires nuclear weapons."[32] Inter-Korean and regional nuclear arms races and the fear of mutually probable assured destruction could jeopardize, rather than enhance, South Korea's security. Of these, American opposition has been the most critical factor in dissuading its proponents from pushing for the independent nuclear option. It is with this understanding that they have switched their position from the independent nuclear armament to the instrumentalist one that favors the re-deployment of American tactical weapons and/or NATO type nuclear sharing.

Redeployment of American Tactical Nuclear Weapons and Nuclear Sharing

American nuclear protection is nothing new to South Korea. During the Korea War, the United States deliberated using nuclear weapons against North Korea and China.[33] In addition, the United States used to maintain 951 tactical nuclear warheads in South Korea until they were withdrawn in 1991. Several factors accounted for the decision. At that time, the DPRK did not have any nuclear weapons, and, thus, strategic justification was lacking. The moral dilemma also mattered. It was totally unjustifiable for the United States to use tactical nuclear weapons against the DPRK

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http://m.pub.chosun.com//client/news/viw.asp?cate=C01&nNewsNumb=20170926241&nidx=26242&form=MY01SV&OCID=MY01SV

[30] See BBC report, op. cit.

[31] Peter Hayes and Chung-in Moon, "Korea: Will South Korea's Non-Nuclear Strategy Defeat North Korea's Nuclear Breakout?," in George Shultz and James Goodby (eds.), *The War That Must Never Be Fought: Dilemmas of Nuclear Deterrence* (Stanford: Hoover Institution Press, 2015), pp. 395-403.

[32] Chosun Ilbo Editorial, "if South Korea is armed with nuclear weapons, there is no need for American forces," *Chosun Ilbo*, November 13, 2019 (in Korean). https://www.chosun.com/site/data/html_dir/2019/11/12/2019111203527.html?form=MY01SV&OCID=MY01SV

[33] Bruce Cumings, *Korea's Place in the Sun: A Modern History* (New York: Norton, 1997): 479-480.

without such weapons. And maintaining tactical nuclear weapons was highly labor intensive and expensive requiring at least two certified technical persons to handle them. There was also a concern on their seizure, not by the DPRK, but by South Korea's radical nationalist students. Moreover, President George H. Bush decided to reduce tactical nuclear weapons deployed overseas.[34]

Nevertheless, conservative politicians are now calling for the re-transfer of American tactical nuclear weapons.[35] They argue that DPRK nuclear threats have become real, and the only credible way to counter is the physical presence of American tactical weapons on South Korean soil. Cho Kyung-tae, a senior member of the opposition Liberty Korea Party, threatened that "if the U.S. refused to negotiate on the re-transfer, we should withdraw from the NPT and instantly enter the development of independent nuclear weapons."[36] Several others joined the move.[37] An opposition Liberty Korea Party delegation led by then its president Hong Jun-pyo paid a visit to Washington, D.C., to lobby for the redeployment. Like Cho, he virtually threatened American congressional leaders and officials of the executive branch that unless the United States re-deploys tactical nuclear weapons to South Korea, his party will push for independent nuclear armament.[38] Hong strongly promoted the idea precisely because of fear resulting from President Trump's potential withdrawal of American forces from South Korea. The deployment of tactical nuclear weapons is essential to fill the vacuum that would be followed by the reduction and withdrawal of American forces. Lee Byung-chul, another liberal pundit, even urged opinion leaders and civil society to engage in public debates on the relevancy of redeployment of tactical nuclear weapons.[39]

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[34] Hayes and Moon, "South Korea…", op. cit: 405-407.

[35] For a concise survey of this perspective, see Gui-geun Kim, "Pro and con on the new debate on deployment of tactical nuclear weapons and rationales," Yonhap News, September 11, 2017 (in Korean). https://www.yna.co.kr/view/AKR20170911081000014

[36] Eun-cheol Lee, "Cho Kyung-tae proposes a nuclear sharing with the U.S.…" *Busan Ilbo*, July 31, 2019. http://www.busan.com/view/busan/view.php?code=2019073119381781177

[37] Jung-kyu Hong, "Ruling and opposition party members debate on the redeployment of redeployment of tactical nuclear weapons at the National Assembly," *Yonhap News,* September 21, 2016. https://www.yna.co.kr/view/AKR20160921066451001?input=1195m

[38] Yong-in Lee, "American experts oppose Hong Jun-pyo's proposal on redeployment of tactical nuclear weapons,"*Hankyoreh,* October 26, 2017 (in Korean). https://m.hani.co.kr/arti/politics/assembly/816193.html

[39] Byung-Chul Lee, "Exchange of deployment of tactical nuclear weapons and withdrawal of American forces in South Korea," *Kyunghyang Shinmun*, August 26, 2019 (in Korean). https://m.khan.co.kr/amp/view.html?art_id=201908262035025&sec_id=990100

But the U.S. government as well as congressional leaders showed a cold response. For them, the American commitment to extended nuclear deterrence is firm, and the United States did not have any tactical weapons to deploy. From a strategic point of view, such redeployment is not desirable either because it can destabilize, rather than stabilize, the Korean peninsula. Deploying tactical nuclear bombs to South Korea could tempt the DPRK to launch a preemptive strike rather than deterring the use of nuclear weapons. Unlike the 1980s, Pyongyang now possesses such strike capability. American politicians and defense planners were dismayed by South Korean conservatives' questioning of the credibility of the current South Korea-U.S. alliance and the strategy of extended deterrence, which is based on the overwhelming nuclear power of the United States.[40]

As the United States rejects the redeployment option, some conservatives in South Korea have shifted their attention to the NATO style nuclear sharing arrangement. During the Cold War, the United States and NATO members in Europe shared nuclear intelligence and developed and executed joint nuclear plans based on mutual discussions. There was also a division of labor in which five European countries where the U.S. military's tactical nukes had been deployed would use their own combat aircraft to drop U.S. gravity bombs. Won Yu-cheol of the opposition LKP organized a 'Nuclear Forum in which there have been extensive discussions on the NATO model. On November 12, 2019, the Forum convened a public session on "How to implement the ROK-U.S. Nuclear Sharing" and called for the deployment of American tactical nuclear weapons to South Korea and their sharing within the framework of the ROK-U.S. Combined Forces Command. The Forum also demanded the routine stationing of American nuclear-powered submarines. More importantly, National Assemblyman Won, who once served as chair of the Defense Committee of the National Assembly, urged the Moon Jae-in government to place the agenda of 'nuclear sharing' at the 2019 ROK-U.S. Security Consultative Meeting.[41]

Another senior ranking LKP lawmaker, Chung Jin-seok, even proposed the activation of American submarines with nuclear weapons capability in the region that would be placed under the joint

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[40] Chung-in Moon, "False premise about N. Korean nuclear capabilities could have disastrous consequences" *the Hankyoreh,* May 17, 2021. http://english.hani.co.kr/arti/english_edition/e_editorial/995558.html

[41] Da-in Rhyu, "National Assemblyman Won Yu-cheol organizes a forum to discuss on how to promote the ROK-US nuclear sharing accord". *Jeongpil* November 12, 2019. https://www.jeongpil.com/173024

operation of Japan, South Korea, and the United States.[42] Hong Joon-pyo lent his support to the idea by stating that "if a NATO-style nuclear sharing policy is introduced, the North Korean nuclear program will be under control, and we will be freed from being slaves to North Korea's nuclear program."[43] Several lawmakers joined him in advocating the nuclear sharing. A leading journalist, Bae Myong-bok, suggested that the ROK Air Force should be trained to be prepared to jointly use American tactical nuclear weapons deployed in Guam in the case of crisis escalation on the Korean peninsula.[44]

The 'nuclear sharing' proposition was boosted partly because of one paragraph in an article on 2018 Nuclear Posture Review in the Joint Force Quarterly by the National Defense University: "The U.S. strategy strongly considers a potentially controversial new concept involving custodial sharing of non-strategic nuclear capabilities during times of crisis with select Asia-Pacific partners, specifically Japan and the ROK."[45] Strictly speaking, however, American nuclear bombs cannot be "shared." The right to decide whether nuclear weapons would be used lies entirely with the U.S. president; tactical nukes in Europe will not work unless the codes are entered in Washington. Moreover, achieving NATO-style coordination of nuclear policies would require the U.S. Senate to ratify a "program of cooperation" according to a 1958 amendment of the Atomic Energy Act (McMahon Act). But the chances of the Senate ratifying such a program with South Korea are effectively nil. According to Nautilus Institute Co-Executive Director Peter Hayes, Germany and certain other European countries where the U.S. military's tactical nuclear weapons have been deployed actually prefer an approach of establishing nuclear deterrence based on tactical nuclear weapons in the continental United States or elsewhere overseas, based on declarations and the sharing of an extended deterrence doctrine of the same kind adopted by the South Korea-U.S. and U.S.-Japan alliances.[46] So the wiser choice would be to strengthen combined conventional

[42] Jihye Lee, "KLP calls for the examination of Korean style nuclear sharing for the strengthening of nuclear deterrence," *Polinews,* July 31, 2019 (in Korean). https://www.polinews.co.kr/mobile/article.html?no=404942
[43] Uijin Hwang, "Hong Jun-pyo insists on the possession of nuclear weapons, Defense Minister Suh Wuk answered with a NATO-style nuclear sharing," *Maeil Shinmun*, September 16, 2020.
[44] Myong-bok Bae, "NATO style nuclear sharing is in fact redeployment of tactical nuclear weapons," Joongang Ilbo, December 19, 2019 (in Korean). https://news.joins.com/article/23660659
[45] R. Cort, C. Bersabe, D. Clarke, and D. Bello, "Twenty First Century Nuclear Deterrence: Operationalizing the 2018 NPR,*" Joint Force Quarterly 94* (3rd Quarter, 2019): 78.
[46] Chung-in Moon, "Nuclear sharing" isn't a thing," *The Hankyoreh*, March 22, 2021 http://english.hani.co.kr/arti/english_edition/e_editorial/987761.html

deterrence based on trust in the extended nuclear deterrence provided by the United States, while using diplomatic talks to create opportunities for denuclearization.

Other than nuclear nationalists who argue for unconditional nuclear armament in the name of nuclear sovereignty, most conservative politicians and pundits appear to follow the instrumentalist approach in which redeployment of American tactical nuclear weapons or nuclear sharing between the ROK and the United States is considered as an alternative. The United States is highly unlikely to accommodate such demands. Likewise, South Korea is bounded by several formidable obstacles, and, thus, the potential for the nuclear domino phenomenon that is caused by South Korea seems very low. However, if South Korea seeks going nuclear independently, it is bound to precipitate it, negatively impacting Japan. How about public opinion in South Korea?

Nuclear Weapons and Public Opinion in South Korea

South Korea's public opinion about going nuclear has been greatly influenced by Pyongyang's behavior. The DPRK's undertaking of nuclear weapons tests or ballistic missile test launches has aggravated South Korean public opinion in favor of nuclear weapons, whereas improved inter-Korean relations coincide with a rising anti-nuke attitude. Genron NPO, a Japanese opinion survey organization, has been conducting annual polls regarding Japanese and South Korean public attitudes on nuclear armament.[47] According to the survey, 59 percent of South Korean respondents supported the independent nuclear armament in 2016, while 36 percent of respondents opposed. But in 2017, when the DPRK undertook its sixth nuclear testing and 15 ballistic missile test launches, those who favored 'South Korea going nuclear' rose to 67.2 percent, whereas the figure for opposition dwindled from 36 percent to 26.7 percent. The 2018 survey revealed quite a different outlook, however. In 2018, there were two Korean summits in April and September, and the first historic meeting between American president and the DPRK leader was held in Singapore on June 12. Consequently, military tension on the Korean peninsula drastically reduced and the public responded as such. Those who favored nuclear armament dropped from 67.2 percent in 2017 to 43.3 percent in 2018, almost a 25 percent drop. Meanwhile, those who opposed nuclear armament rose from 26.7 percent in 2017 to 50.3 percent in 2018. As inter-Korean relations stalled

[47] "The impression of the partner country has deteriorated in Japanese public opinion, but there are signs of improvement in Korean public opinion-Results of the 5th Japan-Korea Joint Public Opinion Survey," The Grenon NPO, July 21, 2017 (in Japanese). https://www.genron-npo.net/world/archives/6677-2.html

following the failure of the Hanoi summit in February 2019, those who supported the nuclear armament increased to 59.6 percent in 2019 and 56.5 percent in 2020 respectively. On average, those who support the nuclear weapons reached an upper 50 percent, whereas those who oppose averaged around 35 percent.

A survey conducted by Gallop Korea in 2017 showed that 60 percent of respondents were in favor of nuclear weapons and 35 percent opposed. An interesting trend is that only 38 percent of respondents in their twenties supported nuclear armament, whereas over 60 percent of those sixty and over were in favor of it. A huge generational gap between the old and the young existed. Another survey conducted by the Asan Institute for Policy Studies in 2014 revealed motivations that affected public attitude on nuclear weapons. Those who were in favor of nuclear armament cited, as primary reasons, nuclear deterrence against the North (38.9 percent), international influence (28.6 percent), national power and status (22.7 percent), and lack of trust in U.S. security commitment (4.8 percent) respectively. Meanwhile, those who opposed gave different motivations: unethical nature of nuclear weapons (46.4 percent), triggering of a regional nuclear arms race (31.2 percent), economic sanctions (9.2 percent), violation of international law (4.1 percent), and reliability of the American nuclear umbrella (3.3. percent). Albeit outdated, the Asan survey offers us an educated guess on South Korean public attitude on nuclear armament. Whereas those who support it reveal a strong realist orientation (i.e., deterrence, national power, and status), those who oppose it show a strong liberalist stance (unethical nature of nuclear bombs, fear of nuclear domino, economic sanctions, and international law).[48]

Public attitude on nuclear armament does not seem to be static. A recent study by Sang-yong Sohn and Jong-hee Park shows that South Korean voters' attitude on nuclear armament can change drastically when and if more information is provided through public debate. Using the method of experimental questionnaire, they started with the assumption of 61 percent supporting nuclear armament and 39 percent opposing it. Figures were drawn from the Gallop Korea survey data. Then, voters were exposed to public debates on nuclear armament with more information on its costs and benefits as well as opportunities and constraints. After respondents' exposure to new

[48] Jiyoon Kim, "South Korean Attitudes toward the Nuclear Weapons Development: A Survey Analysis," a paper presented at the International Joint Seminar on Assessing Northeast Asia Nuclear Domino, organized by APLN and the Sejong Institute, May 14, 2021.

information, Sohn and Park estimated, those who support the nuclear armament would decrease from 61 percent to 38 percent, while those who oppose would rise to 62 percent. Their study revealed that supporters of nuclear weapons turned out to be most sensitive to information related to economic damages that could result from international sanctions. Attitude change of those who oppose nuclear armament was affected mostly by information on the erosion of American security commitment.[49] This implies that public debates and exposure of objective information on nuclear armament can play an important role in changing citizens' attitude.

In sum, the DPRK has significantly increased its nuclear and missile threats since 2017, which South Korea perceives as existential ones. The Moon Jae-in government has been trying to manage those threats through the mix of extended nuclear deterrence by the United States and diplomatic negotiation, but conservative politicians and pundits, defying such efforts, have been raising their voices in favor of independent nuclear armaments. There are two contending schools. Whereas the teleological school advocates the development and possession of nuclear weapons for nuclear sovereignty and nuclear deterrence, the instrumentalists, realizing structural and institutional constraints to it, have called for the redeployment of American tactical weapons and/or nuclear sharing. The teleological school still remains a minority, but a sudden rise in Pyongyang's assertive behavior, signs of waning American security commitment, and deepening of strategic instability in Northeast Asia can readily resuscitate pro-nuke sentiments in South Korea. It is more so because an upper 50 percent of respondents on average support South Korea going nuclear. Public debate and exposure to accurate information can change public attitude, however. That is a positive sign.

Japan and Nuclear Domino

Japan is the only victim of nuclear bombing in the world. The tragedy of Nagasaki and Hiroshima is still deeply and widely ingrained in the hearts of Japanese people. That is why the anti-nuke pacifist movement has been so strong in Japan. The peace constitution and the American provision of a security umbrella under the Yoshida doctrine have also served as additional deterrents to the development of nuclear weapons in Japan. It was in this context that Japanese Prime Minister

[49] Sang-yong Sohn and Jong-hee Park, "Do South Korean Voters Really Want Nuclear Armament?" *The Korea Political Science Review* 54, no.2 (June 2020): 174-204.

Eisaku Sato, a one-time proponent of a Japanese nuclear force, put forward in 1967 the Three Non-Nuclear Principles of not possessing, producing, or introducing nuclear weapons.[50]

But North Korea's nuclear/missile threats, China's rise and nuclear build-up, and the perceived erosion of the American commitment to extend nuclear deterrence have renewed debate on whether Japan should go nuclear.[51] That was the case in the past. When China undertook its first nuclear test in October 1964, Japan's response was fierce. The Sato cabinet's Office of Research and Intelligence published a report that, while Japan needs to adhere to its non-nuclear position, it should demonstrate its technological capability for nuclear armament. Japan should engage in large scale nuclear and space rocket research.[52] Some conservative political leaders expressed their support of nuclear armament in the past. Kishi Nobuske, former prime minister, stated that "possessing nuclear weapons for self-defense is constitutional" as early as in 1957."[53] His grandson and former Prime Minister Abe Shinzo also made the following statement at his speech at Waseda University on May 13, 2002, when he was Vice Minister of Cabinet Affairs: "From a constitutional point of view, there is no problem with nuclear armament. Once committed, Japan can have nuclear weapons in a week."[54] In October 1999, Nishimura Shingo, then Vice Defense Minister, had to resign from his post because of pressures from civil society after stating that possessing nuclear weapons is beneficial to Japan's national security and that the Japanese Diet needs to discuss nuclear armament.[55]

As in South Korea, the Japanese government has been firm on its non-nuclear position by declaring its adherence to the three non-nuclear principles. Kato Katsunobu, the incumbent Minister of Cabinet Affairs downplayed debates on the nuclear path by indicating the indispensable nature of

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[50] Nobumasa Akiyama, "Japan's Disarmament Dilemma: Between Moral Commitment and the Security Reality," in George Shultz and James Goodby (eds.), *The War that Never Be Fought* (Stanford: The Hoover Institution, 2015): 437-480.

[51] Ohashi Takushi (大橋拓史), "Nuclear armament under attack, Taboo trend that blocks free discussion," Sankei, September 17, 2017 (in Japanese). https://www.sankei.com/politics/news/170917/plt1709170006-n1.html

[52] "Japan's nuclear weapons development," Wikipedia. https://bit.ly/3EaS1ID

[53] Ohashi Takushi, op. cit.

[54] "Japanese Nuclear Weapons Program," Wikipedia. https://en.m.wikipedia.org/wiki/Japanese_nuclear_weapon_program/

[55] Ishinabe Kei(石鍋圭), "Can the Liberal Democratic Party be called a responsible party without debating on the possession of nuclear weapons?" *Sankei,* September 22, 2017 (in Japanese). https://www.sankei.com/premium/news/170922/prm1709220010-n1.html

American nuclear deterrence under the Japan-U.S. security system.[56] The government position notwithstanding, since the DPRK's sixth nuclear testing in 2017, Japanese conservative politicians and pundits began to reactivate old debates, which are not on nuclear armament per se, but on whether Japan should engage in public debates on the subject and whether Japan should maintain nuclear latency. Kato Ryozo, former Japan's ambassador to the United States, a vocal advocate of public debate on nuclear armament, argues that "regardless of the American credibility, it should be allowed to have debates on the possession of independent nuclear weapons as the last resort to protect country's interest." And "it is inappropriate to ban public debates because they can be linked to a credible deterrence."[57] By pointing out that there are 'Four Non-Nuclear Principles' of no possessing, no making, no introducing, and no debating. Ishiba Shigeru, former Defense Minister, asserted that it is time to get away from 'no debating' and that "it is not a right attitude to trust the American nuclear umbrella without any verification."[58] According to a survey conducted in 2006, 61 percent of respondents answered that discussion on nuclear options should not be taboo.[59]

Those who advocate Japan's nuclear latency still remain strong. Conservatives in Japan argue that Japan needs to maintain 54 nuclear reactors and its Monju faster breeder reactor to secure nuclear latency due to its worsening security environment and waning American security commitment. Japan must be ready for independent nuclear armament when and if the American nuclear umbrella is gone.[60] Ishiba Shigeru also concurs with this position by stating that Japan should maintain the existing nuclear energy program to secure "a latent nuclear deterrence with which Japan could

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[56] "Minister Kato stated that American 'no first use' policy can undermine Japan's national security," *Sankei*, April 6, 2021 (in Japanese). https://www.sankei.com/politics/news/210406/plt2104060019-n1.html

[57] Kato Ryozo, "Japan should have rational debate on the nuclear question regarding gains and losses of the possession of nuclear weapons"(Kakuhoyu-ni yorieru mono, ushinau monowa nanka: nihonno kakumondaio rise-tekini ronzeyo)," *Sankei*, February 2, 2018. https://www.sankei.com/column/news/180202/clm1802020004-n1.html

[58] Chiba Tomoyuki and Hiroike Keiichi, "Former Defense Minister Ishiba Shigeru calls for verification of effectiveness of American nuclear umbrella… How to prevent the nightmare of Korean unification under North Korea?" (Ishiba Shigeru moto boue-syo- kakuno kasa zikkouse-kensyou-o kitaga hanto-to-itsuno akumu do-husegu?), *Sankei* September 15, 2017. https://www.sankei.com/politics/news/170915/plt1709150083-n1.html

[59] Akiyama, op. cit.: 456.

[60] Huruya Tunehira(古谷経衡), " Ten years after the nuclear reactor incident, reviving voice of nuclear armament, "*Asahi Ronza*, March 7, 2021 2021 년 3 월 7 일 (in Japanese). https://webronza.asahi.com/politics/articles/2021030200008.html?page=1

make nuclear weapons in a certain period of time."[61] In fact, Japan has an immense stockpile of fissile materials. As of 2016, Japan is known to have acquired 47.8 ton of plutonium and 1.5 ton of enriched uranium.[62] In addition, since Japan has rocket capability to launch satellites into space, developing various delivery vehicles will not pose any daunting challenges. It is not easy for Japan to transform these fissile materials into nuclear bombs because of International Atomic Energy Agency (IAEA) and U.S. regulations. But once committed, Japan can easily emerge as a nuclear weapons state.

But some ultra conservative pundits advocate for the development and possession of nuclear weapons to deal with threats originating from the Korean peninsula. For example, Watanabe Tsuneo, a research fellow at the Sasakawa Peace Foundation, advocated a conditional nuclear armament by stating that "as long as nuclear weapons exist on the Korean peninsula, Japan should enter nuclear armament. Japan should disarm nuclear weapons when nuclear weapons on the Korean peninsula are removed."[63] Journalists at the conservative *Sankei* newspaper also argue that "the advent of North Korea-led unified state on the Korean peninsula will be the worst nightmare to Japan. If that happens, Japan should consider acquiring nuclear weapons."[64] Shimada Yoichi, professor of Fukui Prefectural University, even argued that judged on IAEA's exceptional treatment of India, there is an international trend in which sanctions would not be imposed on the nuclear move of 'responsible states like Japan."[65] All these ideas surfaced in Japan immediately after the DPRK undertook its sixth nuclear testing in 2017, implying that nuclear developments on the Korean peninsula can bring about significant impacts to Japan. In this sense, it cannot be denied that there exist perceived chain reactions of nuclear dominos between Korea and Japan.

Nevertheless, it will be hard for Japan to seek a nuclear venture. Its peace constitution, three non-nuclear principles, and Japan's excessive reliance on American security protection are likely to prevent Japan's move toward nuclear armament. In fact, as early as 1970, the Sato cabinet

[61] Requoted from Akiyama, op. cit.:456.
[62] Ian Easton, "Japanese Strategic Weapons Programs and Strategies: Future Scenarios and Alternative Approaches," in Sokolski, op. cit:3-34.
[63] Sakurada Jun, "Japan's nuclear armament debate, dashing or avoiding both are too easy going (Nihon no kakubuso-ron tobitsukunomo kihisurunomo izuremo antsyokusugiru), *Gendai Business*, October 26, 2017. https://gendai.ismedia.jp/articles/-/53273?imp=0
[64] Chiae and Hiroiko, op. cit.
[65] Shimada Yoichi(島田洋一), "Don't avoid the nuclear armament debate,' Sankei, September 6, 2017. https://www.sankei.com/column/news/170906/clm1709060006-n1.html

concluded that Japan's nuclear armament is impossible by citing three reasons: difficulty of conducting underground nuclear testing, vulnerability of industrial concentrated areas to nuclear attacks, and diplomatic isolation. It is for these reasons that conservative politicians and pundits in Japan have favored the introduction of American tactical weapons to Japan and nuclear sharing between Japan and the United States. For example, Ishiba Shigeru once said that "it is contradictory not to deploy American nuclear weapons in Japan's soil, while seeking American nuclear protection." He then argued for the abolition of 'non-introduction' principle of the three non-nuclear principles, while permitting American submarines armed with nuclear weapons to enter Japan's ports.[66]

In contrast to South Korea, public opinion in Japan is not favorable to nuclear armament. According to a Sankei/FNN joint opinion survey conducted on September 16 and 17, 2017, immediately after the DPRK's sixth nuclear testing, 43.2 percent of respondents supported the initiation of public debates on the three non-nuclear principles, whereas 55.7 percent opposed even the debates. Opposition to the introduction of the American nuclear weapons into Japan was much higher. 69.9 percent responded that the introduction of American nuclear weapons is impossible, and only 26.2 percent supported. As to Japan's possession of nuclear weapons, 79.1 percent opposed, whereas only 17.7 percent favored.[67] Another survey by NPO Genron shows a similar trend. In 2017, those who opposed nuclear armament was 74.7 percent, while only 9 percent supported. Opposition to nuclear armament was 65.5 percent in 2018, 69 percent in 2019, and 66.7 percent in 2020, respectively.[68] Likewise, public attitudes in Japan are still strongly opposed to nuclear armament as well as the introduction of American nuclear weapons. Moreover, local governments such as the Hiroshima prefecture and the City of Nagasaki as well as anti-nuke NGOs such as the Research Center for Nuclear Weapons' Abolition (RECNA) at the University of Nagasaki, Peace Depot, and Pugwash Japan have been very active in monitoring and resisting any moves toward nuclear armament.

[66] Ishinabe Kei, op. cit.

[67] Sase Masamori(佐瀬昌盛), "Under North Korea's threats, Japan should swift to 'two non-nuclear principles,'" *Sankei,* September 27, 2017. https://www.sankei.com/column/news/170927/clm1709270007-n1.html

[68] https://www.genron-npo.net/world/archives/6677-2.html

In sum, the DPRK's growing nuclear and missile threats, China's rise and regional instability, and the unpredictable nature of American security commitment have fueled public debates on nuclear armament in Japan. Unlike South Korea, a nuclear taboo deeply rooted in Japanese society has prevented the advent of an outright support of a nuclear path. Conservative politicians and opinion leaders, however, have been championing the right to debate nuclear armament and to maintain a nuclear latency. Some even suggest the deletion of a 'non-introduction' clause of 'three non-nuclear principles,' which would allow the deployment of American nuclear weapons in Japan. Nevertheless, their approach has been cautious. Public opinion is strongly against nuclear armament as well as the introduction of American nuclear weapons. Thus, even if Japan has accumulated considerable fissile materials and missile capabilities, any visible moves toward nuclear armament remain undetectable.

Implications for the Nuclear Domino Phenomenon in Northeast Asia

North Korea's nuclear and missile threats have greatly heightened the potential for a nuclear domino phenomenon in Northeast Asia by fostering nuclear temptation in South Korea and Japan. It is precisely because Japan and South Korea possess fissile materials and technological capabilities. Nevertheless, the nuclear domino is not likely to materialize anytime soon. Both the Japanese and South Korean governments are fully committed to their non-nuclear stance. They also lend full confidence in American extended nuclear deterrence and, therefore, oppose the redeployment of tactical nuclear weapons and the NATO-type nuclear sharing. Fear of international sanctions and negative impacts on their economy and the civilian atomic industry, a potential rupture in their alliance relationship with the United States, and a dangerous nuclear arms race on the Korean peninsula and in the region have served as effective deterrents against the nuclear move in Japan and South Korea.

The domestic political and social atmosphere does not seem to favor the nuclear path either. Public opinion in Japan is strongly opposed to it, and anti-nuke movements by Japanese local governments and civil society are well organized and constantly on alert. South Korea is somewhat different from Japan. A relatively high public support and conservative politicians' efforts to politicize the nuclear issue, amidst the DPRK's constant nuclear threats, make South Korea a weak link in the nuclear domino equation. However, public exposure to adequate information on the costs and constraints of nuclear armament can alter their attitude.

It can be concluded that the Northeast Asia nuclear domino syndrome exists as a potentiality, not a concrete, reality. Failure to mitigate the regional threat environment, negative signals from the United States in terms of either weakening commitment to its extended nuclear deterrence or encouragement of nuclear armament in Japan and South Korea, and abuse and misuse of the nuclear issue for domestic political purposes, can easily turn the current nuclear temptation into actual nuclear armament, leading to a nuclear domino disaster. Japan and South Korea could easily be locked into a ratchet effect. The country that gets into nuclear armament first will surely induce the other to follow the suit. It is more so because of rapidly deteriorating bilateral relations.

What should be done? The most critical step to prevent a nuclear domino in Northeast Asia is to mitigate its overall security environment. The North Korean nuclear quagmire should be resolved peacefully. Otherwise, there will be constant nuclear temptation in Japan and South Korea. China's nuclear modernization and build-up should also be addressed. The size of China's current nuclear arsenal is relatively small compared with that of the United States and Russia, but the United States should take a more constructive role in slowing down any strategic arms race in the region. Improvement of Japan-South Korean relations is essential for the prevention of the nuclear domino. Protracted antagonistic confrontation between the two countries will be the breeding ground for a nuclear arms race.

The United States can reshape the nuclear equation in the region in two ways. One is related to its extended nuclear deterrence. Since the days of the Trump administration, Japan and South Korea have been suspicious of the American security commitment. Proponents of the nuclear armament believe the United States would not sacrifice American cities for Seoul and Tokyo. Such uncertainty has been responsible for propelling public debates on nuclear armament in Japan and South Korea. The other is a signal from Washington that the United States would be permissive of nuclear armament of Japan and South Korea. Such signal may well unleash them from the nuclear taboo. Thus, it is very important for the United States to manage its signal in which it assures an adequate extended deterrence, while avoiding the tolerant attitude of nuclear venture in Japan and

South Korea.[69] The United States should play a more constructive role in slowing down the strategic arms race in the region. Improvement in Japan-South Korea relations is also essential for the prevention of the nuclear domino.

One caveat is in order. The myth of 'U.S. extended nuclear deterrence' needs to be unraveled. As Allan Behm aptly argues, it is neither credible nor rational precisely because the United States, North Korea, and even South Korea are in fact playing compellence, not deterrence games.[70] While maintaining a credible conventional extended deterrence on the Korean peninsula, countries in the region should deliberate a nuclear weapons free zone in Korea and Northeast Asia with a comprehensive security framework such as the Northeast Asian Security Summit.[71]

Chorus of 'going nuclear' can surface anytime, depending on the DPRK's behavior. Hardline conservatives will try to capitalize on it for the advancement of their cause of 'independent nuclear weapons.' It cannot be ruled out that some people could have a foul play of clandestinely promoting nuclear latency. International society should stay on alert for this movement by strengthening its monitoring and safeguarding regime.

Worrisome is the advent of an adversarial coalition among pro-nuke forces across national borders. Hardline advocates of nuclear weapons development in the DPRK, South Korea, and Japan have in fact formed an adversarial coalition. Such a transnational coalition should be rejected. Civil society and NGOs in Japan and South Korea should stay vigilant on those dark forces by cultivating solidarity as well as engaging in anti-nuke movements.

Finally, citizen education and sharing of unbiased information related to nuclear weapons and proliferation seems very important. As the South Korean survey data shows, those who support

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[69]Robert Einhorn made this point clearly in his interview with a South Korean media. Jemin Sohn. "Interview with Einhorn, 'Chance for South Korea's nuclear armament is low, but the U.S. should not take it for granted." *Kyunghyang Shinmun*, August 17, 2016 (in Korean). https://m.khan.co.kr/view.html?art_id=201608170741001&code=970201#c2b

[70] Allan Behm, Special Report: Extended Nuclear Deterrence in a Pandemic World," APLN (Asia-Pacific Leadership Network for Nuclear Non-proliferation and Disarmament), (October 2020). https://www.apln.network/projects/pandemic-nuclear-nexus-project/pandemic-nuclear-nexus-scenarios-project_extended-deterrence-and-extended-nuclear-deterrence-in-a-pandemic-world

[71] Thomas Pickering, Morton Halpern, Peter Hayes, Chung-in Moon, and Leon Sigal,"Ending the North Korean Nuclear Threat by a Comprehensive Security Settlement in Northeast Asia," Nautilus Institute for Security and Sustainability (November 2017). https://nautilus.org/napsnet/napsnet-policy-forum/ending-the-north-korean-nuclear-threat-by-a-comprehensive-security-settlement-in-northeast-asia/

nuclear armament can change their view after being exposed to data related to costs and constraints of going nuclear. Thus, there should be national and international efforts to educate citizens on the danger of nuclear weapons by disseminating timely and objective information.

17. Nuclear Weapons-Free Zones in Asia

Tuya Nyamosor

Introduction

As the world is entering the third decade of the 21st century, multiple challenges are threatening the security and the well-being of nations, including the present great power competition. Fractured relations between nuclear-armed states are crippling the aspirations and efforts towards nuclear disarmament. Nuclear-weapon States, far from willing to pursue negotiations "in good faith" on cessation of the nuclear arms race and nuclear disarmament—as prescribed by the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) —seem to be walking straight into that very arms race. They have also rejected the new Treaty on the Prohibition of Nuclear Weapons (TPNW) that would ban the use, threat of use, or possession of nuclear arms. Efforts towards nuclear nonproliferation are equally in poor shape with the Iran nuclear deal slowly but surely collapsing and the Democratic People's Republic of Korea (DPRK) continuing on its nuclear path. On the arms control front, the New START treaty—the last remaining legal instrument providing for the reduction of the strategic armaments of the two leading nuclear powers, Russia and the United States —is facing uncertain future. The long-term viability of the NPT itself also looks uncertain given the predicament described above. If and when nuclear testing is resumed, the crumbling of the Comprehensive Test Ban Treaty (CTBT), even before it enters into force, would seriously damage the entire treaty-based edifice of nuclear disarmament built over decades.

In this context, the upholding of the regional disarmament efforts, in particular the treaty-based Nuclear Weapons-Free Zones (NWFZs), appears more crucial than ever. Over one hundred countries the world over have come forward to create such zones, in a treaty form, to keep their regions free from developing, acquiring, manufacturing, controlling, possessing, testing, and stationing nuclear weapons. NWFZs also prohibit the stationing of any nuclear explosive devices by any external state in these zones.

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Five such zones currently exist of which three are in Asia: the South Pacific NWFZ established by the Treaty of Rarotonga of 1985, the Southeast Asian NWFZ established by the 1995 Treaty of Bangkok, and the Central Asian NWFZ established by the Treaty of Semipalatinsk of 2006. The other two are in Latin America and the Caribbean (created by the Treaty of Tlatelolco of 1967 that preceded the NPT) and in Africa (created by the Treaty of Pelindaba of 1996). Mongolia enjoys a special nuclear-weapon-free status conferred to it by a UN General Assembly resolution 55/33S. The seabed, outer space, and the Antarctic, not governed by any state, are also nuclear-weapon-free according to international treaties.[1] As different from those countries that have chosen to rely on extended nuclear deterrence—that is on nuclear weapons of an allied nuclear power for their protection—the states parties to NWFZs chose to ban nuclear weapons on their territories to protect themselves from nuclear threats.[2]

This chapter proceeds in four parts. The first section introduces the principles and objectives of the NWFZs. This is followed by an overview of Asian NWFZs with an emphasis on their notable features. The next section discusses the ways in which NWFZs contribute to the goal of the total elimination of nuclear weapons and the last one discusses cooperation and coordination among the NWFZs.

NWFZs: Principles and Objectives

The concept of zones free of nuclear weapons preceded the conclusion, in 1968, of the NPT that created the global regime prohibiting the proliferation of nuclear weapons beyond those states that had acquired them prior to the conclusion of the treaty. According to the 1999 UN *Guidelines on the Establishment of Nuclear-Free-Zones*[3]—hereinafter referred to as the UN Guidelines—such zones are created on the basis of arrangements freely arrived at among countries of a region. A

[1] Detailed information on NWFZs, including the texts of the treaties establishing them, is available on the website of the UN Office for Disarmament Affairs (UNODA) at https://www.un.org/disarmament/wmd/nuclear/nwfz/

[2] It should be noted that Australia, a close ally of the United States, stands out as a country that has stated and reaffirmed its reliance on the latter's extended nuclear deterrence while remaining a party to the South Pacific Nuclear-Free-Zone.

[3] UN General Assembly Official Records, *Report of the Disarmament Commission—Establishment of nuclear-weapon-free zones on the basis of arrangements freely arrived at among the States of the region concerned,* Fifty-fourth session, Supplement No. 42 (A/54/42), 1999, http://www.undocs.org/A/54/42(SUPP)

UN General Assembly resolution 3472 (XXX) B of 1975 had stressed not only the regional but also the legally-binding character of such arrangement by defining NWFZs as "any zone recognized as such by the General Assembly of the United Nations, which any group of states, in the free exercise of their sovereignty, has established by virtue of a treaty or convention."[4]

The UN Guidelines also state that nuclear-weapon-free zones do not prevent the use of nuclear science and technology for peaceful purposes, and that the countries party to them remain free to decide for themselves, without prejudice to the purposes and objectives of such zones, whether to allow visits by foreign ships and aircraft to their ports and airfields, transit of their airspace by foreign aircraft and navigation by foreign ships in or over their territorial sea, archipelagic waters or straits that are used for international navigation, while fully honoring the rights of innocent passage, archipelagic sea lane passage, or transit of passage in straits that are used for international navigation.

In 1956 the Soviet Union first floated the idea to create a weapons limitation and inspection zone in Central Europe that would prohibit the stationing there of atomic and hydrogen bombs. The move came as the United States started deploying its tactical nuclear weapons in Europe as a counterweight to the Soviet conventional superiority. In 1957, Poland came up with the so-called Rapacki Plan, which proposed carving out a zone free of nuclear weapons in Central Europe. These proposals went nowhere given the underlying Cold War tensions in Europe but alerted many to a possibility of regional approaches to disarmament. Northern European countries took an interest. In 1961, Sweden tabled a proposal at the UN (the so-called Unden Plan) that called on states that did not possess nuclear weapons to "enter into specific undertakings" and commit to not producing, acquiring, and hosting nuclear weapons.[5] Stocker argues that the origins of NWFZs as a regional approach to nuclear nonproliferation ought to be traced back to this very Swedish proposal which was backed by the Soviet Union but rejected by the United States.[6] It goes without saying that

[4] United Nations General Assembly, *Resolution adopted by the General Assembly on 11 December 1975 – Comprehensive study of the question of nuclear-weapon-free zones in all its aspects*, Thirtieth session, A/RES 3472 (XXX), 1975, https://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/3472(XXX)

[5] United Nations General Assembly, *Resolution adopted by the General Assembly on 4 December 1961—Question of disarmament*, Sixteenth session. A/RES/1664 (XVI), https://undocs.org/en/A/RES/1664(XVI)

[6] James Stocker, "Accepting Regional Zero Nuclear Weapon Free Zones, U.S. Nonproliferation Policy and Global Security, 1957–1968," *Journal of Cold War Studies* 17 (2), pp. 36-72, 2015, https://www.mitpressjournals.org/doi/pdf/10.1162/JCWS_a_00547

during the Cold War, for any initiative—especially on disarmament matters—to get traction internationally it had to enjoy the support of both superpowers.

An Irish draft resolution submitted that same year, however, enjoyed much broader support. It called for an international agreement whereby nuclear possessor states would refrain from relinquishing control of their nuclear weapons and related technology and non-possessor states would refrain from acquiring them.[7] According to Stocker, this resolution, which passed unanimously, paved the way to the international, or global, approach to nuclear nonproliferation which resulted in the successful US- Soviet Union–led negotiations on the NPT.[8]

With the NPT negotiations still underway, another project that was quietly supported by the superpowers but was of regional nature, came to fruition: in 1967 the first treaty establishing a NWFZ, the Treaty of Tlatelolco, was concluded among countries of Latin America and the Caribbean. The idea of such a zone was first proposed by Costa Rica in 1958 but it was the Cuban Missile Crisis of 1962 that caused the regional countries to more energetically pursue the plan. As opposed to the NPT negotiations that were primarily a US-Soviet undertaking, the Treaty of Tlatelolco (like the subsequent NWFZs treaties) saw a more engaged participation of regional countries in related negotiations and reflected their shared interest in instituting as strong a barrier as possible against nuclear plans of outside powers.

Both the NPT-making process and great power acceptance of a Latin American NWFZ in the 1960s illustrated the profound realization by major powers, in the aftermath of the Cuban Missile Crisis and the failure to achieve any progress on "general and complete disarmament," as well as the Chinese nuclear test in 1964, that nuclear weapons were here to stay and that agreed measures had to be pursued, wherever possible, to prevent proliferation of nuclear weapons and related technologies. As put by Serrano, "the focal point [then] shifted from measures designed either to remove nuclear weapons from world affairs or to maintain a nuclear monopoly, towards attempts to make their presence more tolerable. This latter approach enabled both superpowers to share

[7] United Nations General Assembly, *Resolution adopted by the General Assembly on 4 December 1961—Prevention of the wider dissemination of nuclear weapons.* Sixteenth session. A/RES/1665 (XVI). Available at https://undocs.org/en/A/RES/1665(XVI)
[8] Ibid.

responsibility for nuclear matters."[9] Thus the NWFZ came to complement, at the regional level, the major powers' effort to globally halt the spread of nuclear weapons. Their support for the Latin American zone did not, however, translate into a willingness to see NWFZs replicated in all regions of the world. As history has shown, and as Tago rightly notes, NWFZs were established in regions with "a relative absence of security concerns"[10] as opposed to regions where high security concerns led to reliance on a nuclear deterrent provided by a major allied nuclear power. Hamel-Green has also argued that the existence of conflict, rivalry, or overt hostility within a region presented a serious barrier to the establishment of an NWFZ. He wrote, "It might be argued that NWFZs are only feasible in regions where they are least needed."[11] Indeed, in regions such as Europe, the Middle East, South Asia, and North-East Asia, beset by internal and external security competition and/or alliance politics, initiatives on the creation of such zones did not get much traction.

According to Serrano, two views have been expressed to explain the emergence of NWFZs.[12] The first held that NWFZs were a first step towards general and complete disarmament. The second held that they were a wider arms control measure and served as a means to ensure one's security against a nuclear danger. The latter view prevailed with time. In a more structured way, Thakur argues that NWFZs constitute legal mechanisms for nuclear nonproliferation and political stepping stones towards nuclear disarmament.[13] Of course, they are these things in a complementary manner: since all countries party to treaties establishing NWFZs are party to the NPT they are legally bound by the treaty's non-proliferation clause anyway, and inasmuch as they are a disarmament steppingstone, NWFZs are 'disarmament before the fact,' as Thakur puts it, the 'real'

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[9] Monica Serrano, "Common Security in Latin America, the 1967 Treaty of Tlatelolco," *Research Paper by the Institute of Latin American Studies,* (The University of London, 1992), p.2, https://sas-space.sas.ac.uk/3582/1/B12_-_Common_Security_in_Latin_America_The_1697_Treaty_of_Tlatelolco.pdf

[10] Atsushi Tago, "The Origins of Nuclear Weapons Free Zones: Security Communities or Substitutes for a 'Nuclear Umbrella'?" Belfer Center for Science and International Affairs, Harvard Kennedy School, 2006, http://belfercenter.ksg.harvard.edu/files/uploads/Tago_Nuclear_Weapons_Free_Zones.pdf

[11] Michael Hamel-Green, "Regional Initiatives on Nuclear- and WMD-Free Zones: Cooperative Approaches to Arms Control and Non-Proliferation," *Geneva: United Nations Institute for Disarmament Research (UNIDIR*), p.25, 2005, http://www.unidir.org/files/publications/pdfs/regional-initiatives-on-nuclear-and-wmd-free-zones-cooperative-approaches-to-arms-control-and-non-proliferation-286.pdf

[12] Monica Serrano, "Common Security in Latin America, the 1967 Treaty of Tlatelolco," *Research Paper by the Institute of Latin American Studies, The University of London*, 1992, https://sas-space.sas.ac.uk/3582/1/B12_-_Common_Security_in_Latin_America_The_1697_Treaty_of_Tlatelolco.pdf

[13] Ramesh Thakur, ed., *Nuclear Weapons-Free Zones,* (London: Palgrave Macmillan, 1998), p.3

nuclear disarmament being nuclear weapon states' compliance with Article XI of the NPT. NWFZs' complementarity vis-à-vis the NPT is noted by Fuhrmann and Li who state that "states are less likely to enter NWFZs if they have not already made nonproliferation commitments or if they have incentives to acquire, test, or possess nuclear weapons in the future."[14]

The UN General Assembly resolution of 1967 that welcomed the Tlatelolco Treaty established NWFZs as an international non-proliferation norm by stating that it "constitute[ed] an "event of historic significance in the efforts to prevent the proliferation of nuclear weapons and to promote international peace and security."[15] The NPT reaffirmed this norm by stating in its Article VII that nothing in that treaty affected the right of any group of States to conclude regional treaties in order to assure the total absence of nuclear weapons in their respective territories. The "total absence" included the non-stationing there of nuclear weapons by outside powers, which constitutes a much stronger proliferation commitment that is absent in the NPT. Verification mechanisms provided for in most NWFZs treaties are also of a more rigorous nature. So in general, NWFZs are a foundational building block of what is known as the international non-proliferation regime.

As for their disarmament impulse, the UN Guidelines do make references to NWFZs' being "an important disarmament tool" but only inasmuch as they are "a means of expressing and promoting common values in the areas of nuclear disarmament, arms control, and non-proliferation." As has been noted above, since states parties to NWFZs are all non-nuclear-weapon-states and, by definition, do not possess nuclear weapons, the concept of nuclear disarmament cannot be applicable to them. But without a doubt, by legally committing to keeping their respective regions free of nuclear weapons, including by outlawing the stationing of foreign nuclear weapons, and by introducing legally binding regional protocols on negative security assurance (NSA), NWFZs have contributed to the global effort towards delegitimizing and eliminating nuclear weapons. It is in this sense that their establishment "contributes towards realizing the objectives of nuclear

[14] Matthew Fuhrmann and Li Xiaojun, "Legalizing Nuclear Abandonment: The Determinants of Nuclear Weapon Free Zone Treaty Ratification,"*Managing the Atom Working Paper* Series, March 2008, Belfer Center for Science and International Affairs, Harvard Kennedy School, https://www.belfercenter.org/sites/default/files/files/publication/Legalizing%20Nuclear%20Abandonment.pdf

[15] United Nations General Assembly, *Resolution adopted by the General Assembly on 5 December 1967 – Treaty for the prohibition of nuclear weapons in Latin America.* Twenty second session. A/RES/2286 (XXII), http://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/2286(XXII)

disarmament," as stated in the Final Document of the 2010 NPT Review Conference and in the Treaty on the Prohibition of Nuclear Weapons.

Further on NWFZs' disarmament role, the UN Guidelines note that "respect for such zones by Nuclear Weapon States constitute an important disarmament measure." Here disarmament seems to connote, in a more general sense, the fight for "a world without nuclear weapons." In a more specific and pragmatic way, the UN Guidelines stipulate that Nuclear-weapon States (NWS)[16] "should be consulted during the negotiations of each treaty and its relevant protocol(s) establishing a nuclear-weapon-free zone in order to facilitate their signature to and ratification of the relevant protocol(s)."

Therefore, cognizant of the importance of engaging the NWS to promote the NWFZ objectives, the NWFZs negotiators have sought negative security assurances (NSA) from NWS, that is, a legally-binding commitment not to use or threaten to use nuclear weapons against zonal states. These are specified in protocols to the treaties establishing NWFZs of which solely the one attached to the Treaty of Tlatelolco has so far been ratified by all NWS. These protocols also contain such obligations as 'respect' for the objectives of the zones and 'not contributing to any act that constitutes a violation of the treaty by states parties to it.' Protocol ratifications by NWS have routinely been accompanied by declarations, statements, and understandings that clarify individual NWS' stances vis-à-vis the protocol provisions.

Most prominently, these concern transit rights. The NWFZs' arrangements are ambiguous in this respect, and basically are such that individual states parties are free to decide for themselves on transit and navigation matters. Goldblat views this arrangement as one of the NWFZs' deficiencies.[17] The others being, among other things, conditionality of NSAs, impossibility to verify the obligation of NWS to respect the zones, silence on whether NWFZs are valid both in time of peace and in time of war, etc. As per the UN Guidelines, States-parties to NWFZs remain free to decide for themselves on foreign ships and aircraft visits and the transit thereof in or over their territorial sea, archipelagic waters or straits "while fully honoring the rights of innocent

[16] NWS are states that are formally acknowledged by the NPT as nuclear weapon possessor states. The non-possessors are referred to as non-nuclear-weapon states (NNWS).

[17] Joseph Goldblat, "Nuclear-Weapon-Free Zones: A History and Assessment," *The Nonproliferation Review* 4(3): 18-32, 1997, http://large.stanford.edu/courses/2018/ph241/bashti2/docs/goldblat-1997.pdf

passage, archipelagic sea lane passage, or transit passage in straits that are used for international navigation."

Besides protocols on the granting of NSAs to zone parties, some of the NWFZ treaties contain protocols inviting outside powers to apply their denuclearization provisions in the territories for which they had become internationally responsible and which are located within NWFZs. France is the only country specified in the relevant protocol to the Pelindaba Treaty to sign and ratify it, while the United States has signed but not ratified the similar protocol to the Rarotonga Treaty.

Whatever these deficiencies, over the past decades NWFZs have been an important non-proliferation tool and a regional security enhancer whose objective of keeping entire regions free of nuclear weapons and their testing has enjoyed broad international appeal and contributed to advancing the global debate on nuclear disarmament and to reducing nuclear threats.

Overview of the Asian NWFZs

Three nuclear-weapon-free zones are currently in place in Asia, ranging from the seas of the South Pacific via South-East Asia up to the landlocked landmass of Central Asia. In between, Mongolia enjoys an official nuclear-weapon-free status. There is an ongoing debate among the expert on prospects for a NWFZ in North-East Asia. The Asian NWFZs extend across a territory of over 19 million square kilometers, and the diversity in their geography, history, and political experiences explains the variances among them. Goldblat, Hamel-Green, Thakur, Fuhrmann and Li, Roscini, and others have extensively discussed various aspects of the NWFZs. This paper looks at the notable features and contributions associated with each one of these zones.

The South Pacific Nuclear Free Zone

The first among them, the South Pacific Nuclear Free Zone (SPNFZ), originated primarily from the desire of regional countries to put an end to nuclear testing by the United States, Britain, and France in the region and stop the dumping of nuclear waste at sea. In 1975, New Zealand tabled a resolution at the UN on a South Pacific NWFZ, which was met with abstentions by all NWS except China. Due to a conservative hiatus in New Zealand, Australia—which had by then started positioning itself as an activist middle-power with its own agenda on nuclear matters—took the lead in negotiating the Treaty of Rarotonga on a regional NWFZ, which was signed in 1985 and entered into force in 1986.

In a notable expansion of the Treaty of Tlatelolco, which bans specifically nuclear weapons "appropriate for use for warlike purposes," the Treaty of Rarotonga expanded the object of the ban, which is defined as "any nuclear weapon or other explosive device capable of releasing nuclear energy, irrespective of the purpose for which it could be used "and irrespective of whether it is in unassembled or partly assembled forms. The treaty negotiators deliberately omitted the word 'weapon' in its name and went on to ban peaceful nuclear explosions and the dumping of radioactive waste and other radioactive materials at sea anywhere within the zone, and to prevent and not to assist such dumping by non-parties anywhere in the zone. States parties also undertake not to provide source or special fissionable material, or equipment or material for peaceful purposes to non-Nuclear-weapon States (NNWS) unless subject to the safeguards required by the NPT, or any nuclear-weapon State unless subject to applicable safeguards agreements with the International Atomic Energy Agency (IAEA).

The most significant contribution of the SPNFZ to the cause of non-proliferation and disarmament lies, however, in its stand on nuclear testing. The promoters of the zone have embraced the thinking of the Australian government on the matter which, at the time, was pushing for a comprehensive test ban treaty at the international level. The Rarotonga Treaty prohibits the testing of any nuclear explosive device by states parties—not only of nuclear weapons as is the case in the Treaty of Tlatelolco—and, in the form of a separate legally-binding protocol, prohibits such testing by external powers anywhere within the zone. Thus the Treaty of Rarotonga became the first comprehensive test ban treaty albeit with jurisdiction confined to the SPNFZ only. The United States, however, has yet to ratify the treaty's non-testing protocol as well as its NSA protocol. A global Comprehensive Test Ban Treaty (CTBT) was concluded a decade later with active effort by the SPNFZ countries.

The successful conclusion of the Treaty of Rarotonga gave a much needed impetus to negotiations on an ASEAN NWFZ. For years, Australia and Indonesia had been wary of each other's intentions: the Australian military had for a while floated the idea of the country acquiring nuclear-weapon capability while Indonesia had started its own nuclear energy capacity. As noted by Hamel-Green, the SPNFZ "created more conducive conditions for the ASEAN zone in the sense of promoting confidence that Australia would not seek nuclear weapons… and the South-East Asian and South Pacific regions can be said to have headed off at least one potential nuclear rivalry by putting in place additional regional zone mechanisms for demonstrating commitment to non-proliferation norms."[18]

Despite these achievements, the Treaty of Rarotonga has had its share of critics. First and foremost, criticism was levelled against its liberal approach towards port calls by nuclear-armed ships and the hosting of the US nuclear support installations on the territory of Australia (in fact, none of the NWFZ treaties prohibit the stationing of such facilities). The Treaty's stand on these matters largely stemmed from Australia's nuclear policy, which combined a bilateral military alliance with the United States and support for its nuclear deterrence policy with efforts towards enhancing regional security via multilateral actions.

With the general heightening of tensions in the broader region and the hardening of positions of various actors, it appears that the United States is not considering ratifying the Treaty's three protocols any time soon.

The Southeast Asia Nuclear Weapon-Free Zone

The Treaty establishing the Southeast Asia Nuclear Weapon-Free Zone (SEANWFZ), or the Bangkok Treaty, was signed in 1995 and entered into force in 1997. Its origins are traced back to the 1971 Zone of Peace, Freedom, and Neutrality Declaration (ZOPFAN) in which the ASEAN expressed its cognizance of the "significant trend towards establishing nuclear-free zones for the purpose of promoting peace and security." However, it took several years and the end of the Cold War, and the completion of the SPNFZ for actual negotiations to begin. Twenty-five years on, the Bangkok Treaty remains the only NWFZ treaty whose NSA protocol has not been signed by any of the NWS, let alone ratified.

There are two issues of contention that have prevented the NWS from signing the protocol. The first concerns the expanded NSA that the NWS are invited to commit to: if all other NWFZ treaty

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[18] Michael Hamel-Green, "Regional Initiatives on Nuclear- and WMD-Free Zones: Cooperative Approaches to Arms Control and Non-Proliferation," *Geneva: United Nations Institute for Disarmament Research (UNIDIR*), p. 6, 2005, http://www.unidir.org/files/publications/pdfs/regional-initiatives-on-nuclear-and-wmd-free-zones-cooperative-approaches-to-arms-control-and-non-proliferation-286.pdf

protocols envisage NSAs granted to states parties to respective zones, the Bangkok Treaty adds to them all territory within the SEANWFZ. As Roscini notes, "this entails a commitment by the nuclear weapon states not to launch missiles with a nuclear warhead from ships, submarines, or aircraft located within the zone even if the target is situated outside, and also not to use nuclear weapons against means of transport (even if they belong to another nuclear weapon state) situated in the internal waters, territorial sea and, most importantly, exclusive economic zone of the state-parties to the Bangkok Treaty."[19]

The inclusion of continental shelves and Exclusive Economic Zones (EEZ) of the parties to the SEANWFZ in its zone of application is another departure from other NWFZs. The NWS, especially the United States, see this departure as an obstacle to their signing of the protocol. As put by Tong Zhao,[20] for the nuclear-weapon states, the giving of assurances not to use or threaten to use nuclear weapons in EEZs, where nuclear submarines of a NWS, or any nuclear-armed country, for that matter, could be staying, would be akin to offering such assurances to one another. At this moment, the only assurance the NWS have given to one another is that of a mutually assured destruction; needless to say that a certain effort towards building trust among those powers will have to be made to achieve progress in this area.

As it stands, for the NSA protocol to be signed, parties will have to work on devising mutually acceptable arrangements on a host of issues, including port calls and transit. For one thing, the Bangkok Treaty's provision on notifying state-parties for them to take decisions on whether to allow port calls, transit by air and sea by foreign ships and aircraft, has not been to the liking of some of the countries in the region who are concerned that SEANWFZ parties could use this to challenge the freedom of navigation of US nuclear-capable vessels.[21] In the meantime, Russia had made known its position to the effect that it would deem itself not bound by its protocol

[19] Marco Roscini, "Negative Security Assurances in the Protocols Additional to the Treaties Establishing Nuclear Weapon-Free Zones," In Gartner, Heinz, ed. 2011. *Obama and the Bomb: The Vision of a World Free of Nuclear Weapons*. Frankfurt am Main: Peter Lang- Internationale Verlag der Wissenschafte, p. 132, file:///C:/Users/i/Downloads/SSRN-id1844145.pdf

[20] Tong Zhao, "Nuclear-Weapon States and the South-East Asia Nuclear-Weapon-Free Zone," *APLN Policy Brief No.28*, 2017, http://www.apln.network/briefings/briefings_view/Policy_Brief_28_-_Nuclear_Weapon_States_and_the_Southeast_Asia_Nuclear-Weapon-Free_Zone

[21] Christine Parthemore, "The Southeast Asia Nuclear Weapon-Free Zone: A U.S. Perspective on the Treaty and Its Future," *APLN Policy Brief No. 33*, 2017, http://www.apln.network/briefings/briefings_view/Policy_Brief_33_-_The_Southeast_Asia_Nuclear-Weapon-Free_Zone:_A_US_Perspective_on_the_Treaty_and_Its_Future

commitments should any transit of nuclear weapons and nuclear explosive devices take place through the territory of states that are party to the Bangkok Treaty[22] prompting subsequent calls to remove that reservation. And the United States has applied a policy of calculated ambiguity regarding its nuclear-capable vessels known as "neither confirm, nor deny."

On top of these tricky issues, the longstanding territorial disputes in the South-China Sea also come into play, and the current worsening of the US-China competition writ large serves as a major discouraging factor for any action on the SEANWFZ. The NWS have on a number of occasions expressed their general support for a NWFZ in South-East Asia and held consultations to move the process forward (in late 2021, China even indicated its readiness to sign the treaty) but, at this point, there are few indications that any progress is forthcoming.

The Central Asia Nuclear-Weapon-Free Zone

The Central Asia Nuclear-Weapon-Free Zone (CANWFZ) is the first NWFZ established in the northern hemisphere "on the basis of arrangements freely arrived at among the States of the region concerned," as prescribed in the UN Guidelines. It is also the first NWFZ established in a region where nuclear weapons had previously been deployed. After the disintegration of the Soviet Union, one of the Central Asian nations, Kazakhstan, found itself overnight home to over a thousand nuclear weapons. These were later removed to Russia making it possible for Kazakhstan to join the NPT as a NNWS. The CANWFZ is also the only zone that borders on two NWS, Russia to the north and China to the south, and faces volatility emanating from Afghanistan, South Asia, and the Middle East.

The Treaty of Semipalatinsk, which established the CANWZ, was signed in 2006 and entered into force in 2009. Being the last, to date, internationally recognized NWFZ, it benefited a great deal from the previous experiences on establishing such zones and the thinking that went into them and from the expertise and resources accumulated in the United Nations on this matter. Mongolia's 1992 initiative that declared the country's territory a nuclear-weapon free zone has served both as an inspiration and a call for action for Central Asian countries.

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[22]Alexander Kolbin, "The Bangkok Treaty Protocol: Why Still Not Signed by the P5?" *Security Index: A Russian Journal on International Security* 19 (4): 63-66, 2013, (In Russian) http://www.pircenter.org/media/content/files/11/13730360840.pdf

The drafters of the Treaty were also able to take into account the substantive developments in the world of disarmament, such as the Additional Protocol, the conclusion of which is included in the Treaty as one of the undertakings by states parties. The site of the signing of the treaty, Semipalatinsk, used to be a major Soviet nuclear testing site with a heavy legacy of nuclear-related infrastructure and environmental degradation and contamination. Hence the treaty has strong provisions concerning environmental rehabilitation and prohibition of nuclear tests. The latter closely follows the prohibitions of the CTBT. Also, the Treaty prohibits both nuclear weapons and nuclear explosive devices irrespective of their purpose and in assembled or partly assembled forms thus emulating the Treaty of Rarotonga. The presence of large quantities of nuclear materials left behind by Soviet Union's nuclear activities in the region and the threat of their illicit trafficking explain the undertaking to follow physical protection standards "at least as effective" as the standards of the Convention on Physical Protection of Nuclear Materials. The Treaty also bans research on nuclear weapons.

The prospects for the establishment of the CANWFZ have looked rather dim because some of its parties are members, together with Russia, of a security agreement that provides for mutual military assistance in case of an aggression. Concerns have been expressed by the United States, France, and the United Kingdom as to whether this was compatible with the objectives of a NWFZ. But an article entitled 'Other Agreements' still found its way into the treaty which marries the provision that it does not affect the parties' rights and obligations under other international treaties with the provision that parties shall take all necessary measures for effective implementation of the zone's purposes and objectives. This wording was deemed acceptable enough for all NWS to sign the treaty's NSA protocol. The United States, however, has yet to ratify it. The United States was also adamant that the CANWFZ limit its participation to the five Central Asian countries to prevent a possible move by Iran to join it.

Besides its contribution to strengthening NWFZs' non-proliferation and test ban norms, the CANWFZ clearly represents for the countries of the region, all of whom are former Soviet republics, an instrument for fostering a national security posture that seeks cooperative approaches in the face of the present and future security challenges.

Mongolia's Nuclear-Weapon-Free Status

East of the CANWFZ, Mongolia has labored hard to establish and strengthen its internationally recognized nuclear weapon free status.[23] It started early—just two years after the country shed its communist past in 1990 and a year after the demise of its former ally, the Soviet Union, by declaring its territory a NWFZ at the UN. However, since the established practice at the time was (and still remains) that to create such zones a group of regional states had to enter into a legally binding agreement, Mongolia could not join a region-wide NWFZ for the simple reason that its only neighbors are Russia and China, both NWS. Mongolia's attempts at the UN to gain acceptance of the concept of a single-state NWFZ were overruled by international custom and the NWS' disinclination to set a deviating precedent.

But, in the end, the country was able to secure international recognition of its unique status, called 'Mongolia's nuclear-weapon-free status (NWFS),' and formalized in the UN General Assembly Resolution 53/77 D of 1998. It was supported by the NWS via a joint statement by the five permanent members of the UN Security Council (the P5). The UN resolution (which is a recurrent resolution adopted every other year) welcomed Mongolia's declaration of its nuclear-weapon-free status and addressed some of the country's broader security concerns. The P5 joint statement entitled "Statement on Security Assurances in Connection With Mongolia's Nuclear-Weapon-Free Status" welcomed the declaration by Mongolia of its nuclear-weapon-free status and reaffirmed, in regard of Mongolia, the negative and positive security assurances that were individually stated by the nuclear-weapon states and were contained in the Security Council Resolution 984 adopted in 1995. Both the UN General Assembly resolution and the P5 joint statement raised considerably the international profile of Mongolia's nuclear-weapon-free status. Importantly, the NWS pledged cooperation with Mongolia on the implementation of the UN General Assembly resolution.

In 2000, Mongolia adopted a domestic Law on Nuclear-Weapon-Free Status that prohibits developing, manufacturing, or otherwise acquiring, possessing, or having control over nuclear weapons; stationing and transport of nuclear weapons by any mode of transport; testing nuclear

[23] For a discussion of Mongolia's nuclear weapon-free status see Nyamosor Tuya, "Mongolia's Nuclear-Weapon-Free Status: Recognition vs. Institutionalization," *Brookings Institution's Center for Northeast Asian Policy Studies, Working Paper* (August 2012) available at https://www.brookings.edu/research/mongolias-nuclear-weapon-free-status-recognition-vs-institutionalization/ and Enkhsaikhan Jargalsaikhan, "The Role of Small States in Promoting International Security: The Case of Mongolia," *Journal for Peace and Nuclear Disarmament* 1(2), 2018, pp: 404-435.

weapons; dumping and disposing of weapons-grade radioactive material and nuclear waste. Violations of the provisions of the law constitute a criminal offence.

In 2012, Mongolia and the P-5 countries issued parallel political declarations in New York concerning Mongolia's status. Mongolia confirmed its commitments under the NPT and its domestic law, such as the non-stationing of foreign troops and weapons, nuclear and other WMD, whereas the NWS reaffirmed, in the case of Mongolia, their respective unilateral negative security assurances as stated in their declarations issued on April 5 and 6, 1995, and affirmed their intent, as long as Mongolia maintains its nuclear-weapon-free status, to respect that status and not to contribute to any act that would violate it. The NWS also stated that their joint declaration was issued taking into account Mongolia's unique geographic status and that it constituted a political commitment only and did not create legal obligations.

But whatever the legal/procedural intricacies, Mongolia regards itself, by virtue of its domestic legislation and international recognition, as a full-blown single-state nuclear-weapon-free zone sharing the same goals and objectives as other NWFZs. Thus, it has worked actively to promote closer coordination among, and cooperation with, the regional NWFZs. The Mongolian experience has shown the importance of the political will and the ability to compromise on the part of a smaller country and the importance of a cooperative dialogue between NNWS and NWS to promote their common interests.

A North-East Asia NWFZ?

Several experts on North-East Asia have advocated a NWFZ for North-East Asia (NEANWFZ), and more so after the end of the Cold War. A cursory look at the region where one finds a nuclear China, a nuclear Russia, a Japan and ROK allied with the United States and both falling under its extended nuclear deterrence, and a DPRK pursuing nuclear weapons and missiles programs—all entangled in rivalry—can give pause to observers. Even at the height of the Cold War, however, proposals were made on disarmament and reduction of tension involving even bitter adversaries. In 1959, the Soviet Union put forward the idea of general and complete disarmament; in 1972, a study was issued in the United States suggesting the establishment of a NEANWFZ which went ignored.[24] The DPRK had on a number of occasions proposed a NWFZ on the Korean peninsula albeit providing no details. In hindsight, the general distrust that reigned supreme during the Cold War may have nipped in the bud the possible follow-ups that could have prevented the dire outcome the region is facing now.

Proponents of a NEANWFZ have argued that such a zone would represent a cooperative institutional framework, achieved through peaceful, diplomatic means that can help resolve the DPRK's nuclear issues, denuclearize the Korean Peninsula, and bring about sustainable peace to the region. The reasoning goes that occasional cycles of lapsed negotiations and bursts of heavy-handed rhetoric hardly change anything in the situation on the Korean Peninsula where any conflict escalation, inadvertent or not, can threaten regional peace in unpredictable ways and undermine strategic stability there. An NWFZ is seen not only as a non-proliferation tool but also as a security enhancer. The NWFZs in other parts of the world, negotiated sometimes over decades and then recognized internationally both through the authority of the UN and political support by the NWS, are cited as an example that could be emulated.

Several formulas have been put forward for a NEANWFZ ranging from those focused solely on the Korean peninsula to those covering most of North-East Asia. Notably, the so-called '3+3 formula' has had some currency among the expert community.[25] It would have Japan, the ROK, and the DPRK establish a nuclear-weapon-free zone with China, Russia, and the US extending, via a protocol, negative security assurances to them. A revised 3+3 version suggested an unusual arrangement whereby the three NWS became direct parties to a comprehensive treaty on peace and security in North-East Asia that would contain a provision on a nuclear-weapon free zone.[26]

In a growing recognition of the impossibility of resolving the DPRK nuclear problem without addressing regional security issues, including peace on the peninsula, a more comprehensive and

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[24] Chung-in Moon, "Time May Be Right for a Northeast Asia Nuclear-Weapon-Free Zone," *thebulletin.org,* August 25,2016, https://thebulletin.org/roundtable_entry/time-may-be-right-for-a-northeast-asia-nuclear-weapon-free-zone/

[25] Hiromichi Umebayashi, "A North-East Asia Nuclear-Weapon Zone with a Three Plus Three Arrangement," East Asia Nuclear Security Workshop. Tokyo, November 11, 2011, https://nautilus.org/napsnet/napsnet-special-reports/a-northeast-asia-nuclear-weapon-free-zone-with-a-three-plus-three-arrangement/

[26] For a detailed discussion see Morton H. Halperin, "A Proposal for a Nuclear Weapons-Free Zone in Northeast Asia," NAPSNet Special Reports, January 03, 2012, https://nautilus.org/napsnet/napsnet-special-reports/a-proposal-for-a-nuclear-weapons-free-zone-in-northeast-asia/

gradual approach has been suggested that would eventually lead to a NEANWFZ. In 2017, the Nautilus Institute proposed a comprehensive settlement in North-East Asia that would set up a six-party North-East Asia security council, end sanctions over time, declare non-hostility, end the armistice and sign a peace treaty, provide economic and energy aid to the DPRK, and establish a NWFZ.[27] Similarly, a report by Research Center for Nuclear Weapons Abolition in Nagasaki (RECNA) identified a number of end-goals for the region that included peace settlement of the Korean War, conclusion of a Treaty of Amity and Cooperation, creation of a permanent North-East Asian regional security forum/organization, establishment of an NWFZ, and a regional energy security system.[28] Dalton has suggested agreeing on a "continuum of objective" that would include peace regime, denuclearization, diminished salience of nuclear weapons, adjustments to US extended deterrence, a new security order for the region, and an NWFZ.[29]

Given the DPRK's dislike of multilateral forums and its fear of possible attempts at regime change once denuclearization is achieved, the big question yet to be answered is about the ways and means in which such gradual cooperative process could be initiated and further sustained. The bigger question is can it be successfully navigated amid the troubled relations between the United States and China that are only set to deteriorate.

Contribution of NWFZs Towards the Total Elimination of Nuclear Weapons

The Asian NWFZs and Mongolia's NWFS, as all other NWFZs, came into being as a result of the desire of the countries in different parts of Asia to enhance their security through halting the spread of nuclear weapons in their respective regions. This was done by banning through legally-binding

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[27] Morton Halperin, Peter Hayes, Chung-in Moon, Thomas Pickering and Lee Sigal, "Ending the North Korean nuclear threat by a comprehensive security settlement in North-East Asia," *NAPSNet Policy Forum*, June 26, 2017, https://nautilus.org/napsnet/napsnet-policy-forum/ending-the-north-korean-nuclear-threat-by-a-comprehensive-security-settlement-in-northeast-asia/

[28] Policy proposal by a Joint ROK-Japan Workshop, "From Peace on Korean Peninsula to North-East Asia Nuclear Weapon Free Zone." Executive Summary of the policy proposal issued by *Joint ROK-Japan Workshop "From Peace on Korean Peninsula to North East Asia Nuclear Weapon-Free Zone*" held in June, 2019 in Seongnam, South Korea, https://www.tandfonline.com/doi/full/10.1080/25751654.2020.1747910

[29] Toby Dalton, "From Deterrence to Cooperative Security on the Korean Peninsula," *Journal for Peace and Nuclear Disarmament* 3 (1), 2020, pp:144-156, https://www.tandfonline.com/doi/pdf/10.1080/25751654.2020.1747907?needAccess=true

arrangements, their development, acquisition, manufacturing, possession, testing, controlling, as well as the stationing of nuclear weapons by external powers. Due to their specific circumstances, these NWFZs do have some variations but by banning nuclear weapons on their respective territories they have served, and continue to serve, as an important non-proliferation tool complementing the NPT.

Over forty years of their existence each preceding NWFZ has enriched the next one to come into being and, along the way, they have all enriched approaches to disarmament. By their very emergence and existence NWFZs have considerably contributed to the delegitimization of nuclear weapons and to multilateral disarmament—as have a host of UN General Assembly resolutions, including its first one that established a commission to make proposals on the elimination of nuclear weapons and the 1996 Advisory Opinion of the International Court of Justice on the Legality of the Threat or Use of Nuclear Weapons, which advised that negotiating an instrument leading to nuclear disarmament was an obligation. By the year 2017 when the TPNW negotiations got under way there already existed a *regional foundation* on which to build this UN-supported global effort to stigmatize, prohibit, and eliminate nuclear weapons. That foundation was created to a large extent by countries inappropriately named the Global South.

The NWS, too, have had a role to play in the emergence of the phenomenon of NWFZs, supportive as they were of its non-proliferation potential. In fact, one lesson that can be drawn from the experience of the zonal approach is that to achieve tangible progress in disarmament there has to be some *confluence of interests between NNWS and NWS*. Without it, no "bargain," that is agreement of NNWS to forego nuclear weapons and of NWS to eventually disarm (a side of the bargain that has not been kept), could have emerged in the form of an NPT, and no NWFZs could have been established.

At this point, the traditional division between the NWS and NNWS on the priorities of the NPT where the former have stressed nonproliferation and the latter have given equal weight to disarmament is being paired with an emerging division between nuclear-allied NNWS and non-nuclear-allied NNWS (heavily represented in the NWFZs and the Non-Aligned Movement). This state of affairs does nothing to strengthen the NPT and is damaging to the NWFZs. By rejecting the TPNW the nuclear-allied NNWS undermine the appeal of the NPT for their non-nuclear-allied counterparts who have sought—in vain—nuclear disarmament since day one of the NPT and do the same with respect to the NWFZs, which basically came into being as an alternative to extended nuclear deterrence as a means of protecting countries against nuclear threats. As it stands, reliance on nuclear deterrence, extended or otherwise, simply means an extended lifetime for nuclear weapons and a postponement of nuclear disarmament for an indefinite time. In Asia especially, and with an emphasis on North-East Asia, continued reliance on extended nuclear deterrence practically shuts down the prospects for a NEANWFZ.

It is common belief that, however imperfect, over the fifty years of its existence the NPT, with its authoritative number of 191 states parties, has helped prevent nuclear proliferation and preserve international peace and stability and remains the primary source of nuclear stability that needs to be preserved. And there is general agreement that, however deficient the NWFZs are (chiefly because of their basic reliance on the signing of their NSA protocols by NWS), they have served as an effective non-proliferation complement to the NPT and an essential building block that buttress the efforts towards eliminating nuclear weapons. Common sense would therefore dictate that these instruments be handled with care.

It may well be that what is needed, at this juncture, is “a gradual broadening of the zones of the world from which nuclear weapons are prohibited to a point where the territories of powers which possess these terrible weapons of mass destruction will be something like contaminated islets subject to quarantine.”[30] These words by Mexican diplomat Alfonso Garcia Robles who won Nobel Peace Prize for his work on the Tlatelolco Treaty could serve as an inspiration to the advocates of the total elimination of nuclear weapons and of the establishment of NWFZs in other parts of the world. Given the somewhat encumbered field of disarmament-related initiatives and resolutions and coalitions, both NNWS and NWS as well as civil society actors could draw on the example of *seeking the synergy between the regional and the global* provided by NWFZs and apply synergetic and cooperative approaches to the global efforts towards advancing disarmament goals. Former UN Secretary-General Ban Ki-Moon has been quoted as telling the audience in his address to the 2010 Second Conference of NWFZs and Mongolia that his goal was “to make the

[30] Michael Hamel-Green, “The Nuclear Ban Treaty and 2018 Disarmament Forums: An Initial Impact Assessment,” *Journal for Peace and Nuclear Disarmament* 1 (2), p.452, 2018, https://www.tandfonline.com/doi/pdf/10.1080/25751654.2018.1516493?needAccess=true

whole world a nuclear-weapon-free zone"[31] envisaging a world where nuclear weapons will be prohibited. Views have been expressed that because of "the parallels in the language and objectives" such a reading may be of help in integrating the TPNW into the traditional non-proliferation frameworks and easing the TPNW/NPT tension.[32] As Thakur has noted, "If the global non-proliferation regime is to remain viable, the competing visions reflected in the NPT and the ban treaty must be reconciled" to preserve the integrity of the NPT.[33] Such reconciliation could indeed occur through gradual cooperative expansion of NWFZs to other regions that go hand-in-hand with some confidence building measures to improve mutual trust. As of today, it certainly appears as a distant prospect that countries in North-East Asia, South Asia, or the Middle East and Central Europe, for that matter, would come together and shed their reliance on nuclear weapons or nuclear deterrence. But a nuclear arms race, a possible disintegration of the NPT, weakened NWFZs and heightened global tensions leading to an inadvertent nuclear war do not certainly look like a brighter prospect.

Cooperation and Coordination

In the meantime, with a view to strengthening cooperation and coordination among the NWFZs and raising their profile in the disarmament arena, the OPANAL (Agency for the Prohibition of Nuclear Weapons in Latin America and the Caribbean) took the lead in initiating regular conferences of Nuclear-Weapon-Free Zones and Mongolia, which are held in conjunction with the NPT Review Conferences. Three such conferences have been held starting in 2005, and since 2010 they have been held under the auspices of the UN. A UN General Assembly resolution on the matter states that the objective of these conferences is "to consider ways and means to enhance consultations and cooperation among nuclear-weapon-free zones and Mongolia, the treaty agencies and interested States, with the purpose of promoting coordination and convergence in the

[31] CTBTO, "Making the Whole World a Nuclear-Weapons-Free Zone" https://www.ctbto.org/press-centre/news-stories/2010/making-the-whole-worlda-nuclear-weapons-free-zone/
[32] Sebastian Brixey-Williams, "The Ban Treaty: A Big Nuclear-Weapon-Free Zone?" *thebulletin.org*, June 21, 2017, https://thebulletin.org/2017/06/the-ban-treaty-a-big-nuclear-weapon-free-zone/
[33] Ramesh Thakur, "The Long Road to Nuclear Disarmament," *projectsyndicate.org*, 2018, https://www.project-syndicate.org/commentary/competing-visions-of-nuclear-disarmament-by-ramesh-thakur-2018-05?barrier=accesspay

implementation of the provisions of the treaties and in strengthening the regime of nuclear disarmament and non-proliferation."[34]

NWFZs' cooperation entails not only exchange of ideas and dissemination of information among themselves but also coordination on matters concerning multilateral disarmament. With the adoption of the TPNW, cooperation could also extend to stepped-up efforts towards the prohibition and elimination of nuclear weapons. The Outcome Document of the Second Conference of the NWFZs and Mongolia stated that that the mere existence of nuclear weapons constituted a threat to the survival of mankind and their use would have catastrophic consequences for life on Earth, and that the only guarantee against their use or threat of use was their total elimination. It further stated that their use or threat of use constituted a violation of international law and of the Charter of the United Nations, and a crime against humanity, echoing the Humanitarian Initiative.[35] The parties also reaffirmed the urgent need to advance towards the priority goal of nuclear disarmament and the achievement of the total elimination and legally binding prohibition of nuclear weapons.[36]

These positions taken in the Outcome Document as well as the practical experience of the NWFZs in prohibiting nuclear weapons in entire regions make them potentially a powerful voice in the global efforts towards the total elimination of nuclear weapons, especially as a partner in the promotion of the ratification and, eventually, implementation of the TPNW. However, beyond conferences, practical cooperation among the NWFZs has been limited. No regular mechanisms of sustaining inter-zonal dialogue and communication have yet been devised due, primarily, to the lack of resources, the necessary focus on socio-economic issues, poor institutionalization of respective NWFZs, and varying regional security dynamics. For instance, in Asia, the security issues looked at in the South Pacific and Central Asia can be very different whereas in South-East Asia the Bangkok Treaty still awaits the signing of its protocol by NWS. But since all NWFZs share a common interest not only in banning nuclear weapons in their respective regions but also in totally eliminating nuclear weapons, a clearly defined and feasible set of cooperative undertakings can help take forward

[34] United Nations General Assembly, *Resolution adopted by the General Assembly on 2 December 2009 – Second Conference of States Parties and Signatories to Treaties that Establish Nuclear-Weapon-Free Zones and Mongolia*, Sixty-fourth *session*, A/RES/64/52, https://undocs.org/A/RES/64/52

[35] 'Humanitarian Initiative' is a group of over 150 countries that formed by 2013 to promote the adoption of the TPNW.

[36] Second Conference of States Parties and Signatories of Treaties that Establish Nuclear-Weapon-Free Zones and Mongolia, *Outcome Document,* 2010, https://undocs.org/en/NWFZM/CONF.2010/1

these goals. This could include, among other initiatives, establishment of a global NWFZ website/portal that could serve both as a center for communication and information for and about the NWFZs and an aggregator of notable developments in the efforts towards the elimination of nuclear weapons.[37]

At this critical juncture, when nuclear-armed states, far from willing to pursue nuclear disarmament, are engaged in nuclear modernization and a nuclear arms race, states parties to NWFZ need a renewed commitment to promote the purposes and objectives of NWFZs. For one thing, NWFZs should continue to urge the NWS who have not done so to ratify the relevant protocols to NWFZ treaties and withdraw the reservations or unilateral interpretations that have accompanied the signing or ratification of these protocols. The failure to do so damages the NWFZ' effectiveness and serves as discouragement to other regions contemplating a zonal approach. It may well be that advances in technology may render less necessary the use of nuclear weapons in potential missions in NWFZ regions but as long as nuclear weapons exist NWFZs would want security guarantees extended by way of ratified NSA protocols.

Conclusion

Nuclear-weapon-free zones were established out of the shared conviction of their states' parties that their national security was enhanced, not reduced, if they banned nuclear weapons instead of introducing them. By establishing such zones they have turned entire regions in Southern and Northern hemispheres into lands where no nuclear weapon is allowed, thus making an important contribution to the global non-proliferation regime and towards the objectives of the elimination of nuclear weapons. The protocols to the treaties establishing NWFZs envisage a legally-binding commitment by NWS, albeit with attached reservations, not to use or threaten to use nuclear weapons against states parties. In the absence of a universal instrument providing such a commitment, this has been a welcome development. In Asia, unfortunately, not a single treaty on a NWFZ has its protocols ratified by all NWS.

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[37] For more suggestions, see: Report by the Vienna Center for Disarmament and Non-Proliferation, "Cooperation among Nuclear-Weapon-Free Zones: History, Challenges and Recommendations," *VCDNP Task Force Report*, March 2018, https://vcdnp.org/wp-content/uploads/2018/03/NWFZ-TF-Report-final-1.pdf

By banning and introducing the norm of non-possession of nuclear weapons the NWFZs have played an important role in delegitimizing nuclear weapons. Advocates of the total elimination of nuclear weapons could benefit from the NWFZs' example of seeking the synergy between the regional and the global and search for ways to reconcile the current misunderstanding between nuclear-armed states and non-nuclear-allied NNWS with regard to the TPNW.

18. NPT-TPNW Standoff: Who Can Break This Gridlock?

Nobuyasu Abe

Introduction

Having secured 50 ratifications, the Treaty on the Prohibition of Nuclear Weapons (TPNW) came into force on January 22, 2021. The treaty's promoters are determined to win more ratifications, which presently stands at 59. If the treaty is adhered to by a comfortable majority of states, it will come close to establishing a legal norm in the world. Nuclear weapon-possessing states were firm in opposing the TPNW and, led by the United States (US), campaigned against the signing and ratifying of the treaty. The new Biden administration may somehow soften its stance, but in view of the fact that the US opposition to the idea of a TPNW started not under the Republican Trump administration but under the Democratic Obama administration, it is hard to predict the US attitude. Opponents argue that nuclear disarmament can only be achieved step by step and jumping to the ultimate abolition and prohibition of nuclear weapons diverts attention from the NPT (Treaty on the Non-Proliferation of Nuclear Weapons) and the efforts to prevent nuclear proliferation until weapons are abolished altogether. While the strength of the NPT itself is placed in doubt, the rescheduled NPT Review Conference which, first slated for August 2021 and now for some time in 2022, threatens to become a confrontation between the NPT and TPNW camps. Efforts have to be made to bridge gaps between the two camps so that they together can move to promote nuclear disarmament and strengthen nuclear non-proliferation efforts. This paper looks at who can do so and how.

There are already some signs of softening observed in some allies of nuclear weapons states. Among the US allies, New Zealand has signed and ratified the treaty. A NATO member—the Belgian government—has started to show a positive view of the treaty. Kazakhstan, a member of the Collective Security Organization allied with Russia, has also signed and ratified the TPNW.

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These states have proved that even allies of nuclear weapon-possessing states can join the treaty. Having done so, they must now renounce the protection of a nuclear umbrella (in the case of Kazakhstan) or, they may have already done so (in the case of New Zealand). Two NATO members, Norway and Germany, have expressed their intention to participate in the first meeting of the States Parties of the TPNW which is to be held sometime during the course of 2022.

Japan is closely following the US opposition campaign against the TPNW, but in the meantime expresses its intention to try to bridge the gap between the TPNW's proponents and opponents. It organized a group of eminent persons to advise the ways to do this bridging. The group issued a thirteen point appeal in April 2019, including reaffirming the commitment of the unequivocal undertaking by the Nuclear Weapon States (NWS) to accomplish the total elimination of their nuclear arsenals, sustaining and preserving bilateral and multilateral nuclear arms control treaties and agreements, clarifying their nuclear policies and force postures are consistent with applicable international law, especially international humanitarian law, and realization of legally binding security assurances to non-nuclear-weapon states (NNWS).[1] But to date, this Japanese effort has not achieved any significant progress in bridging the gap. There are minority voices in Japan that it should search for ways to join the treaty, or at least sign it, or observe the conference of treaty parties.

NPT—A Treaty Facing the Risk of Increasing Irrelevance

The NPT succeeded in its initial task of preventing the proliferation of nuclear weapons among potential key players at the time of its entry into force in 1970.[2] Countries with sufficient industrial capability to do so but ultimately did not obtain nuclear weapons included Canada, West Germany, Sweden, Switzerland, Japan, South Korea, and Australia. Taiwan's proliferation program was blocked, and South Africa gave up its nuclear weapons and joined the NPT. Thus, the NPT did

[1] The recommendations were presented in conjunction with the NPT Review process but some of the recommendations refer to "nuclear-armed states" or "all states" such as appeal to ratify CTBT and strengthening physical protection.
[2] For the analysis of the successes and failures of the NPT refer to The NPT at Fifty: Successes and Failures by the author, published in the Journal for Peace and Nuclear Disarmament, September 2020, https://www.tandfonline.com/doi/full/10.1080/25751654.2020.1824500

help prevent the spread of nuclear weapons. It was helped by the establishment of the International Atomic Energy Agency's (IAEA) comprehensive safeguard system to monitor the nuclear activities of those countries that pledged not to acquire nuclear weapons under the treaty. The NPT, over the years, also succeeded in enticing second tier countries such as Egypt, South Africa, Brazil, Argentina, Mexico, Cuba, Indonesia, Iran, Iraq, Saudi Arabia, the DPRK, France, and China, thus bringing the total number of states parties to 187 by the turn of the century. This outcome was helped by the strong diplomatic efforts of the United States, and subsequently by the end of the Cold War. As accession to the treaty was almost universal, a near international norm against nuclear proliferation was generated.

In the last three decades, however, the NPT has started to show its limitations. Non-adherents, like India and Pakistan made their own nuclear weapons and the DPRK withdrew from the treaty to build its own nuclear weapons. Clandestine nuclear weapons programs had also been proceeding in Iraq, Libya, and South Africa. Some of these have been forcibly abandoned and some were voluntarily abandoned. During this time, the inability of the IAEA safeguards to uncover nuclear weapon programs in a timely fashion became evident.

In terms of promoting nuclear disarmament, the NPT cannot claim to be very successful. Even after fifty years of its existence, there is a long way to go to achieve the goal set out in Article VI of the treaty. As the disappointment of the NNWSs about the slow progress of nuclear disarmament intensifies, the commitment of those states to adhere to their treaty obligation is weakening. In the Middle East, the *de facto* possession of nuclear weapons by Israel, while it is not against international law as it is not an adherent to the NPT, gives a sense of inequality to the surrounding countries and works to weaken their adherence to the NPT obligations. The 2008 decision by the Nuclear Suppliers Group to exempt India, non-NPT adherent possessing nuclear weapons, from its export restrictions also weakened the incentives of some NPT parties to strictly observe the NPT obligations because the acceptance of nuclear non-proliferation obligation and the access to nuclear supplies and technology were considered a basic bargain underlying the NPT. Goes the refrain: 'If you can have free access to nuclear supplies and technology even without adhering to the NPT and still get nuclear weapons, why bother to adhere to the NPT?'

For all these reasons, the NPT faces another challenge to stop further proliferation of nuclear weapons. Given these evident deficiencies of the NPT, how then might these be overcome and the credibility and authority of the NPT be restored? There are at least six major steps that must be taken to achieve this result.

1. Nuclear Disarmament

In 2009 US President Barack Obama pledged in Prague to work for a world without nuclear weapons. So, one approach is to simply wait for the nuclear weapon possessing states to work among themselves to achieve a world without nuclear weapons. But, it was exactly the disappointment about the lack of progress towards nuclear disarmament that led to the adoption of the TPNW. The fact that none of the nuclear weapon possessing states has shown willingness to join the TPNW indicates that they have no intention of giving up their nuclear weapons any time soon, and, without pressure, they will remain resolute on keeping these weapons. Some non-nuclear states may join the efforts to decelerate the current nuclear modernization and buildup thereby demonstrating that there are ways to overcome obstacles to nuclear disarmament, or at least ensure that the nuclear armed states refrain from any move that complicates an already complex situation.[3]

2. Regional Nuclear Disarmament

In the absence of concrete progress toward global nuclear disarmament, regional approaches such as the treaty-based Nuclear Weapon-Free Zones (NWFZ) have been important and crucial. Five such zones currently exist in the world and Mongolia has also been designated with a nuclear weapon-free status. Two more zones – in the Middle East and in Northeast Asia – have been proposed.

Establishing a Middle East zone free of weapons of mass destruction, as envisaged in the resolution adopted in the 1995 NPT Review and Extension Conference, would address Israeli nuclear weapons and arrest new nuclear proliferation in the Middle East. Twenty five years after the adoption of the resolution, however, there has been little meaningful progress towards the realization of such a zone. Arab states try to adopt a resolution calling for Israel to adhere to the NPT and accept comprehensive IAEA safeguards, meaning Israel should abandon its nuclear weapons and prove all the nuclear activities are for peaceful purposes. Israel on its part insists that

[3] A formula to take care of the current deadlock about the involvement of China in the US-Russian arms control is suggested in *The NPT at Fifty: Successes and Failures* by the author. op. cit.

for a WMD-free zone to be achieved, regional peace and security have to be established. Practically speaking, these conditions would have to be established concurrently. Thus, both sides have to show flexibility to realize any meaningful negotiation to achieve a free zone.

In Northeast Asia, if North Korean denuclearization is to be realized, it may be in the course of establishment of a Northeast Asia NWFZ. In the joint statement of the 2018 US-DPRK presidential Singapore summit, US President Trump committed to provide security guarantees to the DPRK, and DPRK Chairman Kim Jong Un reaffirmed his unwavering commitment to complete *denuclearization of the Korean Peninsula*.[4] The DPRK never agreed to unilateral denuclearization but rather, to denuclearization of the entire Korean Peninsula. For the DPRK, this phrase means that not only the DPRK abandon its nuclear weapons but the ROK also pledges not to acquire nuclear weapons and accept strict verification the same way as the DPRK may be required to. Not only that, DPRK demands that there should be no nuclear weapons stationed in American bases in the ROK, which also should be verified. President Trump also "committed to provide security guarantees to the DPRK."[5] For the DPRK however, it is not sufficient for the US to make a political statement to provide security guarantees to the DPRK; instead the US should do so in a legally binding way backed up by deeds. It follows that if the US guarantees not to invade the DPRK, it would not need to keep its forces in the ROK. The DPRK sometimes asks for renunciation of the nuclear umbrella by not only the ROK but also Japan. It also asks for the renunciation of the US-Korea Mutual Defense Treaty and the US-Japan Security Treaty. Thus, accommodating all these North Korean demands becomes synonymous with the establishment of a Northeast Asia NWFZ in which the DPRK, ROK, and Japan become bound not to acquire nuclear weapons, nor to station any nuclear forces in return for negative security assurance by the United States, China, and Russia. Abandonment of alliances and the nuclear umbrella will be a subject of negotiations in drafting a NWFZ treaty.

[4] Joint Statement of President Donald J. Trump of the United States of America and Chairman Kim Jong Un of the Democratic People's Republic of Korea at the Singapore Summit, June 12, 2018, https://trumpwhitehouse.archives.gov/briefings-statements/joint-statement-president-donald-j-trump-united-states-america-chairman-kim-jong-un-democratic-peoples-republic-korea-singapore-summit/

[5] Ibid.

3. IAEA Safeguard System

The Iraq and the DPRK cases demonstrated that existing IAEA safeguards system at the time were not effective enough to uncover the clandestine nuclear activities early enough to prevent the progress of the clandestine activities. Thus, the IAEA adopted the model additional protocol to supplement the existing safeguards so that its inspectors could verify a wider range of sites and use such methods as taking soil samples of minute radio isotopic particles. The problem is that even after more than two decades since its introduction, the additional protocol has not been ratified by key countries of concern such as Iran, Brazil, Argentina, Egypt, Saudi Arabia, Israel, and Pakistan, although it has been ratified by more than 130 countries. India has only ratified an additional protocol regarding limited facilities. The apparent political reluctance to conclude an additional protocol has to be overcome if the world is to resume nuclear disarmament in a serious manner.

4. Compliance and Enforcement

The experience of the DPRK and Iran nuclear proliferation highlighted another critical issue regarding the NPT: how to enforce compliance with the NPT obligation to not acquire nuclear weapons? Whether the DPRK lawfully withdrew from the NPT or not, it continues to increase its nuclear warheads. If other NPT parties find that the DPRK can withdraw from the NPT, then the validity of the NPT will be seriously damaged, and other countries may use it as a way to acquire nuclear weapons when the time comes for them to face their own proliferation decisions. This is a question common to the NPT and the TPNW. The IAEA itself does not have any strong means to enforce compliance with the non-proliferation obligation undertaken by non-nuclear NPT parties. Ultimately non-compliance has to be reported to the UN Security Council (UNSC) and it is up to the Council to enforce compliance. During the agonizing debate concerning the Iranian question, however, the IAEA Board of Governors had considerable difficulty in reporting Iranian non-compliance with the IAEA safeguard requirements to the UNSC. Although the UNSC had declared nuclear and other WMD proliferation to be a matter affecting the maintenance of international peace and security, in practice, it has often had difficulty even addressing the issue of specific non-compliance. It seems that Council members, in particular permanent members, favor certain countries and resist addressing the question of their non-compliance. For the sake of credibility of the NPT and the IAEA, the UNSC must execute their responsibility properly and impartially. A way to do so, for example, would be to agree beforehand that the IAEA Director-General does not require the IAEA Board's consent to report non-compliance, and the UNSC agrees beforehand that any issue of NPT non-compliance or violation should automatically be put on its agenda.

5. Closing the HEU/naval Propulsion Loophole

An issue that has surfaced over the years concerns the acquisition of Highly Enriched Uranium (HEU) for naval propulsion purposes, particularly for nuclear-powered submarines. Brazil has been working on a program to develop nuclear submarines. There are arguments in Iran regarding the acquisition of nuclear submarines. The ROK is actively considering acquiring nuclear weapons. The AUKUS (Australia-United Kingdom-United States) arrangement is to help Australia acquire nuclear-powered submarines. There is no provision in the NPT that prohibits the acquisition of HEU or nuclear submarines. The IAEA considers use of nuclear material for "military purposes" as for explosive purposes. Thus, transfer of HEU for naval propulsion is not considered diversion from peaceful purposes. Once HEU is placed in a submarine it is not subjected to the IAEA safeguard inspection. Thus, there is a risk of HEU use for naval propulsion to be used as a convenient loophole to justify uranium enrichment capability and to produce HEU that may be quickly converted to nuclear weapons production.

6. Question of Deployment of Small Nuclear Reactors

Further emerging issues concern the deployment of small nuclear reactors to warfronts and using nuclear propulsion for cruise missiles, drones, and other unmanned vehicles. Americans seem to be considering the deployment of small nuclear reactors to the warfront to solve power supply questions in the days when many gadgets and pieces of equipment consume an increasing amount of electricity without interruption. Similarly, small mobile nuclear power plants have been deployed by Russia and China close to frontlines or on disputed lands. Russia boasts about nuclear-powered cruise missiles, drones, and underwater vehicles that can operate for a far longer time than using conventional fuel. This generates concerns about the heightened possibility that these facilities may be involved and destroyed in military conflicts, or that attacks on the facilities could cause widespread radioactive contamination in the environment. Scattering many nuclear devices and material to so many places raises the risk of them stolen or misused by rogue elements. An attack destroying ballistic missile nuclear submarines would be so enormous that it could potentially signal the end of the world. The destruction of small nuclear reactors or small nuclear propulsion devices may become a matter of daily events and greatly increase the risk of environmental contamination, theft or misuse.

Pros and Cons of TPNW Coming into Force: Analysis

Proponents and opponents of the TPNW have articulated a number of arguments in the course of bitter debates leading up to its ratification. This section outlines the pro- and anti-positions, and then analyzes them in search of common ground between the NPT and the TPNW.

Pro-TPNW Arguments

The first such argument is that, once used, nuclear weapons can cause "catastrophic consequences" that "cannot be adequately addressed, transcend national borders, pose grave implications for human survival, the environment, socioeconomic development, the global economy, food security, and the health of current and future generations," the "risks concern the security of all humanity," and "all States share the responsibility to prevent any use of nuclear weapons."[6] Thus, nuclear disarmament and its legality cannot be left to nuclear weapon possessing states, but all the non-nuclear weapon states have a legitimate say on it. Moreover, the proponents adduce the following reasoning: (a) TPNW will help implement UN General Assembly resolutions calling for nuclear weapon elimination and the need for compliance with international humanitarian law; (b) TPNW will "reshape the global normative milieu: the prevailing cluster of laws (international, humanitarian, and human rights), norms, rules, practices, and discourse that shape how we think about and act in relation to nuclear weapons."[7] Even though it does not have an instant impact on nuclear weapon abolition, the TPNW will "lessen their attractiveness and change the incentive structures for states that possess them and others that rely on extended nuclear deterrence."[8] And (c), the 'step-by-step disarmament' approach advocated by the NWS has stalled. Among the goals set at the 1995, 2000, and 2010 NPT Review Conferences, the Conference on Middle East zone

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[6] Quotations from the TPNW preamble. July 2017, http://undocs.org/A/CONF.229/2017/8

[7] Ibid.

[8] Ramesh Thakur, "The Nuclear Ban Treaty: Recasting a Normative Framework for Disarmament," *The Washington Quarterly* 40 (4), 2017, pp: 71–95, https://www.tandfonline.com/doi/full/10.1080/0163660X.2017.1406709

free of WMD has not moved forward. The Fissile Material Cutoff Treaty (FMCT) negotiation has not started. Only the Comprehensive Nuclear Test Ban Treaty (CTBT) has been adopted but has not come into force even after more than twenty years since its adoption.

Anti-TPNW Arguments

Contrary to these propositions, TPNW opponents argue first and foremost that the TPNW "does not address the security concerns that continue to make nuclear deterrence necessary, cannot result in the elimination of a single nuclear weapon and will not enhance any country's security, nor international peace and security."[9] They then present a countervailing chain of logic as follows: (a) Nuclear weapons possessing states remain committed to the obligations of Article 6 of the NPT on nuclear disarmament, but—given the realities of international security—nuclear disarmament can only be promoted in a step-by-step manner. Jumping to prohibition and elimination is impractical; (b) Until nuclear disarmament is attained, nuclear nonproliferation remains a high priority. The TPNW distracts attention from the NPT and risks weakening NPT-based non-proliferation efforts; (c) The TPNW posits that some treaty parties will join it still holding nuclear weapons and prescribes procedures to abandon them to fulfill the treaty's basic obligation to accept the prohibition and the elimination of nuclear weapons. But, there is as yet no robust verification procedure to ascertain abandonment of nuclear warheads in the highly contentious real world, not to mention compliance and enforcement procedures.

Evaluating Pro-Con TPNW Arguments in the NPT Context

The TPNW leaves verification procedures to the meeting of States Parties to elaborate after the treaty comes into force. Article 8 paragraph 1 of the TPNW provides that the "States Parties shall…consider and…take decisions…on further measures for nuclear disarmament, including: "Measures for the *verified, time bound and irreversible elimination of nuclear weapon programmes*."[10] As the nuclear weapon possessing countries stayed away from the negotiating conference for the treaty, they were not there to argue for the need for a robust verification process

[9] Joint Press Statement from the Permanent Representatives to the United Nations of the United States, United Kingdom, and France, July 7, 2017, New York City, https://usun.usmission.gov/joint-press-statement-from-the-permanent-representatives-to-the-united-nations-of-the-united-states-united-kingdom-and-france-following-the-adoption/

[10] Article 8, paragraph 1 (b) of the TPNW. Italicized emphasis added by author. https://undocs.org/pdf?symbol=en/a/conf.229/2017/8

nor to provide expertise about it. So, in a way, the treaty opened a door for the nuclear weapon possessing states to consider the decision of a verification system, deadlines for elimination, and measures to ensure irreversibility. So far, the TPNW only requires that a state undertake comprehensive safeguards[11] while leaving the door open to committing to the additional protocol. Should the nuclear weapon possessing states ever start reducing and ultimately eliminating their nuclear weapons in accordance with their Article 6 obligation, they are likely to demand a robust verification system be established, whether this is part of the TPNW or not; and such a system may be employed at that time by states party to the TPNW if the disarming state has become a party to the TPNW. Such warhead dismantlement process may benefit from the studies done by the IPNDV (International Partnership for Nuclear Disarmament Verification).[12]

Also, the TPNW provides for setting a deadline to abandon nuclear weapons, when and if a nuclear weapon possessing state joins the treaty. The deadline is to be determined by the first meeting of States Parties to the treaty.[13] It may be recalled that nuclear disarmament proponents have long argued for "time-bound," verifiable, and irreversible elimination of all nuclear weapons. The nuclear weapon possessing states contend, however, that it is unrealistic to set a definitive date for elimination in view of the years required to dismantle thousands of warheads and the complex and demanding verification and compliance measures that will be required. This is a fair question to which there is as yet no answer from TPNW proponents, and without clarity on the pathway and timelines, it is unclear that any state would undertake open-ended and absolute commitments to disarm.

A third critical issue is what to do in a case where a breakaway state declares it has acquired nuclear weapons when every other state has already abandoned their nuclear arsenals? The International Commission on Nuclear Non-proliferation and Disarmament (ICNND) came up with a two-step approach to get around this question. The first priority is to get the nuclear weapon possessing states to reduce their holdings to the minimum level possible. Then, they will proceed to the final

[11] Article 3, paragraph 2 of the TPNW, op. cit.
[12] Refer to https://www.ipndv.org/. On the specific issue of involving NNWS in the warhead dismantlement, refer to Carlson, John. "Verification of DPRK nuclear disarmament: the pros and cons of non-nuclear weapon states (specifically, the ROK) participating in this verification program", NAPSNet Special Reports, May 19, 2019, and https://nautilus.org/napsnet/napsnet-special-reports/verification-of-dprk-nuclear-disarmament-the-pros-and-cons-of-non-nuclear-weapon-states-specifically-the-rok-participating-in-this-verification-program/
[13] Article 4, paragraph 1, TPNW, op. cit.

stage to eliminate their nuclear weapons taking care of the highly demanding final stage issues.[14] Recently, Parliamentarians for Nuclear Non-proliferation and Disarmament (PNND) proposed that August 2045—the hundred year anniversary of the Hiroshima and Nagasaki bombings—should be declared as the timeline by which nuclear weapons would be eliminated as a potent symbolic driver that leaves time to negotiate the security issues and to solve the technical issues outlined above.[15] Whereas nuclear abolitionists may complain that this timeline is too slow and poses too much cumulative risk even at low levels of the probability that nuclear war may occur; but at least it is a practical proposal that refutes the arguments of nuclear realists that it may take forever to eliminate all the nuclear weapons—that is, elimination will never be achieved.

Regional Dynamics on NPT and TPNW in Asia-Pacific

In the Asia-Pacific region there are three NPT-recognized Nuclear Weapon States (the United States, Russia, and China); two non-NPT nuclear weapon possessing states (India and Pakistan); and one NPT-defector nuclear weapon possessing state (the DPRK). None of the nine nuclear weapon possessing states has signed nor ratified the TPNW.

Among the remaining non-nuclear weapon possessing states, a total of twenty states have joined the TPNW as of February 19, 2021: ten from the Pacific, six from Southeast Asia, two from South Asia and two from Central Asia. Among them New Zealand, the Philippines and Kazakhstan deserve special mention as they are in security arrangements with the United States and Russia respectively.[16]

Other states allied with a nuclear power have not joined the TPNW, viz, Japan, the ROK, and Australia allied with the United States, and Kyrgyzstan and Tajikistan allied with Russia.

[14] Section 19 of the report of the ICNND provides a set of actions to create conditions for the final elimination stage. http://www.icnnd.org/reference/reports/ent/part-iv-19.html

[15] Alyn Ware, Vanda Proskova and Saber Chowdhury, "2045: A New Rallying Call for Nuclear Abolition," *InDepth News,* October 2, 2020, https://www.indepthnews.net/index.php/opinion/3934-2045-a-new-rallying-call-for-nuclear-abolition

[16] New Zealand is in the ANZUS (the relationship was once suspended but resumed in 1996), the Philippines has Mutual Defense Treaty with the United States, and Kazakhstan is in the Collective Security Organization.

Uzbekistan has suspended its membership in the post-Soviet Collective Security Treaty Organization.

Table 1. States Parties to the TPNW in Asia-Pacific.

Sub-region	States Parties
Pacific	Cook Islands, Fiji, Kiribati, Nauru, New Zealand, Niue, Palau, Samoa, Tuvalu, Vanuatu
Southeast Asia	Cambodia, Laos, Malaysia, Thailand, Philippines, Viet Nam
South Asia	Bangladesh, Maldives
Central Asia	Kazakhstan, Mongolia

Looking forward, Indonesia has expressed its intention to ratify the TPNW. ASEAN member states are members of the SEANWFZ (Southeast Asian Nuclear-Weapon-Free-Zone) so theoretically would not have much difficulty joining the TPNW. The remaining ASEAN members are Brunei Darussalam, Myanmar, and Singapore. Likewise, the remaining member states of the Treaty of Rarotonga (South Pacific Nuclear Free Zone Treaty) would not have much difficulty joining the TPNW. The remaining states are Australia, Papua New Guinea, Solomon Islands, and Tonga. Among them Australia is the only state under the US nuclear umbrella. The Marshall Islands, the Federated States of Micronesia, and Palau are north of the Equator and not party to the treaty but are eligible to become parties should they decide to join. The Marshall Islands has lived under the shadow of American nuclear tests and consequentially has a strong anti-nuclear sentiment. But, these states have varying degrees of political association with the United States, which may affect their decision on whether to join the TPNW.

Among the members of the Central Asian Nuclear Weapon Free Zone, so far, only Kazakhstan has joined the TPNW. The other members, that is, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan, theoretically would not have difficulty joining the TPNW.

In contrast, Japan and the ROK, the two non-nuclear states in Northeast Asia, face considerable hurdles to joining the treaty given increasing nuclear threats from the DPRK. Additionally, Japan has an active territorial dispute with China and a potential nuclear threat from it as well as facing Russian nuclear forces located in the Russian Far East and in the coastal seas and north Pacific. Nevertheless, there is a strong internal voice in Japan supporting the TPNW. Civic groups led by mayors of Hiroshima and Nagasaki have asked the government to join the treaty. Junior partner in the ruling coalition, Komeito, has asked the government to participate in the first meeting of States Parties as an observer. This domestic pressure is likely to continue.

Who Can Break the NPT-TPNW Gridlock and How?

As noted above, a number of small, middle, and large powers are committed to bridging the gap between the TPNW and the NPT, and some of them being allies of a nuclear weapon possessing state are well-placed to apply pressure in both directions. Outside the Asia-Pacific region, there are similar voices expressed in Belgium and Canada.

The first chance for the TPNW proponents and opponents to have a meeting of minds may be the next NPT Review Conference. If they are to move beyond competing for support for their respective positions, then both sides will need to reach out to those inclined to support their opponents. The NWS should show progress in nuclear disarmament efforts, or that they are determined to make some. They should show that they are working hard to decelerate nuclear arms modernization and competition, and taking measures to reduce the risk of accidental or inadvertent uses of nuclear weapons. Austria and the other proponents of the TPNW should stress that the treaty does not weaken the NPT, but rather is compatible with it and that they will be working to devise ways to achieve the abolition of nuclear weapons, for example, by strengthening the requisite disarmament verification measures and the ways to meet treaty non-compliance and the ultimate enforcement against states that might try to break out.

The next opportunity to find common ground will be at the first meeting of the TPNW States Parties when they meet in 2022. It will be an important meeting as the treaty leaves many tasks for future implementation by the States Parties. These include:

Definition of key articles in the treaty text: What exactly, for example, is meant by Article 1 paragraph e that binds States Parties to never “a(A)ssist, encourage or induce, in any way, anyone to engage in any activity prohibited to a State Party under this Treaty."[17] Depending on the way this prohibition is defined, some US allies that host American military facilities, for example, ballistic missile acquisition radars or strategic communication facilities, may or may not be able to join the treaty.

Observer status: Rules of procedure including in what manner the meeting allows non-States Parties to observe. Will states such as Japan that might attend with observers' status be allowed to attend all the sessions of the meeting? Would they be allowed to speak? Will they be allowed to table a proposal?

Disarmament measures and timelines: as Article 8, paragraph 1 (b) anticipates that States Parties may take additional measures for nuclear disarmament, including "[m]easures for the verified, time-bound and irreversible elimination of nuclear-weapon programmes, including additional protocols to this Treaty."[18] The weakness of verification procedures, especially but not only from the perspective of nuclear weapon possessing states, is frequently pointed out as a major flaw in the TPNW. Efforts to elaborate robust verification procedures would help alleviate this concern. If both sides are serious enough, TPNW States Parties, NWSs, and other non-TPNW members may organize a working group to elaborate such a verification system, possibly building on the works done by the IPNDV.

There are further steps that 'bridging countries' may undertake to overcome the gaps between the TPNW proponents and the opponents with those who support the NPT. As noted above, dialogue sessions may be organized between them to identify ways to find common ground at the next NPT Review Conference and/or as a side event of the first meeting of the TPNW States Parties. Another approach would be to convene a conference on victim assistance and environmental remediation in parallel with the meeting of the TPNW States Parties. International cooperation to this end is envisaged in Article 6 of the treaty, and given the nature of such cooperation, willing states and civil organizations may be invited irrespective of their legal standing vis-à-vis TPNW. Article 6 seems to be modelled after the provision of the Ottawa Convention banning anti-personnel landmines. Even though the United States is not a party to the convention, it is active in demining

[17] United Nations General Assembly, Treaty on the Prohibition of Nuclear Weapons, July 7, 2017, http://undocs.org/A/CONF.229/2017/8

[18] Ibid.

efforts. Japan is a state that has deep expertise in the area of assisting radiation victims and environmental remediation, and domestic support for such activities, and might serve to host such a conference.

It is also critically important to remind humanity of the horrific humanitarian consequences of the use of nuclear weapons. Realistically, there is no immediate prospect that nuclear weapon possessing states will agree to abandon their nuclear weapons any time soon. Thus, it is important to ensure that the people around the world and, in particular, the political leaders and military commanders who are in the position to decide the use of nuclear weapons, are fully aware of the consequences of the use of nuclear weapons. One way to do so is to invite the people to Hiroshima and Nagasaki to observe the memorials and to talk to the surviving victims. As the victims are aging and the memories are fading, innovative methods to let the people become aware of the consequence are needed.

For the same reason, it is essential that the legal requirements under the laws of armed conflict and other pertinent international law be incorporated into every aspect of doctrinal and operational planning by nuclear weapon possessing states to prevent the manifestly illegal use of nuclear weapons and to delimit the cases as much as possible of arguably legal use until the weapons are prohibited and eliminated. All nuclear commanders and weaponeers must understand this and be ready to act on their obligation to ensure that nuclear weapons are always controlled by the criteria of discrimination, proportionality, necessity, and precaution to limit collateral damage and protect civilians from nuclear warfare.

Finally, an all-out global effort by civilian and governmental agencies is called for to support all efforts to ensure the ultimate goals of the NPT and the TPNW are realized. In particular, medical, legal, environmental, and humanitarian experts should be invited to apply their expertise in each of these activities.

19. Hope Becomes Law: The Treaty on the Prohibition of Nuclear Weapons in the Asia-Pacific Region

Richard Tanter

Introduction

For three quarters of a century, might was treated as right as the number of nuclear-armed states in the Asia-Pacific region increased from one to now seven.[1] Four of these Nuclear Possessing States are bound by the Nuclear Non Proliferation Treaty and evolving international laws that define the (il)legality of nuclear weapons and their use, and three are non-NPT states but still otherwise subject to international law—especially the Laws of Armed Conflict and the ambiguous ruling by the International Court of Justice in 1996.

The number of states that entered into nuclear umbrella contracts with the United States ("nuclear extended deterrence") varied, but at its peak during the Vietnam War, included regional states party to the SEATO treaty (that is, New Zealand, Australia, the Philippines, Thailand, and Pakistan), South Korea, Japan, Taiwan, and by implication albeit not explicitly at that time, Australia and New Zealand. These states were implicated via stationing of forward-deployed nuclear weapons on land or in transit, or by hosting nuclear command, control, and communications and early warning facilities, in preparation and planning for nuclear war and were thereby implicated under international law as also accountable for nuclear threats and use.

[1] Seven of the current nine Nuclear Possessing States have a presence in the Asia-Pacific: only Israel and the United Kingdom have none. France has staked a claim to be an Indo-Pacific power on the basis of its possessions in the two oceans. Although the military reality behind this grand, not to say, grandiose, claim may be disputed, the nuclear weapons-capable aircraft carrier Charles de Gaulle has been repeatedly deployed to the Indian Ocean. See for example, Frederic Grare, 'France, the Other Indo-Pacific Power', Carnegie Endowment for International Peace,' 21 October 2020.

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The Asia-Pacific states not party to this system of nuclear threat known to Strategic Air Command as 'Rest of World' or just ROW was simply assumed to have no agency and no rights or prerogative to exert jurisdiction over the conduct of nuclear war and were bullied or cajoled to become members of the NPT except for the three standouts—India, Pakistan, and North Korea.

Now the non-nuclear rest of the world, especially clearly in the Asia-Pacific region, has stood up and declared enough. For the 'rest of the world' hope has become law—irrespective of what the nuclear-armed states do or say. The Treaty on the Prohibition of Nuclear Weapons will enter into force for its States Parties on 22 January 2021 after the requisite fifty out of eighty-four signatories completed ratification on October 16th. The end came in a rush—sixteen ratifications amid the pandemic this year, including Malaysia, Tuvalu, Jamaica, Nauru, and Honduras since September 30th.[2] These ratifications leading to Entry into Force were despite—or possibly, in part, because of—a last minute cease and desist demarche from the United States urging governments that had already either signed or ratified the treaty to withdraw their support.

The US letter to signatories of the TPNW, reported on 22 October, stated that the treaty 'turns back the clock on verification and disarmament and is dangerous':

> 'Although we recognize your sovereign right to ratify or accede to the Treaty on the Prohibition of Nuclear Weapons (TPNW), we believe that you have made a strategic error and should withdraw your instrument of ratification or accession.'[3]

It is hard to imagine a clearer expression of the dilapidation of the US hegemonic capacity to lead by the creation of nuclear consensus, or even, to coercively counteract even small countries in the rebellion from below against the US-led global nuclear order that the TPNW represents.

The rupture of US nuclear hegemony accelerated by former President Donald Trump's reign of chaos has energized two competing and opposing trends: on the one hand, the nuclear abolition movement, epitomized by the TPNW and the awarding of the Nobel Peace Prize in 2017 to the International Campaign Against Nuclear Weapons (ICAN), which originated in Australia; and on

[2] United Nations Treaty Collection, Status of Treaties, Chapter XXVI, 9: Treaty on the Prohibition of Nuclear Weapons; International Committee of the Red Cross, Advisory Service on International Humanitarian Law, '2017 Treaty on the Prohibition of Nuclear Weapons: Ratification Kit', 24 April 2018.
[3] Edith M. Lederer, 'US urges countries to withdraw from UN nuke ban treaty', *AP News*, 22 October 2020.

the other, the precise reverse movement, with leading policy-makers of major Non-Nuclear Weapons States publicly re-considering the desirability of developing nuclear weapons themselves—vide Japan, South Korea, Germany, and Australia – all US allies. The consequences of these contrary trends are of great significance for the countries of South East Asia and the Pacific, which make up the core membership of two neighbouring Nuclear Weapon Free Zones.[4]

To be sure, there is no guarantee that the treaty will achieve its aim of impelling a move from prohibition to elimination. Indeed, as we shall see below, the nuclear-armed and umbrella states (hereafter Nuclear Possessing States and Nuclear Supporting States[5]) in this region contest the notion that the treaty is a valid and universally applicable international law, not least because a fundamental principle of international law is that states most affected by international laws must concur in the creation of that law for it to be binding.[6] The nuclear-armed and umbrella states in the Asia-Pacific region clearly intend to ignore or quash it. And, of course, the entry into force of a treaty with global intent with as yet only a quarter of the world's countries as states parties[7] has a long way to go before it reaches either of its three primary goals: to become binding international law on a larger number of states to the point where it impinges in practice on the behaviour of nuclear umbrella countries that are not states parties; to induce one or more of those countries to accede to the treaty; or, more distantly, to contribute to shifting at least one of the Nuclear

[4] Michael Hamel-Green, 'The implications of the 2017 UN Nuclear Prohibition Treaty for existing and proposed nuclear-weapon-free zones', *Global Change, Peace & Security*, Vol. 30, No. 2, (2018), pp. 209-232; and Nautilus Institute, *Northeast Asia Nuclear Weapon Free Zone Briefing Book*

[5] The use of the terms Nuclear Possessing States and Nuclear Supporting States (NSSs) is intended to supersede the unhelpful consequences of relying on terms drawn from the NPT. Both supporters and opponents of the NPT include Non-Nuclear States. Similarly, the term Nuclear Supporting State refers to states accepting or defending the legitimacy of nuclear deterrence and reject the claims of the TPNW. In practice, most currently Nuclear Supporting States are U.S. allies and declared recipients of U.S. extended nuclear deterrence, and could therefore simply be referred to by the more common term of umbrella states. However, there are other states which do not have a declaratory policy of reliance on END. Two examples of the latter may be Sweden and Switzerland, countries which are neutrals, do not accept defence by extended nuclear deterrence. Both voted for the adoption of the text of the TPNW, but have since drawn back somewhat. The situation with both is unclear at present. However, it is possible that other countries may end up as non-umbrella Nuclear Supporting Countries. Since almost all Nuclear Supporting States discussed below currently rely on extended nuclear deterrence I will endeavour to identify uses of NSS which do not involve END.

[6] 'The consent of the states parties to the treaty in question is a vital factor, since states may (in the absence of a rule being also one of customary law) be bound only by their consent. Treaties are in this sense contracts between states and if they do not receive the consent of the various states, their provisions will not be binding upon them.' Malcolm M. Shaw, *International Law*, Cambridge University Press. Kindle Edition (2018), p. 690.

[7] "States parties" is a legal phrase used to denote states that are party to a treaty, whether the noun is singular or plural.

Possessing Countries to towards the status of Nuclear threshold Disarming State (of which more below).

Yet, for first time since nuclear weapons were first used in war seventy-five years ago, there is an unambiguous prohibition in international law on their use and possession that will come into force—and most likely for a majority of states in the world—and in the Asia-Pacific. It is now reasonable to expect that most of the remaining thirty-four current signatories will ratify, and that more will join them in time, bolstering the institutionalization of the treaty regime. There are a number of instances of international regimes with limited full accession, but even so, have carried considerable normative influence beyond the formal membership of the treaty regimes concerned. At a minimum, all governments supporting the right to possess or rely on the use of nuclear weapons for their defense polices will now face potential discursive challenges to previously unchallenged legitimacy on that matter.

If the final, still distant objective of the TPNW is to move from prohibition of nuclear weapons to their elimination, then the key proximate goals are the full institutionalization of the treaty regime together with its universalization. Governmental and civil society TPNW supporters in the region intend to continue campaigning to realize these near-term goals, which will entail engaging in dialogue with opponents and sceptics of the treaty in the six nuclear-armed and umbrella states. Thus, much as these nuclear-dependent states may want to ignore the TPNW, they will be forced to respond to it at home and in regional and global fora, with inevitable impacts on political foundations of nuclear strategy that bear close examination.

One starting point of such dialogues will be a regionally-based dialogue in the Asia-Pacific region.[8] The 'Asia-Pacific' is a famously flexible, not to say slippery, term, its content, like any other classification system, shifting according to purpose. This paper takes a frame of the non-nuclear states of East Asia, Southeast Asia, and the Pacific Island states, including Australia and New Zealand. These regions correspond to the non-nuclear states that make up two well-established

[8] I would like to acknowledge the stimulation provided by Professor Mely Caballero-Anthony, 'The Ban Treaty: Perspectives from Southeast Asia', *Asia-Pacific Leadership Network, Policy Brief No. 71*, September 29, 2020. Professor Caballero-Anthony's initiative on TPNW dialogue follows on from a fine history of advocacy of regional security initiatives and for expanding the agenda of what counts as 'security' well beyond the traditional confines of militarily-focussed state security in Southeast Asia. Her argument that there is fertile ground for dialogue in Southeast Asia is most welcome. From a somewhat distinct position, this paper takes up the challenge to build on the foundations of her initiative.

Nuclear Weapon Free Zones (NWFZ) (the South Pacific NWFZ and the Southeast Asian NWFZ) and those that make up a proposed third (a Northeast Asian NWFZ).[9] (See table 1.) South Asia is an important and separate "nuclear" region that links China, India, and Pakistan to the Northeast Asian nuclear threat system, and in turn to the global nuclear threat system involving the United States and Europe. Important as the region is in terms of the risk of nuclear war, this paper will not address how the TPNW will enter into the nuclear discourse and evolution of nuclear commitments in South Asia.

Both the Southeast Asian and Pacific Islands regions show the pattern of sharp division within the regions between a small number of Nuclear Supporting States and a large number of ban treaty supporters. The three major US nuclear allies have opposed the treaty, sometimes vociferously. None of the three principal US-allied Nuclear Supporting States—Australia (a member of the South Pacific NWFZ), Japan, and the ROK—attended the treaty negotiations, and all three have subsequently reaffirmed their commitments to reliance on US nuclear deterrence and opposed the TPNW.[10]

Non-nuclear states overwhelmingly supported the adoption of the treaty text in 2017. Nine of the thirteen ASEAN states have signed with only one, Singapore, showing explicit doubt at any stage.[11] None of the three principal US allies and Nuclear Supporting States—Australia (a member of the South Pacific NWFZ), Japan, and the ROK—attended the treaty negotiations, and all three have subsequently reaffirmed their commitments to reliance on US nuclear deterrence and opposed

[9] The Mongolian Nuclear Weapon Free Status covers its own territory, and is recognized by the United Nations as conforming to the obligations of a single-state nuclear weapon-free zone under United Nations General Assembly Resolution 3261 F of December 9, 1974. Nuclear Weapon Free Status of Mongolia, Nuclear Threat Initiative.

[10] Some ICAN sources classify Thailand as a United States ally in Southeast Asia, and accordingly reference its strong support for the treaty to contradict erroneous claims that adherence to the treaty is incompatible with alliance with a nuclear state. There is in fact no foundation for the claim that the treaty prohibits membership in an alliance with a nuclear state: what would be prohibited would be a specifically nuclear alliance in terms of Article 1(e) of the TPNW. In any case, use of the Thailand case as a paradigm of a U.S. ally for this purpose is in any case a weak case. The claim for 'U.S. ally' for Thailand status is based on the restricted Congressional formulation for section 644(q) of the Foreign Assistance Act of 1961 (22 U.S.C. 2403(q)). That category exists for the purpose of approving certain categories of Foreign Military Sales. The sense in which the NATO countries or Japan, South Korea or Australia are 'allies' of the U.S. is very much more substantial non both sides of the equation. Thailand and the Philippines do have defence agreements with the U.S., but they are of trivial significance for the U.S. by comparison. The fact that in the past both countries had much stronger defence relations with the U.S., including in the Philippines case, hosting nuclear weapons, is not relevant.

[11] Singapore, having taken an active part in the treaty negotiations, and apparently positively disposed, abstained from the vote. According to discussion with diplomatic and ICAN sources, it is not clear what lead to an apparently last-minute change of voting intention, or final this position will turn out to be.

the TPNW. On the contrary, the member states of the Association of Southeast Asian States (ASEAN) have in general show strong support for the treaty, and several large states took a leading part in the treaty text negotiations. All thirteen ASEAN member states participated in the UN General Assembly negotiations leading to the adoption of the text of the TPNW in July 2017, with all but one voting for its adoption. Nine ASEAN members states have signed the treaty, of which four have ratified to date, including Malaysia, Thailand, and Vietnam. All Pacific Island members of the South Pacific Nuclear Weapon Free Zone supported the adoption of the treaty text, and seven (including New Zealand) have signed or acceded to the treaty.

It may be thought that none of this matters in regional diplomacy, but that may well not be the case. The three Nuclear Supporting Countries are almost wholly isolated from their regional neighbours in Southeast Asia and the Pacific Islands. This division from neighbours is especially important for Australia and Japan, which have both sought closer relationships with Southeast Asia, and which both have spoken of the need for closer relationships with Pacific Island states in the face of increasing strategic competition for regional dominance from China.

Dialogue in the region faces a suite of issues and problems regarding movement of the treaty towards institutionalisation as a regime. All of these issues have regional dimensions. The effectiveness of regional dialogues about the TPNW will be affected by the following:

- the nuclear ban treaty as rebellion against global nuclear hegemony;
- decisions regarding proposals of basing dialogue about the TPNW on a claimed primacy of the Non-Proliferation Treaty;
- debates about the path forward: stigmatisation vs. devaluing and delegitimating nuclear weapons;
- the critical counterfactual: Can we imagine a Threshold Nuclear Disarming State?
- debates on Nuclear Supporting States and Extended Nuclear Deterrence;
- the regional obstacles to treaty compliance posed by globally distributed systems of nuclear command, control, communication and intelligence;
- a universal human interest in having in place by the time a threshold nuclear disarming state appears on the horizon a comprehensive verification regime which will be ‘fit for purpose’ in the circumstances that will prevail at that point—and beyond; and

- the importance of the inclusion of Pacific Island states in regional dialogue about the TPNW.

The Treaty as Rebellion Against Global Nuclear Hegemony

As noted in section 1, for the past half century, the dominant framework for discussion of nuclear disarmament has been the division of the parties to the 1968 nuclear Non-Proliferation Treaty into two groups recognized under the NPT: Nuclear Weapons States (NWSs) and Non-Nuclear Weapons States (NNWSs). This NPT division of the world's states has long been seen as unsatisfactory, beginning with the refusal in the 1960s by India in particular, then without nuclear weapons, to join the treaty on the grounds that the NWS/NNWS division amounted to an illegitimate regime of global nuclear apartheid. The exit of the DPRK from the treaty, and the refusal of subsequently nuclear-armed India, Pakistan, and Israel to join the treaty, have deeply compromised the treaty's putative distinction on the basis of 'recognized' nuclear weapons possession. It is a mark of the hegemonic power of the NPT's framework that its terms of that distinction have acquired an assumed legitimacy and discursive efficacy well beyond the treaty.[12]

Following the entry of the TPNW into force it is more useful to frame global discussions about nuclear weapons in terms of the division of the world into three main groupings:

- the Nuclear Possessing States (NPSs), made up of the five Nuclear Weapons States 'recognized' under the NPT plus the other four nuclear-armed states;
- the currently thirty-plus Nuclear Supporting States (NSSs) composed mainly of those asserting the legitimacy of reliance on US extended nuclear deterrence; and
- the largest group, the Nuclear Ban Treaty States (NBTS).

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[12] In October 2016 ICAN spokesperson Tim Wright made this point in an eloquent critique of the United Kingdom's claim to responsible nuclear possession and adherence to the NPT while modernizing its nuclear strike force. The NPT, Wright argued rightly, 'is not a licence for five nations to retain nuclear weapons in perpetuity. It does not confer any legitimacy on their weapons.' Tim Wright, 'Do no harm: ban nuclear weapons now', International Campaign Against Nuclear Weapons. On nuclear hegemony, see Peter Hayes, 'Trump and the Interregnum of American Nuclear Hegemony, Journal for Peace and Nuclear Disarmament, Vol. 2, No. 1, pp. 219-237; and Nick Ritchie, 'Waiting for Kant: devaluing and delegitimizing nuclear weapons', International Affairs, Vol. 90, No. 3 (2014), pp. 601–623; and Nick Ritchie, 'A hegemonic nuclear order: Understanding the Ban Treaty and the power politics of nuclear weapons', *Contemporary Security Policy*, Vol. 40, No. 4, (2019), pp. 409-434.

Whatever the disdainful disregard of the 'entirely unserious'[13] ban treaty by the Nuclear Possessing States and the Nuclear Supporting States, the ban treaty will establish a United Nations-auspiced legal regime based on the presumption of the fundamental illegitimacy and prohibition of development, testing, production, stockpiling, stationing, transfer, use, and threat of use of nuclear weapons, and also assistance and encouragement to such prohibited activities.

Nick Ritchie and Kjølv Egeland summarized the rationale behind the concentration on the treaty's capacity to reshape the frameworks of nuclear weapons discourse:

> 'From a theoretical perspective, the purpose of these discursive shifts was to transform the subjectivities of core actors, which is a central feature of productive power. While the non-nuclear-armed states would be redefined from passive or "subaltern" bystanders to active stakeholders in humanitarian diplomacy, the nuclear-armed states (especially the NPT NWSs) would be recast from "responsible nuclear sovereign" entitled to practice nuclear deterrence to irresponsible possessors of uncivilised weapons of mass destruction.'[14]

The coming expanded nuclear policy debate is about the establishment of norms and practices derived from the treaty and resistance to such processes.[15] As expressed trenchantly and elegantly by Kjølv Egeland,

> 'The supporters of the ban are aiming to replace the NPT's distinction between nuclear haves and have-nots with a distinction between nuclear civilizers and barbarians.'[16]

The US demarche to TPNW signatory states was extraordinary in its cavalier attitude to good faith in international law by encouraging signatory states to ignore Article 17 of the treaty permitting withdrawal only on the condition a state party

> 'decides that extraordinary events related to the subject matter of the Treaty have jeopardized the supreme interests of its country.'

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[13] Briefing on Nuclear Ban Treaty by NSC Senior Director Christopher Ford, Carnegie Endowment for International Peace, 22 August 2017.
[14] Nick Ritchie & Kjølv Egeland, 'The diplomacy of resistance: power, hegemony and nuclear disarmament', *Global Change, Peace & Security*, vol. 30, no. 2 (2018), p. 132.
[15] Nick Ritchie & Kjølv Egeland, 'The diplomacy of resistance'.
[16] Kjølv Egeland, 'Banning the Bomb: Inconsequential Posturing or Meaningful Stigmatization?', *Global Governance*, Vol. 24, (2018), p. 18.

But the US letter was also revealing in its repetition of US government-issued talking points repeated over the past four years and echoed loyally by Nuclear Supporting States such as Australia.[17] A sample of such claims, most of which have been refuted effectively, would include:

- 'The TPNW undermines the Non-Proliferation Treaty.'
- 'The TPNW has weaker nuclear safeguards than the Non Proliferation Treaty.'
- 'The TPNW disregards the need for verification of disarmament by Nuclear Weapons States.'
- 'The TPNW is incompatible with alliance by Non-Nuclear Weapons State countries with Nuclear Weapons States.'
- 'The day after the TPNW comes into force, there will be just as many nuclear weapons as there are now.'
- 'No state possessing nuclear weapons has signed the treaty—or is ever likely to do so.'
- 'The TPNW and its supporters are creating divisions in the global arms control and disarmament community.'
- 'The TPNW undermines democratic open societies which are committed to transparency about nuclear disarmament, and it protects autocratic and authoritarian states that are secretive and repressive.'
- 'Many states that voted to adopt the text of the TPNW in 2017 now have signers' remorse: it will never come into force.'

All of these criticisms were aired during the 2017 UN General Assembly negotiations over the text of the TPNW—which, in regional terms, was supported by all but one of the ASEAN states and almost all Pacific Island states. Further, almost all have either been disproved by the TPNW's short history to date (little signer's remorse on display; the precondition for Entry into Force has arrived); shown to be wilful misrepresentation (how many countries have countries has the NPT disarmed?; the treaty clearly does not limit alliances with Nuclear Possessing States, just specifically nuclear alliances); or shown to be simply self-serving (all Nuclear Possessing States

[17] See for example, the similarity of the September 2020 letter to NATO, United States Non-Paper: "Defense Impacts of Potential United Nations General Assembly Nuclear Weapons Ban Treaty"; Note by the Secretary,' AC/333-N(2016)0029 (INV), October 17, 2016, annex 2. f.

are secretive and repressive when it comes to their nuclear weapons—just ask Mordechai Vanunu). There are indeed several valid concerns, along with continued misunderstandings, about some aspects of the treaty, which are discussed below, but most of the list above are now a matter of unwarranted repetition of debunked claims.

In this year of pandemic, the number of countries that have ratified the treaty under such conditions is striking: Belize, Botswana, Fiji, Honduras, Ireland, Jamaica, Lesotho, Malaysia, Namibia, Nauru, Nigeria, Niue, Paraguay, Saint Kitts and Nevis, and Tuvalu. That these countries, some of which are relatively small and almost all of which face economic and climatic difficulties, should have taken on the burden of ratification under the added weight of the pandemic suggests a measure of determination on the part of the less powerful of the world's governments to move the ban treaty into law. Together with the near universal signing of the treaty by the countries of the Association of Southeast Asian nations and of the Pacific Island Forum, this pattern suggests there is fertile ground for proactive dialogue in the Asia-Pacific, in the first instance between government and civil society organizations from the Nuclear Ban Treaty Supporting States and Nuclear Supporting States.

Two Key Choices on the Pathway to TPNW Universalization

With the entry of the TPNW into force both proponents and opponents of the treaty enter into a new strategic setting. There are issues of concern to both sides about how to proceed, and some of them are potentially difficult. Two of those issues concern the starting points for ongoing dialogue each side commonly proposes, both of which require serious thought before the longterm framework for dialogue is firmly set.

One issue is how to discuss the relationship between the NPT and TPNW: whether the basis of negotiations should be the primacy of the nuclear Non-Proliferation Treaty as the foundation of global regulation of nuclear weapons. Seeing the NPT as 'the cornerstone of the global non-proliferation regime' and therefore as the starting point for any dialogue on nuclear disarmament leads some critics of the TPNW into difficulty. To be clear, I believe an assessment of the NPT regime will conclude that for purposes of nuclear disarmament the Non-Proliferation Treaty is effectively a dead letter. A simple ecumenical approach will not be productive for dialogue. But this is a matter on which reasonable people may differ, and positions on this issue may also shape-shift and differ in subtle but important ways depending on their stance, opening at least the possibility of some common ground on which to pressure the nuclear-armed and umbrella states to disarm and reduce nuclear war risk during the disarmament process rather than the current trend of nuclear armament and modernization and increased risk of nuclear war.

The second issue involves a concern with the common framing by proponents of the TPNW of the treaty's primary process as stigmatizing the states possessing nuclear weapons and their supporting states. Clearly, nuclear weapons will continue to give rise to feelings of disgust and revulsion amongst vast numbers of people, TPNW proponents will face a hard choice as they engage with those committed to retaining nuclear weapons between continuing to focus primarily on stigmatizing the admittedly pathological psychosocial aspects of nuclear weapons theory and practice, versus concentrating on universalizing of the nuclear ban treaty less emotive but no less explicit strategies of devaluing and delegitimating nuclear weapons.

The rest of this section examines the contested terrain on the key issues that TPNW and nuclear weapons advocates will fight to retain the political high ground in each country in the region, although the degree to which each of these issues is salient in a given polity with their unique geopolitical circumstances, location in the world system, and geostrategic experience and related key historical lessons derived from their histories, will vary. In presenting these arguments, I will inflect the analysis with my own views on which position is valid and sound taking into account the fundamental goals of realizing human security and constructing a peaceful world that is sustainable; but wherever one falls on each of these arguments—and readers are welcome to substitute their own value judgements and views—I suggest that these issues will define the agenda of the debate in the region on the TPNW versus the nuclear status quo.

(a) The NPT is not a starting point for dialogue

Many critics of the TPNW argue that discussion and dialogue about the TPNW should be framed on the basis of the primacy of the nuclear Non-Proliferation Treaty as the foundation of global regulation of nuclear weapons.[18] Insistence on the primacy of the NPT as starting point is often accompanied by support for a range of arms control, nuclear security, and non-proliferation measures. Like the NPT, these other measures are based on an explicit or implicit presumption of legitimacy of nuclear weapons. In fact, it will be important to distinguish between the insistence on the primacy of the NPT and support for other arms control and nuclear security measures.

There are three fatal flaws to the primacy of the NPT argument.

There can be little objection to dialogues with supporters of the NPT as such, but given the almost moribund state of NPT discussions in recent years, it would first be appropriate to cast a sceptical eye over the prospects of anything productive emerging from the postponed 2020 NPT Review Conference, now due to convene in April of next year. There was little evidence of that before its postponement. The past two decades of NPT RevCons have featured many promises but shown little or no actual progress or achievement—and certainly none on nuclear disarmament as required of the Nuclear Weapons States and their supporters by the NPT's wholly ignored Article 6. The NPT is not dead, but there is little likelihood of substantial reform, even just in the form of making good on the promises of RevCons past. No governments in the Asia-Pacific, (and certainly not the government of Australia, the regional country most supportive of and hardwired into US nuclear planning), have shown any serious and sustained commitment to the root and branch proactive policy renewal process that would be need to make good on the very limited commitments of RevCons past, let alone the level of globally coordinated effort needed to revivify the NPT.[19]

[18] Two of the strongest cases for the primacy of the NPT that I know of are by John Carlson and by Allan Behm. See John Carlson, 'The 2020 NPT Review Conference and the TPNW factor', in Viatcheslav Kantor (ed.), *Arms Control: Burden of Change*, (International Luxembourg Forum on Preventing Nuclear Catastrophe, 2019), pp. 86-100; Carlson, 'Is the NPT Still Relevant? – How to Progress the NPT's Disarmament Provisions', J*ournal for Peace and Nuclear Disarmament*, vol. 2, no. 1, (2019) pp. 97-113; and Allan Behm, 'Nuclear Non-Proliferation Treaty Review Conference: It's time to revive a struggling treaty', The Australia Institute, forthcoming; and Allan Behm, 'Extended Deterrence and Extended Nuclear Deterrence in a Pandemic World', NAPSNet Special Reports, 15 October 2020. It should be noted that both Carlson and Behm, both experienced in arms control, and disarmament issues within Australian government roles and beyond, indicate that the level of governmental commitment needed to impel the reforms of the NPT they urge as essential are very difficult to foresee under current circumstances. Behm: 'The problem is that the non-proliferation edifice is essentially a façade resting on a single corner, and that corner is crumbling. The question that faces the parties to the NPT is whether they want to strengthen the edifice – and the cornerstone – or whether they are prepared to see the NPT go the way of the New-START – desuetude. Either way, there is much at stake.' Extended Deterrence and Extended Nuclear Deterrence in a Pandemic World', p. 17.

[19] See John Carlson, 'Is the NPT Still Relevant?' and Allan Behm, 'Nuclear Non-Proliferation Treaty Review Conference'.

Secondly, leaving aside the severe limitations of the NPT deriving from the its recognition of five 'approved' Nuclear Possessing States, there is no indication of a viable route for the four non-NPT Nuclear Possessing States to enter the NPT regime.

Lastly, and most fundamentally in relation to the TPNW, over the more than fifty years of the treaty's existence the five Nuclear Possessing States 'recognized' under that treaty have shown no serious willingness to meet their disarmament obligations under Article 6. Half a century is enough: that route is most unlikely to open.

Of course, action to support nuclear non-proliferation, nuclear weapons security, and arms control are almost always commendable and helpful, but it must be remembered that such initiatives are distinct from nuclear disarmament and do not function as a substitute for it.

And the situation on nuclear arms regulation is more serious than many critics of the TPNW recognize. Nuclear arms control is now virtually an endangered species. As Alexey Arbatov put it in a recent review of the 'the disintegration of arms control,'

> 'The world's ability to muddle through the next phase of international tensions without a major crisis, and to prevent such a crisis from escalating to nuclear Armageddon, is in doubt.'[20]

Every Nuclear Possessing State is committed to 'modernization' of their nuclear arsenal, and the Nuclear Supporting States of the Asia-Pacific are not only not demurring but, in the case of the regional major allies of the United States, are tightening their alliance links, nuclear and otherwise.

Contemporary mainstream reformist policy approaches to nuclear weapons based on the NPT and fading memories of a Golden Age of Arms Control are anaemic, and their likelihood of near-term major success implausible. To then set the framework of necessary dialogue as one between supporters of the NPT and supporters of the TPNW seems constraining rather than productive, and not assistive to discussions of more serious problems facing the universalization and efficacious institutionalization of the TPNW.

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[20] Alexey Arbatov, 'Mad Momentum Redux? The Rise and Fall of Nuclear Arms Control', *Survival: Global Politics and Strategy*, 61, (3): 7-38, (June–July 2019) .

(b) Devaluing and delegitimating nuclear weapons versus stigmatization

For many proponents of the nuclear ban treaty its immediate utility as international law would be its norm-forming capability, especially a capacity to stigmatize the use and possession of nuclear weapons. Egeland's quotation above epitomizes the positive version of that thought of the necessity and utility of stigmatization as a key campaigning resource.

Disgust and revulsion from the use or prospect of use of nuclear weapons are entirely understandable and likely be increasingly unavoidable, and it is hard to deny the role of such revulsion impelling people towards action on nuclear weapons.[21] However, there are reasons to be concerned about a strategy for universalization of the TPNW based primarily on an uncritical heightening of stigmatization of nuclear weapons in international society. It may be wise to avoid a strategy primary based on the trope of stigmatization and its practice for two reasons.

Firstly, stigmatization is not a simple matter of 'socializing' a passive transgressive state into a preferred norm, as at least two leading researchers on stigmatisation emphasize. The stigmatization strategy draws on work over a number of years pointing to revulsion with nuclear weapons as a motivation for opposing their possession and more particularly their use in war. Nina Tannenwald's work on the origins and dynamics of the taboo on the use of nuclear weapons has emphasized the role of the stigma attached to nuclear weapons as a key support for a nuclear taboo, and conversely as an impetus to USgovernment officials to overcome restraints on U. nuclear weapons use deriving from that stigma.[22]

Basing her work on stigma in international society on Erving Goffman's classic 1965 book *Stigma: Notes on the Management of Spoiled Identity*, Rebecca Adler-Nissen also emphasizes the normality of stigma in international society, which, she argues is

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[21] And of course, it is important for supporters of the TPNW to recognize that many serious proponents of nuclear deterrence as a foundation of global security also feel the same disgust with the prospect of actual use of the weapons in war if deterrence fails. Self-righteousness can be an occupational hazard of peace campaigners.

[22] Nina Tannenwald, 'Stigmatizing the Bomb: Origins of the Nuclear Taboo', International Security, Vol. 29, No. 4 (Spring 2005), pp. 5–49; Nina Tannenwald, 'How Strong Is the Nuclear Taboo Today?', *The Washington Quarterly*, Vol. 41, No. 3, (2018), pp. 89-109; and Nina Tannenwald, 'The Great Unravelling: The Decline of the Nuclear Normative Order', in Nina Tannenwald and James M. Acton, *Meeting the Challenges of the New Nuclear Age*, (American Academy of Arts and Sciences, April 2018), pp. 6-31. But note also William Walker, 'The absence of a taboo on the possession of nuclear weapons', *Review of International Studies*, Vol. 36, (2010), pp. 865–876.

> 'in part constructed through the stigmatization of "transgressive" and norm-violating states and their ways of coping with stigma.'

Adler-Nissen cautions against the widespread misunderstanding that sees international society founded solely on common values and norms. Stigma plays a more complex role than is often acknowledged in some constructivist accounts of states passively absorbing norms through simple processes of 'internalization.' States reacting to stigma or experiencing it are active agents.

Most importantly, Adler-Nissen argues, the potency of stigma can be diminished or avoided through positive action by the stigmatized, especially when they hold the means and power to reframe negative discourses to their advantage:

> 'Stigmatized states may strategically cope with their stigma, and may, in some cases, challenge and even transform a dominant moral discourse.' [23]

Historically one important and salient example in the Asia-Pacific has been the ability of the United States to slough off the historical stigma of the first use of nuclear weapons through censorship of the human consequences in Japan and construction of a counter-narrative of the necessity for nuclear first use to 'end the war' in the Pacific, contested though that highly effective account may be from the margins of power.[24]

A second reason for caution is that stigmatization, even when it is not simply a discursive tool of the powerful against the weak or out-groups, almost always involves at least potential or incipient dehumanization and violence. In contemporary international society Mr. Trump is an adept from whom other authoritarian world leaders have learned, and who himself has learned from them. All nuclear deterrence policy must presume and robustly prepare for the use of nuclear weapons in war. In practice nuclear deterrence will always involve what we call, when in the hands of governments we dislike, the intent to use weapons of mass destruction, and which should more properly be regarded in all cases as actions on a genocidal scale. Such deterrence discourses, to be

[23] Rebecca Adler-Nissen, 'Stigma Management in International Relations - Transgressive Identities, Norms, and Order in International Society', *International organization*, Vol. 68, (Winter 2014), pp. 143-176.

[24] A second relevant example is that of Israel's possession of nuclear weapons, a fact 'politely' not mentioned in public by the United States and its allies in a highly effective fig leaf deflection of stigma of Israel.

politically successful, necessarily start from psychosocial processes of dehumanization of the adversary—those in Judith Butler's useful reminder, whose lives are 'not grievable.'[25]

Rather than founding the path towards the universalization of the nuclear ban treaty on unreflective and possibly counter-productive strategies of stigmatizing nuclear weapons, the safer and more richly generative alternative, as a number of researchers have argued, is to pursue strategies of devaluing nuclear weapons in defense strategies and delegitimating the possession and use of nuclear weapons. These two latter strategies are distinct in concept and requirement, and while not opposed, lead to the need for quite different suites of dialogue partners.

De-valuing nuclear weapons involves dialogue and debate with security community practitioners who support nuclear possession for deterrence and war-fighting, to explore and identify

- the limits of the military utility of nuclear weapons;
- the counter-productive consequences of their use; and to
- develop alternative—and sustainable—non-nuclear security doctrines and practices.

On the other hand, de-legitimating nuclear weapons involves engaging in strategic, political, legal, and moral discourses involving nuclear weapons to challenge and then vitiate claims of legitimacy for the use, possession, preparation for use, and assistance for and inducement to use nuclear weapons. In Nick Ritchie’s words, delegitimation involves

> ‘exposing the divergence of nuclear weapons practices and values from justifiable rules, consent, legal precedent, and the principle of equality.’[26]

A starting point is to recognize that virtually all existing international law on nuclear weapons prior to the TPNW explicitly or implicitly legitimizes the right of certain countries to possess and use nuclear weapons, regardless of the opinions—and the likely fate—of the majority of the world’s countries. Once the claim of the fundamental illegitimacy of nuclear weapons is posed

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[25] Judith Butler, *Frames of war: when is life grievable?* Verso, 2009. Butler also reminds us of the ‘media framing’ of ‘who is grievable’ and who are to be the officialised targets of stigmatisation characterising public discourse the United States under the Trump administration. See also Judith Butler, *The Force of Nonviolence*, Penguin Random House, 2020.
[26] Nick Ritchie, 'Waiting for Kant’, p. 56.

systematically, the discussion of why that state of barely registered *méconnaissance* in the face of an inherently genocidal existential situation should be tolerated can be discussed openly.[27] Ritchie suggests delegitimation practices will involve

> 'withdrawal of popular consent, changing the legal validity of the possession and use of nuclear weapons, and demonstrating that current nuclear practices and power relations do not reflect justifiable rules based on shared beliefs prevalent in society—in our case global society.'[28]

Both approaches—devaluing nuclear weapons and delegitimating nuclear weapons—can and should involve both state and civil society agents, at global, regional, and national levels, and will involve construction of new transnational epistemic and moral communities.[29] Challenges to both the military utility of nuclear weapons and to the presumptive right of both Nuclear Possessing States and their dependent Nuclear Supporting States to risk nuclear next use are—in appropriately diplomatic phrasing—useful frames for regional dialogue between regional TPNW supporting states and Nuclear Supporting States.

The NPT, as 'the foundation of nuclear restraint' in existing international law aimed at regulating nuclear weapons, has in fact been the most enduring discursive legitimation for the ongoing possession and use of nuclear weapons, and even then is silent on the four non-NPT Nuclear Possessing States and likely to remain so.[30]

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[27] Nick Ritchie, 'Waiting for Kant'; Nick Ritchie, 'A hegemonic nuclear order'; and Ken Berry, Patricia Lewis, Benoit Pélopidas, Nikolai Sokov and Ward Wilson, ***Delegitimizing nuclear weapons: examining the validity of nuclear deterrence,*** (Monterey Institute of International Studies, 2010). Paradoxically, contrary to its title, Berry *et al* provides one of the best reviews devaluing the utility of nuclear weapons.

[28] Nick Ritchie, 'Waiting for Kant', p. 55.

[29] See in particular the work of Nick Ritchie.

[30] Anna Hood, 'Questioning International Nuclear Weapons Law as a Field of Resistance', in J. L. Black-Branch and D. Fleck (eds.), *Nuclear Non-Proliferation in International Law - Volume V - Legal Challenges for Nuclear Security and Deterrence*, (Springer, 2020), pp. 11-30; Nick Ritchie, 'A hegemonic nuclear order'; and Peter Hayes, 'Trump and the Interregnum of American Nuclear Hegemony'.

Can We Imagine a Threshold Nuclear Disarming State?

A common theme of criticism of the TPNW is that the Nuclear Possessing States took no part in the TPNW negotiations, and that there is no likelihood of any such state joining the treaty.[31]

Let us assume, for the purposes of argument, that the current tide of nuclear proliferation is arrested in its present situation of nine Nuclear Possessing States. Is it absurd to expect any state that possesses nuclear weapons would willingly enter into a process of giving them up? The historical record, to some extent, answers 'No, it is not absurd,' pointing at least to the South African case and to the case of Ukraine. But these two cases are undoubtedly somewhat 'special cases'—apartheid South Africa in the brink of collapse ensuring its successor majority regime did not possess nuclear weapons, and Ukraine independent from the former Soviet Union rejecting continued possession of its inherited but not fully controllable nuclear arsenal in favor of an explicit non-nuclear status in return for security guarantees. Furthermore, for the sake of clarifying the argument let us leave aside the fading hopes that the DPRK will one day be persuaded to trade its nuclear weapons for guarantees of regime survival, security, and financial reward.[32]

The critical question is whether there is any reason to think any major Nuclear Possessing State would voluntarily relinquish its nuclear weapons by seeking to accede to the TPNW? All thinking through of question of this kind (both con as well as pro) involves a consideration of counter-factuals—the essential but forbidden fruit of social inquiry as Richard Ned Lebow called them.

The United Kingdom is a difficult but plausible candidate. Britain is always distinctive among the Nuclear Possessing States insofar as it is highly dependent on the United States for its nuclear weapon system. So extensive is this dependence on the United States that the United Kingdom is best understood as a client nuclear state of the United States.[33]

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[31] For a recent example see George Percovich, 'Living with the Nuclear Prohibition Treaty: First, Do No Harm', Carnegie Endowment for International Peace, 12 November 2020.
[32] William Walker's point about the differences of each of the Nuclear Possessing States paths to that condition applies particularly to the DPRK. Not only has it a state that has 'suspended' its membership of the NPT, but it is also distinguished by three decades of U.S. and allied attempts to bring the DPRK to voluntarily relinquish its nuclear weapons. This remains the U.S. objective and guiding principle.
[33] The UK is dependent on the U.S. for the leased Trident II D5 missiles to be launched from on its submarines; the Anglicized W76-1 warhead and Mk4/4A re-entry vehicle designed at Los Alamos National Laboratory and manufactured at Pantex, the General Dynamics Fire Control System, and the MC4700 arming, fuzing, and firing

At the beginning of the 21st century, Malcolm Chalmers and William Walker set out an argument to the effect that a successful Scottish independence project would quite possibly render the continuation of the United Kingdom's submarine-based nuclear capacity impractical, mainly for reasons of geography.[34] The United Kingdom's nuclear deterrent force of submarines is based at Faslane in Scotland near Glasgow, with a large nuclear munitions facility at nearby Coulport, and the ascendant Scottish National Party is committed to closing both bases. Practical options for alternative basing in what would be the remains of the United Kingdom (rUK) are highly constrained by geography and political considerations.[35] It may well be that the government would have to consider the option of basing its UK nuclear deterrence force in the United States at Kings Bay, Georgia.[36]

Since Chalmers and Walker opened discussion of the possible impact of Scottish independence two decades ago the structural coherence of the United Kingdom has been considerably undermined, and the probability of Scottish independence heightened, not least by the combined consequences of Brexit and the pandemic, to say nothing of the fiscal distress of the UK government. Moreover, in the intervening years the United Kingdom held a surprisingly wide-ranging public debate on the modernization of its nuclear weapons capacity through the renewal of the Trident missile submarine force. A range of views were represented, including acknowledgement by defense specialists of difficulties that will be caused by the great cost of Trident renewal for the United Kingdom's capacity to participate in global conventional operations in future US-led multilateral intervention coalitions.

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system built at the Sandia National Laboratory (operated by Lockheed Martin). See Nick Ritchie, Attachment 1, 'US-UK Special Relationship', Written testimony to the House of Commons, Foreign Affairs Committee, *Sixth Report on Global Security: UK-US Relations*, 18 March 2010, https://publications.parliament.uk/pa/cm200910/cmselect/cmfaff/114/114we12.htm.

[34] Malcolm Chalmers and William Walker, 'The United Kingdom, Nuclear Weapons and the Scottish Question' *The Non-Proliferation Review*, 9, 1, Spring 2002, 1-15; William Walker, 'The UK, threshold status and responsible nuclear sovereignty', *International Affairs* 86: 2 (2010) 447–464; Hugh Chalmers and Malcolm Chalmers, 'Relocation, relocation, relocation', *RUSI Occasional Paper*, August 2014; and Ian Jack, 'Trident: the British question', *The Guardian*, 11 February 2016. See also William Walker, 'Trident's Replacement and the Survival of the United Kingdom', *Survival*, vol. 57, no. 5, (2015), pp. 7-28;

[35] The Scottish government has used the 'RUK' abbreviation to refer to a possible future 'rest of UK' country or its government. Jack uses the term 'rUK'. Chalmers and Chalmers reviewed alternative nuclear submarine homeport options in detail, arguing that the naval base at Devonport in southern England and Milford Sound in Wales would be the most likely candidates. Both would present the rUK government with considerable relocation difficulties to overcome.

[36] William Walker, 'Trident's Replacement' and the Survival of the United Kingdom', pp. 20, 25, and 28.

Coming to power abruptly in July 2016 in the immediate aftermath of the Brexit referendum Prime Minister Theresa May terminated the Trident renewal debate immediately and authorized the nuclear renewal program. That now seems a long time ago, and it is useful to consider what would have happened if that debate about the renewal of Trident was taking place in the United Kingdom under the current circumstances. Much has happened since then to exacerbate strains on Britain's identity as a sovereign nuclear power, along with the fiscal and domestic political capability to maintain a claim to such a role. The still developing Covid-19 pandemic, and in particular the accompanying perceived functional shrinking of the UK government into 'the government of England' on the core matter of health, clearly strengthens the likelihood of another Scottish independence referendum, with a strong chance of electoral success. Given the compounding pressures of the present conjuncture on the United Kingdom structurally, fiscally, and in terms of identity, it is reasonable to suggest that there would be a much greater weight leaning in the direction of a negative decision on Trident renewal.

None of this narrative of future possibility is certain. Whether in the event of a successful referendum a post-independence Scotland would make good on SNP's commitment to close the Scottish nuclear bases is obviously uncertain, as would be the reaction of the rump UK/English government to such moves. And even more uncertain would be the response of other governments, including the other NATO nuclear powers of the United States and France. Nuclear establishments, especially so closely tied to maintenance of post-imperial status, do not give way without a great conflict.[37]

However, the claim, commonly heard in mocking terms from opponents of the TPNW, that it is impossible to seriously imagine any Nuclear Possessing State of consequence moving to the status of a Threshold Nuclear Disarming State is simply unsupportable. It may well not happen, but the frequent denial of a realistic possibility reflects a worrying element of compulsive insistence on the untested immutability of the global nuclear order. The TPNW as a politico-legal project of regime formation is rooted in the possibility of such a plausible, though by no means certain, future development, and provides the foundations of a legal and institutional pathway to the realization of such a shift in the global order.

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[37] William Walker, 'International reactions to the Scottish referendum', *International Affairs,* Vol. 90, No. 4, (2014); and Malcolm Chalmers and William Walker, 'The United Kingdom, Nuclear Weapons and the Scottish Question'.

As a result, confirmation of the plausibility of a counter-factual that imagines a significant Nuclear Possessing State considering nuclear disarmament renders the question of verification of national disarmament programs more urgent than those who cannot imagine such a possibility will recognize.

Walker's views rest on the understanding that not only are the elements of support for nuclear possession in any given state complex (and probably overdetermined), but that the nine Nuclear Possessing States are quite distinct from each other than is suggested by the Nuclear Weapon States label. Drawing together a set of possible contributing elements in a Nuclear Possessing States, Walker suggested an important research approach to the question of threshold nuclear disarming states:

> 'It would be interesting to mount a research project to compare the "distances" of the nuclear-armed states from the disarmament threshold, as assessed in terms of capabilities, strategies, regulation, identity fixation and institutional entrenchment, among other things.'[38]

These are not simply matters for disinterested researchers. If the TPNW is to have any utility it must be based on a well-founded assessment of the future historical possibility of its primary assumption: that there will be a Threshold Nuclear Disarming State, as a prelude to making it more likely.

The appearance of a Threshold Nuclear Disarming State anywhere on the planet will in itself have a profound political impact, even with the likely uncertainty of whether it would then proceed over the threshold. The United Kingdom's nuclear relationship to the Asia-Pacific is now essentially nil, although the strategic implications of its history of nuclear testing in Australia and Kiribati and the Marshall islands continues. Yet even so, the appearance of a Threshold Nuclear Disarming State even from distant Europe would mark a seismic shift in a region dominated from the dawn of the nuclear age by Nuclear Possessing States brazenly and energetically abjuring law as a form of nuclear regulation.

[38] Walker, 'The UK, threshold status and responsible nuclear sovereignty', p. 462.

Nuclear Supporting States and Extended Nuclear Deterrence

Most currently Nuclear Supporting Countries are allies of the United States, and almost all of these have declaratory defense policies explicitly reliant on US extended nuclear deterrence.[39] Reliance by each of these countries on policies of extended nuclear deterrence would violate the TPNW prohibition on encouragement or inducement to use or threat of use of nuclear weapons in Article 1(e) of the treaty:

> 'Assist, encourage or induce, in any way, anyone to engage in any activity prohibited to a State Party under this Treaty.'

A government seeking to accede to the TPNW would need to abandon the policy of reliance in US extended nuclear deterrence and provide convincing evidence to a TPNW Conference of the Parties of repudiation of any non-public agreements or policy arrangements with the United States to the same effect.

Clearly, in the case of Asia-Pacific allies currently relying on US extended nuclear deterrence for aspects of their defence—Australia, Japan, the ROK, and, defacto, Taiwan—repudiation of nuclear deterrence would involve a great change in their strategic outlook, which would be very difficult to imagine politically, and if it did occur, would involve considerable changes in defense and foreign policy. But conceptually, it is a comparatively straightforward matter.[40]

Without pretending that such a policy would be politically straightforward to establish for any of these countries, this brief exploration suggests that once an Australian government was committed to such a position, there might be relatively few obstacles to simply replacing the Extended Nuclear Deterrence (END) policy with one of full self-reliance—unless the United States created such obstacles. In practice removal of reliance on extended nuclear deterrence by an Australian

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[39] The standard list of recipients of U.S. extended nuclear deterrence consists of the 24 NATO allies that do not possess nuclear weapons (i.e. excluding France and the UK), together with Japan, Korea, Australia, and de facto, Taiwan. For an argument on the doubt that Australia is in fact an assured recipient of U.S. END, see Richard Tanter, '"Just in Case": Extended Nuclear Deterrence in the Defense of Australia', *Pacific Focus,* Vol. 26, No. 1 (April 2011).
[40] See also see also Monique Cormier and Anna Hood, 'Australia's Reliance on U.S. Extended Nuclear Deterrence under International Law', *Journal of International Law and International Relations*, Vol. 13, No. 2, (2017), pp. 3-47; and Monique Cormier, 'Running Out of (Legal) Excuses: Extended Nuclear Deterrence in the Era of the Prohibition Treaty', in Jonathan L. Black-Branch and Dieter Fleck (eds.), *Nuclear Non-Proliferation in International Law - Volume V*, (Springer, 2020).

government would be politically very difficult but more straightforward than for the other three allies in East Asia. All would need to exit from any intergovernmental military or other defense coordination bodies or institutions with the United States concerning the use or planning for use of US nuclear weapons. Exiting from nuclear institutional linkages would include any secondment or embedding of defense personnel in United States nuclear-related military, bureaucratic, or intelligence agency positions. This move would, in theory, be somewhat easier in the Australian case because US extended nuclear deterrence arrangements with Australia are much more nebulous, not to say uncertain, than in the East Asian cases.[41] Not only are those countries closer to nuclear threat than Australia, but Japan and the ROK have well developed bilateral nuclear policy coordination bureaucratic and military structures akin to the NATO Planning Group, which Australia does not. [42]

For campaigners for the universalization of the ban treaty, these Nuclear Supporting Countries with declaratory policies of reliance on extended nuclear deterrence are probably the primary targets of the next phase of their work. Experience with the United States response to the New Zealand repudiation of reliance on extended nuclear deterrence culminating in the passage of the *New Zealand Nuclear Free Zone, Disarmament, and Arms Control Act (1987)* suggests the United States would likely take a similar political approach to any of these countries following New Zealand and joining the TPNW. In order to limit 'contagion' the United States would seek to claim that such an act would be a violation of what was called in the New Zealand case—incorrectly—the 'global indivisibility of extended nuclear deterrence.'

One other issue closely related to calls for US allies that are Nuclear Supporting States to abandon extended nuclear deterrence in order to join the TPNW has been raised on a number of occasions. The matter was recently raised on the occasion of the TPNW reaching the ratification requirement for entry into force, echoing earlier comments by the US government and by critics of the TPNW.

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[41] On the nebulous, not to say imaginary, characteristics of nature of Australian reliance on U.S. Extended nuclear deterrence, see Tanter, '"Just in Case"', and in particular, Allan Behm: 'Extended Deterrence and Extended Nuclear Deterrence in a Pandemic World', NAPSNet Special Reports, 15 October 2020: 'Extended nuclear deterrence theory has gradually morphed into a kind of deterrence theology – a belief system founded on a codified set of indemonstrable doctrines' (p. 20).

[42] See Christine Leah, *Australia and the Bomb*, Palgrave Macmillan, 2014; and Tanter, '"Just in Case."'

Matthew Harries of the International Institute of Strategic Studies summarized the issue in 2017 as one of the unfairness and folly of using democratic means to achieve nuclear disarmament in democratic states, while authoritarian Russia is immune to any comparable domestic pressures:

> 'The problem is that, when one moves past abstract principles to what the ban will actually do in practice, the target of the treaty is clear: intentionally or not, it is an attack on the nuclear-armed democracies—the United States, in particular—and their allies to the near-exclusive benefit of Russia and China... If I were a Russian policymaker, I would be enthusiastically cheering on the ban movement in private, while maintaining an appropriately scornful tone in public.'

Harries is correct that one of the targets of ban treaty supporters is the reliance of US allies on assurances of extended nuclear deterrence, both in Europe and Asia. Here Harries is following the argument put forward forcefully by the United States 'Non-Paper' of October 2016 on 'Defense Implications of Potential United Nations General Assembly Nuclear Weapons Ban Treaty,' sent to all NATO member countries, urging them to boycott the treaty negotiations.[43] Like Harries, the Non-Paper correctly identifies the implications of a treaty as envisaged by its main proponents as being deeply inimical to the what the United States has at times called 'the global indivisibility of extended nuclear deterrence.' George Perkovich recently updated the argument as Russia 'continues to add to its nuclear arsenal and repertoire of coercion and interference in the internal affairs of NATO countries.':

> 'Thus, the Hippocratic question is whether and how champions of the TPNW could avoid the harm of rewarding Russian intransigence and penalizing NATO states' adherence to democratic norms of free association and lobbying.'

The essential arguments are that peace and the security of democracies in Europe depends on the viability of US extended nuclear deterrence, which the ban will erode, and that the effects of the coming treaty regime will be imbalanced because it will do nothing to eliminate Russian (and, by

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[43] George Perkovich, 'Living with the Nuclear Prohibition Treaty: First, Do No Harm', Carnegie Endowment for International Peace, 12 November 2020; United States Non-Paper: "Defense Implications of Potential United Nations General Assembly Nuclear Weapons Ban Treaty", Committee on Proliferation, NATO, 17 October 2016; and Matthew Harries, 'The Real Problem With a Nuclear Ban Treaty', Carnegie Endowment for International Peace, 15 March 2017.

implication, Chinese) nuclear weapons, while undermining the delicate nuclear policy consensus achieved by the democratic states. Such a claim assumes that the stigmatizing effects the treaty proponents intend the treaty to generate have no follow-on effects on such countries or their strategic environment.

The 'Hippocratic' line of attack—'first, do no harm'—has a fundamental moral problem in so far as it necessarily defends the right of use of nuclear weapons for defence: nuclear deterrence policy must presume a willingness to use nuclear weapons in war if it is to function effectively. This charge is a rerun of 1980s arguments about the impossibility of what was then analyzed in terms of a requirement for multilateral disarmament over unilateral disarmament. Moreover, it brings a distinctly American perspective to NATO and its nuclear operations.

Perkovich outlines the basic argument by applying it not only to US extended nuclear deterrence as such in Europe but—specifically to its most dangerous component—the 'nuclear-sharing' arrangements that has 150 U.S. B-61 nuclear weapons prepositioned on airbases of Belgium, Germany, Italy, Netherlands, and Turkey. This blunt defense of nuclear-sharing is surprising, since in earlier work Perkovich showed a more constructive analytical approach to the question of how countries with END policies should go about assessing their desirability.[44] Percovich helpfully suggested three questions, somewhat different from his more recent approach:

- What are the actual threats to Australia against which extended nuclear deterrence is invoked?
- What are the probabilities attached to such threats?
- Where threats are deemed to be actionable with nuclear response, what alternative responses or means of addressing the issue exist or could be generated?

[44] George Perkovich, 'Extended deterrence on the way to a nuclear-free world', Research Paper, International Commission on Nuclear Non-proliferation and Disarmament (May 2009); and his comments in 'Are the Requirements for Extended Deterrence Changing?' Panel discussion at the 2009 Carnegie International Nonproliferation Conference: The Nuclear Order – Build or Break (6 April 2009).

Here Perkovich provided a useful example of the strategy of constructing dialogue around devaluing the utility of nuclear weapons by making explicit and measurable the validity of claims by Nuclear Supporting States as to the utility or otherwise of nuclear weapons.

Each of these arguments apply to the NATO non-nuclear states as a whole regarding END, as well as to the five nuclear-sharing states. The 'Hippocratic' question also applies to the Asian Nuclear Supporting States—Japan, the ROK, and Australia—with regard to China. A more useful approach would be to start with Perkovich's 2009 questions, separate out the evident folly of the nuclear-sharing arrangements and locate the fundamental question of the desirability of NATO as a US-led nuclear alliance in the broader questions of reconsideration of Europe's autonomous foreign and defense policy requirements and capacities.

But, to return the earlier comments on extended nuclear deterrence and the TPNW, even if the politics of such a conceptually straightforward shift of policy away from reliance on extended nuclear deterrence in Nuclear Supporting States seeking to accede to the TPNW are very difficult, they become much more difficult still when a second element in the prohibitions of Article 1(e) of the TPNW is considered.

Globally Distributed NC3I: Obstacles to Compliance with the Prohibition on Assistance

A small number of Nuclear Supporting Countries in the Asia-Pacific seeking to accede to the TPNW face another and very significant obstacle to compliance with Article 1(e) of the treaty. This obstacle is the prohibition of 'assistance' to any of the prohibited nuclear weapons activities and the implications in the TPNW for compliance of command, control, communications, and intelligence (NC3I) systems that are critical enabling elements for nuclear attack planning and operations. These systems are typically global in character, both in terms of distribution around the world (and in space), and in the sense of network space.

Paul Bracken recently summarized the global geographic sense of the current NC3I situation as follows:

> 'Nine countries now possess nuclear weapons. Five more countries (Germany, the Netherlands, Belgium, Italy, Turkey) have US nuclear weapons positioned on their territory. Other nations are so critically involved with US nuclear operations through warning, intelligence, and missile defense that for all practical purposes they are part of the US NC3 system (Japan, the ROK, Australia, Taiwan). This gives at least eighteen countries in total involved in nuclear or closely related NC3. Globally, no less than thirty six states are directly or indirectly involved in the projection of nuclear threat against other states (namely, the U.S. and its NATO and Pacific allies, plus the other eight nuclear armed states, all dependent in one way or another on nuclear command and control systems).'[45]

Four of these US allies lie within the Asia-Pacific, all Nuclear Supporting Countries, all of which have defense policies openly reliant on US extended nuclear deterrence, and all, as Bracken puts it, 'part of the US NC3 system.' Much less often discussed than in the need to repudiate extended nuclear deterrence, the manner in which all four major US Asia-Pacific allies host elements of the US NC3 system on their territory contradicts the prohibition in Article 1(e) on 'assistance.'[46]

The issue of NC# systems and the TPNW can only be addressed productively on a foundation of substantial research on systems such as those Bracken refers to, mainly, though not solely, concerning US systems, with an understanding of the technological and political integration of the nationally hosted nuclear-related elements into the US-constructed global assemblages.

Briefly, to take one regional example, Australia hosts several intelligence and military facilities that contribute to US nuclear operations capability as elements of the US global nuclear command, control, communications, and intelligence (NC3I) structures. These are juridically 'joint' Australian-US facilities operated, according to the Australian government, with the full knowledge and concurrence of the Australian government.[47]

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[45] This is of course, only a glimpse of Bracken's concerns in his response to a large set of papers at a Nautilus Institute workshop on NC3: 'NC3 in A Multipolar Nuclear World: Big Structures And Large Processes', NAPSNet Special Reports, May 14, 2019. See also Peter Hayes, Binoy Kampmark, Philip Reiner, Deborah Gordon, 'Synthesis Report–NC3 Systems and Strategic Stability: A Global Overview', NAPSNet Special Reports, 5 May 2019, and numerous studies published as Nautilus Institute Special Reports in 2019.

[46] I leave aside for the present the issues raised for compliance with Article 1(f).

[47] To avoid misunderstanding, in the Australian case, these facilities are today joint in a real sense to a large extent. In the paradigm case of the Joint Defence Facility Pine Gap in Central Australia discussed below, Australians make up half of the work force, are present at all levels and all sections of the base, and fill the positions of deputy chief

In May 2018 a senior Australian official testified to a parliamentary committee that joining the TPNW would be against Australia's national interests, principally because of potential damage to its alliance with the United States. This potential for damage, he argued, was in large part precisely because of the nuclear-related elements of 'joint' Australia-US intelligence and military facilities in Australia. The Australian government's view is that the alliance is made up of

> 'many separate interlocking structures, understandings, agreements and joint activities and facilities ... [that are] incompatible with the treaty,'

It is, the official averred,

> 'impossible, not practical, for Australia to restrict roles under the alliance to non-nuclear missions.'[48]

Little further elaboration was provided on that or subsequent occasions.

In fact, such matters have rarely been explained to the Australian public in the six decades during which the most important of these facilities have been in existence. On the face of it, the official's explanation was an extraordinary admission of an apparently willingly accepted integration of Australia into preparations for nuclear war and nuclear war-fighting, long hidden from the Australian public.[49]

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and other senior positions along with Americans. This is quite different from the situation at Pine Gap's companion station in the UK, RAF Menwith Hill, which can only be regarded as nominally 'joint'. On the other hand if a facility in Australia was built by the US, paid for by the US, and can only function as part of a U.S. globally distributed technologically system, then it is best regarded as U.S. facility to which Australia has greater or lesser degrees of access. See Desmond Ball, Bill Robinson, and Richard Tanter, *Australia's participation in the Pine Gap enterprise*, Nautilus Institute Special Report, 8 June 2016; and Richard Tanter, 'Tightly Bound: Australia's Alliance-Dependent Militarization', *Global Asia*, Spring 2018, Vol.13 No.1.

[48] Mr. Richard Sadleir, First Assistant Secretary, International Security Division, Department of Foreign Affairs and Dr John Kalish, Acting Director General, Australian Safeguards and Non-Proliferation Office. Extract from testimony to the Senate Foreign Affairs, Defence and Trade Legislation Committee, Parliament of Australia, Estimates Hearing, (31 May 2018), pp. 121-125.

[49] The most prominent Australian analyst of these Australian nuclear-related facilities, Desmond Ball, frequently described the way in which 'American installations in Australia have always been the subjects of continued lack of candour on the part of the United States and of extraordinary secrecy, evasion and deception on the part of Australian governments.' Desmond Ball, *A Suitable Piece of Real Estate: American Installations in Australia*, Hale & Iremonger, 1980, p. 10. This was a view Ball maintained until his death in 2016. See also Tanter, *The "Joint Facilities" revisited – Desmond Ball, democratic debate on security, and the human interest*, Special Report, Nautilus Institute for Security and Sustainability, 12 December 2012. For a unique exploration of the place of Pine

While this situation of claimed contradiction between Australia's alliance obligations and the requirements of possible future compliance with the TPNW may appear to be of parochial Australian concern, the implications for the countries surrounding it are no less significant and rarely discussed in regional dialogues. Prima facie, Australia could not be compliant with the treaty unless it either closed the facilities with NC3I linkages in toto or verifiably removed the nuclear-related elements of the bases.

However, the actual situation of the most important example identified both by the government and by its critics, the Joint Defence Facility Pine Gap near Alice Springs in Central Australia, shows that the government's blanket rejection of the TPNW because 'it's impossible, not practical' to comply with Article 1(e) should be put under scrutiny.

In broad terms, Pine Gap is one of the largest US intelligence facilities outside the United States, with three main functions. It serves firstly as a command, control, and data downlink ground station to US signals intelligence satellites in geosynchronous orbits above the equator, collecting, monitoring, and downlinking for processing and analysis all manner of electronic emissions within its satellites' 'footprints' covering most of the earth's surface from the mid-Pacific to eastern Africa. Secondly, it carries out the reverse mode of signals collection, with ground antennas at Pine Gap intercepting, monitoring, and analyzing downlinks from foreign communications satellites in geosynchronous orbit.[50] Thirdly, it hosts a somewhat separate Relay Ground Station that downlinks data from another set of US satellites in geosynchronous orbit carrying large infrared telescopes that detect the heat bloom of the launch of ballistic missiles to provide both early warning of missile attack and to assist in the United States, Japanese, and South Korean missile defence targeting. [51]

Gap in Australia and its political culture, see Kieran Finnane, *Peace Crimes: Pine Gap, National Security and Dissent*, University of Queensland Press, 2020.

[50] Other activities at Pine Gap are of considerable importance to Southeast Asia, as shown clearly in the revelations by Edward Snowden that Australia's signals intelligence agency bugged the cell phones of the Indonesian president, his wife and other senior officials, and on other occasions intercepted the communications of Indonesian trade official negotiating with the United States, and offered the product to the US. Pine Gap, along with other Australian listening stations made this possible. See the discussion in Richard Tanter, 'Indonesia, Australia and the Edward Snowden Legacy: Shifting asymmetries of power', *The Asia Pacific Journal*, Vol. 12, Issue 10, No. 3, 10 March 2014.

[51] See the research papers on Pine Gap by Desmond Ball, Bill Robinson and Richard Tanter collected as The Pine Gap Project. Ball and Tanter conducted a parallel research project on Japanese electronic intelligence and U.S. electronic intelligence in Japan. The books and papers in that project are collected as The Japan SIGINT Project. For

Pine Gap's nuclear connections are multiple, but the most important and immediate way in which hosting the facility would impede Australian compliance with the TPNW involves the Relay Ground Station and its linkage to a number of large and powerful Overhead Persistent Infrared (OPIR) satellites.[52] The key salient fact for the TPNW is that the same infrared satellites that provide the United States with early warning of missile attack, and which are critical to US and Japanese missile defense, also in time of war provide US strategic nuclear planners with intelligence as to which adversary missiles silos have launched their missiles and are consequently empty, and those which have not, and are consequently candidate US targets. The data downlinked from the OPIR satellites is passed automatically through the Relay Ground System to the Mission Control Station in Colorado in near real time to feed targeting plans of a US second nuclear strike.

To comply with the TPNW's prohibition on assistance to nuclear weapons activities, an Australian government would have to undertake one of three possible approaches to the Relay Ground Station at Pine Gap. Pragmatically, the politically critical question for Australia in each case, after seven decades of alliance deeply embedded into Australian political culture, is how treaty compliance could be achieved without leading the United States to terminate the ANZUS mutual security treaty. All three would be examples of what former Australian Prime Minister Malcolm Fraser proposed as a judicious partial disentangling of Australia from elements of the United States alliance as an alternative to unquestioning acceptance of a specious automatic identity of Australian and United States strategic interests.[53]

One approach would be to give notice to the United States requiring the closure of the entire base, i.e., both the two signals intelligence surveillance systems as well as the Relay Ground Station. The approach of simply requiring the closure of the base as a whole would have the virtue of comprehensiveness, but it would also be very politically difficult to imagine, even in a

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one approach to some of the nuclear war implications of that research see Robert Ayson and Desmond Ball, 'Can a Sino-Japanese War Be Controlled?' *Survival: Global Politics and Strategy*, Vol. 56, No. 6, pp. 135-166, (2014). There is a separate question about the Harold E Holt Naval Communications Station at North West Cape which is a longstanding critical communication link to submerged U.S. submarines, historically including both strategic ballistic missile submarines and nuclear-armed attack submarines. The extent to which this remains the case on both counts is an ongoing research question.

[52] Pine Gap is currently linked to both legacy Defense Support Program satellites and Space-Based Infra Red System (SBIRS) infrared satellites.

[53] Malcolm Fraser, with Cain Roberts, *Dangerous Allies*, (Melbourne University Press, 2014); Malcolm Fraser, 'America: Australia's Dangerous Ally', *The National Interest*, 16 December 2014.

counterfactual thought experiment of this kind. Leaving aside arguments about the utility to Australia of access to the space-based and ground-based signals intelligence systems at the base, the US response would undoubtedly be drastic and would threaten the continuation of the alliance itself—which in Australian political culture would be deemed suicidal for mainstream political parties.

In a second, 'reformist' approach, the Australian government would have to request, and the United States to accept, verifiable binding legal, organizational, and technical limits on specific categories of the operations of the Relay Ground Station. This second approach would involve distinguishing 'defensive' functions of the OPIR system—primarily early warning of missile attack from unarguably nuclear war-fighting RGS links and support for US retaliatory nuclear missile strikes.[54] For technical reasons to do with the automatic character of the RGS and remote control of its operations from the United States (rather than at Pine Gap itself), the level of required verification of operational separation by an Australian government would be almost impossible to achieve, to say nothing of the political obstacles.[55]

There is a third alternative, however, a more promising 'reformist' approach to bringing the Relay Ground Station into compliance with the requirements of the ban treaty. This third approach is based on existing redundant communications links the United States has built into its global OPIR system of satellites and ground stations to guard against destruction of ground facilities like Pine Gap in war. The existence of communications redundancy indicates a strategically viable and politically not wholly impossible pathway to compliance with the TPNW without necessarily disrupting its alliance with the United States.[56]

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[54] For clarity for the present, let us leave aside arguments as to whether RGS support for U.S. and Japanese missile defence systems should be regarded as 'defensive' and not in inherently a matter of prohibited nuclear assistance under the TPNW.

[55] These technical obstacles were recognised by defence officials at the time of Cabinet approval of the establishment of the RGS in 1997. See Richard Tanter, 'Hiding from the Light'; and Richard Tanter, 'An Australian pathway through Pine Gap to the nuclear ban treaty', *Pearls & Irritations*, 5 August 2019 [extended and footnoted version].

[56] All of Pine Gap's OPIR satellites have satellite-satellite crosslinks and communications links to U.S. relay satellites. These enable the crucial warning data to be transmitted from one to another and then downlinked to the Mission Control Station on U.S. soil without ever relying on the Pine Gap RGS. In addition, U.S. OPIR satellites themselves can and do downlink directly to dispersed mobile ground terminals in the US, as well as to U.S. combat commands in around the world, such as South Korea. The RGS at Pine Gap – which is highly vulnerable to attack -

Under this proposal an Australian government could give reasonable notice to the United States requiring the closure of the Relay Ground Station and the removal of its systems from Pine Gap. The remaining larger part of the base and its principal signals intelligence functions would be left unaffected.[57] In this situation, if the Australian government gave the United States appropriate notice—say five years—the Relay Ground Station could be closed without significant detriment to the performance of the OPIR systems or to genuine US national security interests—although there would obviously be considerable political turbulence.

This sketch above outlining the strategic, technical, and political aspects of the choices facing an Australian government seeking to comply with the assistance prohibitions of the TPNW has two aims.

Firstly, a close examination of the Relay Ground Station's technical aspects and military roles suggests that while all of three pathways would be politically fraught, the third pathway shows that the Australian government's blanket claim that it would be 'impossible, not practical for Australia to restrict roles under the alliance to non-nuclear missions' can be refuted in the most egregious example of Australian assistance to prohibited nuclear activities. Of course, this proposal to close only the RGS leaves questions about nuclear-related aspects of other parts of Pine Gap's operations to be scrutinized, but by demonstrating a plausibly viable pathway in the most important case indicates a line of political and policy strategy against unexamined claims of 'impossibility.'

And secondly, as Bracken's survey of US NC3 activities suggests, these globally-distributed facilities pose obstacles to compliance with the prohibition on assistance to nuclear missions for major US allies in the Asia-Pacific more broadly, as well as in Europe.

The relevance of hosting NC3 elements is an unavoidable issue for the TPNW regime and its supporters to consider, not just in several countries in this region, but in many other US allied states.

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provides redundant backup to both the cross-links and the mobile stations systems but is not in itself essential to the OPIR system's survival. See Richard Tanter, 'An Australian pathway'.

[57] In addition to Pine Gap's Relay Ground Station the U.S. has constructed three redundant communication systems for its DSP and SBIRS infrared satellites to link to their Mission Control Stations, including satellite-to-satellite crosslinks; satellite links to relay satellites; and satellite links to mobile ground stations in U.S. theatre commands. See Tanter, 'An Australian pathway'.

A Verification Regime 'Fit for Purpose'

The most common criticism of the TPNW has concerned verification.[58] One important line of criticism regards the TPNW as a step backwards from the achievement of reforms of safeguards policy in the NPT. In particular these critics emphasize the absence in the TPNW of a binding requirement on states parties to tighten safeguards on nuclear facilities by requiring accession to the International Atomic Energy Agency's (IAEA) Additional Protocol, rather than just requiring adherence to the longstanding but less stringent IAEA Comprehensive Safeguards Agreement.

Supporters of the ban treaty argue that in fact only a small group of TPNW signatories to date have not acceded to the Additional Protocol. Almost all are small states with very limited or no nuclear energy facilities, for whom the issue is irrelevant in practical terms. As the Australian safeguards specialist John Carlson has emphasized, however, there are at present three important exceptions to the claim the Additional Protocol issue does not matter for the TPNW: Brazil, Argentina, and Egypt.

Brazil is a signatory to the ban treaty, and while Argentina and Egypt have not signed to date, all three countries were active participants in the negotiations in the UN General Assembly leading to the adoption of the treaty text in 2017. All three countries have expressed interest in nuclear weapons in the past—Brazil and Argentina seriously. Some analysts are currently concerned about Brazil's nuclear-powered submarine program as a stalking horse for a weapons program.

After the fall of the military dictatorships in Brazil and Argentina the two countries formed the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC), which has intrusive bilateral verification features somewhat comparable to the Additional Protocol. The IAEA itself is a party to ABACC. Egypt has said it will sign the Additional Protocol if Israel does,

[58] The most consistent and articulate critic in this region has been the Australian safeguards specialist John Carlson. See, for example, John Carlson, 'Nuclear Weapon Prohibition Treaty: A Safeguards Debacle', *Trust & Verify*, (VERTIC), Issue 158, (Autumn 2018), pp. 1-6; and John Carlson, 'The 2020 NPT Review Conference and the TPNW factor', in Viatcheslav Kantor (ed.), *Arms Control: Burden of Change*, (International Luxembourg Forum on Preventing Nuclear Catastrophe, 2019), pp. 86-100.

a somewhat disingenuous explanation given that the accession of Israel to any NPT verification agreement is a most unlikely event in the foreseeable future. These three cases undoubtedly remain important to monitor very closely.[59]

However, there are two further problems with most verification attacks on the TPNW. One is that they often disregard or misconstrue the verification architecture of the TPNW and the framework character of the treaty. The other, on the contrary, is that they may have too limited a sense of the verification challenges posed by the treaty, both in relation to treatment of Nuclear Possessing States wishing to join the treaty and, most importantly, in the wide-ranging comprehensive verification requirements over the necessary *longue durée* to ensure global confidence that successful covert reconstruction of a nuclear weapons capacity by a treaty breakout state will be detected in a timely manner.

The verification architecture of the TPNW is properly understood as a design for

> 'an adaptive and flexible process to address future challenges, progressively expand its scope and over time to include more member States, ultimately leading to the elimination of nuclear weapons.'[60]

By design, the treaty has deferred precise detail of how claims by nuclear disarming states are to be assessed for future consideration by the regular Conferences of the Parties (CoPs) specified in the treaty. The importance of designation of the treaty's appropriate 'competent international authority or authorities' to develop 'verified, time-bound and irreversible elimination of nuclear weapon programs' for disarmament verification was not ignored by the treaty's formulators. The two pathways outlined in Article 4 of the treaty (*Eliminate weapons and then join*, and *Join and*

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[59] 'Status List', Conclusion of Additional Protocols Status as of 18 September 2020, International Atomic Energy Agency. On Brazil, Argentina and Egypt, see, for example Togzhan Kassenova, 'Brazil's Nuclear Kaleidoscope: An Evolving Identity', *Brief*, Carnegie Endowment for International Peace, March 2014; Renata H. Dalaqua. '"We will not make the bomb because we do not want to make the bomb": understanding the technopolitical regime that drives the Brazilian nuclear program', *The Nonproliferation Review*, Vo. 26, No. 3-4, (2019), pp. 231-249; Leonardo Bandarra, 'Brazilian nuclear policy under Bolsonaro: no nuclear weapons, but a nuclear submarine', *Bulletin of the Atomic Scientists*, 12 April 2019; and Nicholas J. Wheeler, 'Beyond Waltz's Nuclear World: More Trust May be Better', *International Relations*', Vol. 23, No. 3, pp. 428–445; and 'Egypt', Nuclear Threat Initiative.

[60] Jürgen Scheffran, 'Verification and security of transformation to a nuclear-weapon-free world: the framework of the Treaty on the Prohibition of Nuclear Weapons', *Global Change, Peace & Security*, Vol. 30, No. 2, (2018), pp. 144. Scheffran provides an excellent and detailed explication of the challenges facing the TPNW verification regime and directions for responses.

then eliminate) will require complex, and quite likely different, kinds of verification regimes. At whatever point such thresholds appear on the horizon it will be strongly and evidently in the interests of the Conference of the Parties to have already dealt substantially, if not fully, with those issues.

Obviously, under the heading of the institutionalization of the TPNW, there will be hard questions about how a 'competent authority' will actually be designed, developed, built, and paid for. In the meantime, as Tamara Patton and her colleagues have argued, it is highly desirable for the treaty's Conference of the Parties to set up some kind of preparatory scientific advisory body as soon as is practicable—as was done effectively in the rather simpler case of the Comprehensive Test Ban Treaty in anticipation of its still delayed Entry into Force.[61]

Most critics have focused on the verification of adherence to the TPNW requirements within the nuclear-fuel cycle and, in particular, looked at accounting for fissile material in terms of both possession and production of the kind that the IAEA CSA and Additional Protocol are designed to address. Clearly these remain important, and it will be desirable to continue to press for universal adherence to the Additional Protocol or a functional equivalent such as ABACC or, less satisfactorily, through NWFZ provisions. But even so, on fissile material accounting alone, after the experience of the past 'surprises' of Iraq *et al*, no one should pretend that the current 'gold standard' is the end of the story. There will be new surprises in the future, and the TPNW architecture allows for addressing those situations.

The other side of the coin is that an abolition treaty regime will involve multilateral verification capacities considerably more wide-ranging in their concerns, more precise and accurate in their assessments, and much more demanding in their robustness than anything to date. These will need to endure effectively over centuries rather than years or decades.

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[61] Tamara Patton, Sébastien Philippe and Zia Mian, 'Fit for Purpose: An Evolutionary Strategy for the Implementation and Verification of the Treaty on the Prohibition of Nuclear Weapons', *Journal for Peace and Nuclear Disarmament*, Vol. 2, No. 2, (2019), pp. 387-409; Tamara Patton and Alexander Glaser, 'Nuclear Verification', Institute of Nuclear Materials, 58th Annual Meeting, July 2017; and Toby Dalton, Wyatt Hoffman, Ariel E. Levite, Li Bin, George Perkovich, and Tong Zhao, *Toward a Nuclear Firewall: Bridging the NPT's Three Pillars*, Carnegie Endowment for International Peace, March 2017, pp.13-21. For a recent review of other approaches to national and other multilateral disarmament verification centred on the NPT, see 'Means to Reinforce Research on Nuclear Disarmament Verification: Report on a Series of Regional Conversations', *Verification Matters: VERTIC Research Reports*, Number 13, (November 2017).

What will be required in the way of ban treaty verification capability to persuade virtually all countries on earth that a nuclear prohibition regime will be sufficiently reliable and robust to detect, in 100 percent of cases, that no country is secretly preparing to reconstitute a nuclear weapon? What kind of verification issues will have to be faced at the point of a threshold nuclear disarmer seeking to join the treaty?

Some of the useful accounts to date of these issues include the work of Scheffran, and of Patton and her colleagues, both drawing on a major 2017 Carnegie Endowment for International Peace study titled *Toward a Nuclear Firewall: Bridging the NPT's Three Pillars*. Patton and her colleagues argue that not only will fissile material accounting requirements be more stringent than at present, but that the treaty's requirement for 'verified, time-bound and irreversible elimination of nuclear weapon programs' will involve surveillance of much more than the nuclear-fuel cycle. This expansion of domains of verifications required under the TPNW will involve, both groups argue, developing 'a comprehensive set of nuclear weapon program indicators,' which will address at least four general domains:

- fuel-cycle and reactor operations;
- nuclear weapons research and development and weaponization;
- weapons delivery and systems (payload) integration; and
- militarization.[62]

This list of broad but compelling set of requirements touches on matters that are today overwhelmingly the domain of national unilateral verification capabilities, most prominently involving surveillance of the third and fourth of the broad categories listed above—weapons delivery and militarization (itself a much larger and more difficult category to define satisfactorily). These matters are today mainly discussed within the domain of verification of arms control agreements.

Patton and her colleagues point out that to date, verification of different elements in contemporary nuclear weapons assemblages have mostly been dealt with through the NPT and IAEA safeguards, while others been addressed through bodies such as the Missile Trade Control Regime and the

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[62] Toby Dalton *et al*, *Toward a Nuclear Firewall*; and Tamara Patton *et al*, 'Fit for Purpose'.

Nuclear Suppliers Group. The Comprehensive Test Ban Treaty Organization's (CTBTO) International Monitoring System (IMS) has been constructed to detect nuclear detonations. Yet these exemplars do not fully embrace all aspects of necessary verification capacities for the TPNW.

The CTBTO's International Monitoring System is a multilateral—and indeed global—UN-auspiced verification capability developed to a high level of technical standard in the absence of the CTBT itself entering into force. One important aspect of the IMS is that it is a multilateral system based on the coordination and integration of eighty-nine national monitoring systems—benefitting from access to seismic, hydroacoustic, infrasound, and radionuclide detection of nuclear detonation in 337 facilities worldwide.[63] It is a genuinely multilateral body with a high level of technical achievement.

It should be recalled, however, that the IMS is based on the merger of civil/scientific networks of seismic monitoring of earthquakes with long classified national networks of seismic and radiological detection of nuclear detonations, pioneered and dominated for much of the Cold War by the United States, which remains the world leader in classified nuclear detonation technology and analyses.

For the United States, its current nuclear detonation detection capabilities (including the NUDET sensors on its Global Positioning System satellites and the legacy Defense Support Program infrared satellites) are considered a part of its suite of National Technical Means of Verification. These are based on much broader intelligence capacities that may also provide assurance to the United States it has the capacity to verify compliance with particular types of control agreements. These capacities are not separately constructed for verification purposes. Moreover, those intelligence capacities are closely held, and their functions rarely shared, even with close allies. They are essentially unilateral capacities, remaining under US government and military control.

In the early 1990s the Japanese National Defence Academy analyst Ushioda Setsuko went to the conceptual heart of the matter facing the TPNW:

[63] Comprehensive Test Ban Treaty Organization, 'Overview of the verification regime', [accessed 16 November 2020']. See also Andreas Persbo, 'Compliance science: the CTBT's global verification system', *The Nonproliferation Review*, Vol. 23, No. 3-4 (2016), pp. 318-328.

> 'Verification is today largely unilateral and non-cooperative. Each state makes its own evaluations; it reacts to any breach of an agreement to which it is a party on the basis of its own interests. As a result, in the absence of a collective process, verification appears to be not a guarantee that the agreement will be implemented but a guarantee of the individual security of the parties.'[64]

The situation Ushioda was describing remains the situation today, and it opens a further set of issues to be addressed concerning the institutional capacity for verification of the TPNW: how—if at all—are what are currently National Technical Means of Verification to be brought into the service of a global collective security project such as the TPNW? At present only a very small number of countries have any serious capacity to come close to multi-domain global nuclear and space surveillance, and most countries in the world would have little reason to be confident their interests would be pursued with impartiality and diligence by a multilateral verification structure dominated by the major nuclear powers.

In the context of the Treaty on the Prohibition of Nuclear Weapons, the demand for an abolition treaty regime will not be just for genuinely global multilateral verification capacities fit for purpose, but itmust endure effectively over periods much longer than any currently existing verification regime.

Unilateral national surveillance facilities such as Pine Gap, and the global surveillance systems of which they are an integrated part, are potentially, depending on precise requirements, exactly relevant to address such a situation, and yet seem to be the antithesis of what is required for cooperative security. Unlikely as it may seem, it is worth asking under what institutional, legal, and security conditions could currently unilateral verification capabilities be brought into a regime of collective security? More distantly, is it possible to consider genuinely global multilateral

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[64] Setsuko Ushioda. *Satellite-Based Multilateral Arms Control Verification Schemes and International Law*. Dissertation, Institute of Air and Space Law, McGill University, Montreal. November 1992, pp. 303-304; Ushioda Setsuko, 'Possible Organizational Framework for a Multilateral Monitoring Organization', The Korean Journal of Air & Space Law and Policy, Vol. 6, (1994), pp. 345-65. See also the discussion of Ushioda and related issues in Richard Tanter, 'American Bases in Australia Revisited', in Brendan Taylor, Nicholas Farrelly and Sheryn Lee (eds.), *Insurgent Intellectual: Essays in honour of Professor Desmond Ball*, (ISEAS, December 2012), pp. 206-208, and at slightly greater length in Richard Tanter, *The "Joint Facilities" revisited*.

verification institutions on the scale necessary for certainty of the continuing absence of covert nuclear weapon reconstitution?

To take the now relatively straightforward example of space-based earth observation technology, there were proposals at the height of the Cold War, originally from France, for the United Nations to develop an International Satellite Monitoring Agency (ISMA), resulting in a UN expert study focused on space-based imaging.[65] While those proposals died under the disdainful gorgon stare of the Cold War nuclear superpowers, it has returned in a number of different forms in the past two decades.[66] In some respects, the idea of an ISMA-like body with a dedicated space-based earth observation capacity has been rendered at least partially redundant by advances in commercial space-based imaging potentially widely accessible. However, in the case of either real-time thermal signature detecting of missile launches and detonations, electronic intelligence surveillance or space security verification issues there has been no such commercially-available development at the necessary level.[67]

With the current pace of nuclear weapon horizontal and vertical proliferation, long-range ballistic and cruise missile and hypersonic missile proliferation, and the nuclear dimensions of the competitive militarization of space, serious assertion of collective rights to verification assurance capacities is necessary and must engage closely and imaginatively on an informed basis with unilateral national technical means of verification as one starting point.

Lest anyone leap to the conclusion I am arguing for the retention of the Pine Gaps of the world for such purposes, the answer is definitely not. But I am asking whether there are ways in which particular, partial functions of such a facility can be used for collective, multilateral verification

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[65] Report of the Secretary-General, The Implications of Establishing an International Satellite Monitoring Agency, Department for Disarmament Affairs, United Nations, New York (1983).

[66] This paragraph is adapted from Richard Tanter, 'American Bases Revisited', pp. 206-207, and Tanter, *The "Joint Facilities" revisited*, pp. 45-49 . See Bhupendra Jasani. "International Satellite Monitoring Agency – Has the time come for its establishment?" Proceedings of Workshop on Safeguards Perspectives for a Future Nuclear Environment, Cernobbio Villa Erba, Italy, 14-16 October 2003; Trevor Findlay, *Compliance Chronicles* 1 (December 2005); Walter A. Dorn. *The Case for a United Nations Verification Agency: Disarmament Under Effective International Control*, Working Paper 26, Canadian Institute for International Peace and Security, (July 1990); and Office for Disarmament Affairs, *Verification in all its Aspects, including the role of the United Nations in the field of verification*, (New York: United Nations, 2008).

[67] For one discussion of possibilities on the latter see Walter A. Dorn, *Tools of the Trade? Monitoring and Surveillance Technologies in UN Peacekeeping*, Department of Peacekeeping Operations, United Nations, (September 2007).

purposes beyond arms control into the realm of nuclear abolition. It is hard to imagine, but then so was the idea of a nuclear ban treaty. But what has to be understood is that there has probably never been a political project in human history of such complexity and consequence as a functioning and enduring nuclear abolition verification regime. It has to be commenced somewhere.

The Discursive Consequences of Erasing the Actual Pacific From the Asia-Pacific

The design and frame of dialogue processes often has considerable effects on outcomes. Regional dialogue presumes agreement on what constitutes the region under discussion. In some respects, the geographical frame is nothing to argue about, but some approaches may turn out to be less—or more—productive, depending on the aim of the dialogue in question. The Asia-Pacific is an inherently expansive label that can be stretched or constrained in many different ways. ASEAN is an interesting element because as a Southeast Asian entity, it has sought to move beyond internal considerations to engender links with East Asian and Pacific states more broadly in its security and economic dialogue partnerships.

In practice, however, discussion of dialogue in 'the Asia-Pacific' often omits reference to or participation by the Pacific Island states that have been so supportive of the ban treaty. Most are small countries and perhaps not significant players in the power politics version of the framing of the Asia-Pacific. That is true of many of the eighty-four signatories to the TPNW, but the failings of that perspective were undoubtedly part of the motivation for the UN General Assembly vote of 122-1 in July 2017 to adopt the text of the treaty. The Pacific Island Forum may not have the clout of ASEAN Regional Forum or the East Asian Summit, but it is an effective multilateral organization in which small states often combine to pressure its larger member states, especially Australia, over both nuclear and climate issues.

Elision or erasure of the Pacific Island states from the dialogue framework would be regrettable. Inclusion of the Pacific Island states in dialogue together with the states East Asian Nuclear Supporting States and the largely pro-TPNW states of ASEAN would be beneficial for two practical reasons.

Firstly, the Pacific Island states are mostly small countries where civil society networks have been and remain particularly strong both within and between states—a valuable characteristic for constructing dialogue networks.

Secondly, Pacific Island support for the treaty largely derives from the not-so-distant direct experience of nuclear testing and nuclear colonialism in the region.[68] The ASEAN experience and situation are thus quite different from that of most of the Pacific Island states. Three Nuclear Possessing States have tested their nuclear weapons in the Pacific Islands—the United States, the United Kingdom, and France. All three did so in Pacific colonial territories—Bikini and Enewetak in the Marshall Islands, and (United States); Christmas Island (now Kiribati; United Kingdom, and United States), as well three locations in Australia (United Kingdom): and the atolls of Moruroa and Fangataufa in French Polynesia. In the Pacific Islands, self-determination in the face of ongoing colonial possessions and nuclear issues are understandably closely linked. Recognition of these interlinked issues would be beneficial for dialogue with the larger and more powerful states.

Two of the key legal and political innovations in the TPNW are the positive provisions set out in Article 6 to provide for assistance to nuclear test survivors and for remediation of the environmental effects of nuclear weapons use or testing in member states. No other element of international law relating to nuclear weapons so directly addresses these matters—certainly not the NPT. Given the long-term persisting strength of opinion in Pacific Island countries about the enduring human and environmental consequences of nuclear testing by external imperial powers within the living memory of many citizens of the Pacific Islands, these positive provisions would seem to provide a promising and fruitful concrete topic for the regional government-civil society discussions.[69] Such initiatives would be particularly useful in bridging the tendency of major states in 'the Asia-Pacific' to overlook most of the eighteen island countries in the actual Pacific.

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[68] Nic Maclellan, 'Nuclear Testing and Racism in the Pacific Islands', in S. Ratuva (ed.), *The Palgrave Handbook of Ethnicity*, Springer Nature Singapore, 2019.
[69] Nic Maclellan, *Prohibiting Nuclear Weapons: A Pacific Islands Priority*, ICAN Australia, 2017; and Nic Maclellan, *Grappling with the Bomb: Britain's Pacific H-Bomb Tests*, (ANU Press, 2017).

Themes for Regional Dialogue on the TPNW

What then, are the most productive and urgent themes for discussions in Asia-Pacific dialogue on the TPNW? There is a considerable range of possibilities. Two contributors to this workshop who acknowledge the significance of the emergence of the ban treaty present important agendas going beyond what has become business-as-usual in contemporary commentary.

Allan Behm concludes his savage demolition of the underwhelming approach to nuclear disarmament by Australian governments, inflected downwards by the pandemic:

> 'At this point, the prospects of advanced and sustained progress may look bleak. That is precisely why collective action is needed. For the NNWS, there are three issues that need early resurrection:
>
> - the proposed cut-off of the production of fissionable material;
> - the proclamation of a 'no first use' by the NWS and the other states possessing nuclear weapons; and
> - the further strengthening of the IAEA safeguards and inspections regime and their application to the NWS.
>
> It must be understood that the NWS are not special cases, but rather deviant cases that have failed to honor their obligations under the NPT.'[70]

Behm then suggests a five-point program, one particularly oriented to the Asia-Pacific regional Nuclear Supporting States and their US ally. To paraphrase abruptly, these countries, including Australia must

- reinvest in nuclear negotiating capacity;
- re-engage with like-minded countries;
- work to ensure New START is rekindled, with China involved;
- persuade the United States that nuclear war is never in the interest of the United States or its allies; and

[70] Allan Behm: 'Extended Deterrence and Extended Nuclear Deterrence in a Pandemic World', p. 19.

- listen to the voices of the ASEAN countries—'the economic powerhouse of the 21st century.'

All of these items are salient and urgent to support. None of these agenda items is either in any way unimportant in themselves or inimical to the advancement of the TPNW. But all are founded on the continued legitimacy of nuclear weapons possession and use—however much that end state is understood to be a matter of existential danger. If the primary task is to devalue and delegitimate nuclear weapons, then these are tasks in parallel, not in place of, that goal.[71]

In the context of a review of nuclear command, control, and communications Hayes argues that

> 'It is urgent, therefore, to commence dialogue within and between nuclear-armed states on the legal standards against which NC3 must be measured and transparency with regard to the achievement of minimum levels of NC3 performance.'

Since NC3(I) facilities are located in each of the Nuclear Supporting States in the region, Hayes' call for urgent reform spelled out in a clear and concise Global NC3 Code of Conduct is highly relevant to the region. As with Behm's agenda, progress toward these important concrete reforms of nuclear weapons operations practice would significantly reduce the likelihood of nuclear next use. Yet, such a code necessarily legitimates the possession, and use, of nuclear weapons, albeit with horror.

To distinguish the agendas of proponents of the TPNW to construct productive regional dialogues to advance the TPNW between supporters of the ban treaty and, on the one hand, Nuclear Supporting States, and on the other, Nuclear Possessing States, the twin strategies of devaluing and delegitimating nuclear weapons must be added.

Deeply thoughtful 'reform' strategies intensely sensitive to the current nuclear dangers such as those put forward by Behm already point to some required strands of devaluing or questioning the

[71] I suspect Behm would agree with me that the primary task, properly understood, is the avoidance of nuclear next use – for as long as can conceive of. We would differ as to the priority of allocation of scarce political and diplomatic resources (in government and civil society) to activities leading to that end. My own working assumption is that we will never know, without doubt, a priori what is the most productive route to a shared goal. Under that condition, the first rule is to ensure that work towards one pathway does not negate or obstruct or obscure the other.

military utility of nuclear weapons, such as persuading the United Staes that 'that nuclear war is never in the interests of the United States or its allies.'

Given the historic commitment of governments in Southeast Asia and the Pacific to the goals of the nuclear weapon-free zones, dialogue with Nuclear Supporting Countries on extension and deepening of the requirements of those zones will generate questions on both the value of nuclear weapons and their legitimacy.

To be just a little un-diplomatic, it might be interesting to see what reply an Australian government would give to a politely worded discussion starter from ASEAN signatories to the TPNW as to why Australia feels the need for defense based on extended nuclear deterrence. It might be felt at this point that such a discussion should be unnecessary, for surely the felt need for nuclear defense would be a matter that the Australian government has spelled out with care and detail in official public documents as well as in closed door diplomatic settings?

In fact, such is not the case. Defense White Paper and similar references to the rationale for reliance on extended nuclear deterrence are a matter of sentences, not paragraphs, let alone serious explanation weighing all relevant aspects at an appropriate level of detail.

Since historically, the most long-running answer to that question in the past would have pointed to a putative nuclear threat from the leaders of ASEAN, such a dialogue could lead to a productive discussion about the costs and benefits on both sides of nuclear defence.

Similarly, the question of the circumstances under which an Australian government (or that of Japan or the ROK) believes the use of nuclear weapons to be appropriate would be a matter of interest to regional governments inclined to concern on the matter. And it is one that it might be thought an Australian government would have an answer of some detail and argumentative strength ready to hand.[72]

At present, it appears to be unlikely that there is such an argument in detail already prepared for such purposes. On the only occasion I know of where an Australian government official of any

[72] In the following examples I concentrate on Australia as the representative Nuclear supporting State. In the case of Japan, the only other country in the group I know well enough to risk a comment on, I very much doubt that the situation is substantially different.

seniority has attempted to provide an answer to such a question, the result has been deeply embarrassing.[73] In a fluster of 'ums' and 'errs' and frantic searching through talking points provided (to no avail), to the shock of the senatorial questioner, the answer proffered was, in full:

> 'Senator, as we all know, extended deterrence is something which comes to the fore in a situation of extreme emergency, of a sort that has been referred to in terms of self-defence.'

At a minimum, dialogue with neighboring countries not reliant on nuclear defense would focus the mind of those reliant on nuclear defence as to exactly how Australia would expect nuclear weapons to be used, with the supplementary line of discussion as to under what circumstances would such an action be military utility compared to other approaches to defense under the nominated circumstances.

In the other direction, a dialogue between such sceptic neighbours might involve asking something like

> 'What leads Australia to believe it has the right to inflict the human and environmental and strategic consequences of that policy on neighbouring countries in the event Australia calls on the United States to make good on its promises?'

Fundamentally, the first use of the establishment of the TPNW regime is not specifically legal: the majority of ASEAN states being states parties to the TPNW will not have a legal effect on Australia unless Australia specifically invites that outcome. But the most important consequence is that Nuclear Supporting States will find themselves in the position of having to explain themselves on matters of what they had hitherto regarded as just 'obvious,' not needing any justification beyond vague reference to unspecific threats and unquestioned utility and legitimacy of nuclear deterrence.

Regional dialogue about the utility and legitimacy of nuclear weapons could well, in Ritchie's phrasing, lead to a demonstration within the dialogic process 'that current nuclear practices and power relations do not reflect justifiable rules based on shared beliefs prevalent in society,' here

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[73] See Senator Lisa Singh asking this question of Department of Assistant Secretary of Foreign Affairs and Defence Richard Sadleir in October 2017, 'Senate Estimates - Question regarding the appropriateness of using nuclear weapons', *YouTube*, 26 October 2017. The two-minute video is well worth watching.

in the regional dimension of global society, an exploration of accountability for nuclear weapons support.

Both sets of questions—questioning military utility and legitimacy—are relevant to Japan and the ROK and could be productively explored in dialogue sets with Southeast Asian and Pacific Islands' partners. Both countries are increasingly concerned to foster closer ties with both Southeast Asia and the countries of the Pacific Islands.

Given the importance to the countries of Southeast Asia and the Pacific Islands of membership of their respective Nuclear Weapons Free Zones, dialogue between those countries and Mongolia and regional Nuclear Supporting Countries—Australia (a member of the SPNWFZ) , Japan, and the ROK—on the characteristics of NWFZs with their shared accepted intent to constrain nuclear weapons use could lead to an exploration of pathways for deepening and extending zone obligations and more explicitly address issues of both accountability for the activities prohibited under the TPNW, and responsibility for positive support for nuclear test survivors and remediation of nuclear test sacrifice zones.

Such a theme of discussion could have three particular common consequences amongst participants. Firstly, it may well lay the ground for understanding of shared experiences previously either not understood or not acknowledged. The example that comes most readily to mind is exactly the shared experience of use of nuclear weapons on their respective citizenries.[74]

Secondly, such dialogue could advance discussion of the desirability of a Northeast Asian Nuclear Weapons Free Zone and the exploration of both particular models and possible pathways.[75] All NWFZ concepts implicitly advance awareness of differing understandings of accountability in relation to different aspects of nuclear weapons.

Thirdly, successful dialogue to progress understanding of the elements of nuclear constraint in both the TPNW and NWFZs may provide opportunities for supporters of the TPNW, Nuclear

[74] This would include the experiences in Japan of the *hibakusha* of Hiroshima and Nagasaki; and in South Korea, the Korean hibakusha in those cities in 1945. In the Pacific Islands, it would include the experience of the survivors (including often military veterans) of US, British, and French nuclear testing – which in the French case continued until as late as 1996. In Australia, twelve 'major tests' of fission weapons were carried out between 1952-1957, but the more numerous and more environmentally destructive 'minor tests' continued to 1963.

[75] See Michael Hamel-Green, 'The implications of the 2017 UN Nuclear Prohibition Treaty for existing and proposed nuclear-weapon-free zones'.

Supporting States, and Nuclear Possessing States to find common cause on new pathways to reverse the to date intractable DPRK commitment to nuclear weapons.

Certainly, any element of common cause on matters of nuclear restraint between Nuclear Supporting Countries and proponents of the TPNW opens small fissures of possibility in the presumptive unity of END recipients and provider.

In Conclusion: The TPNW in Time of Pandemic and the Other Coming Plague: Massive Climate Disruption

Many have commented the social and political system stresses imposed by the pandemic and the nexus between morbidity and mortality and the key characteristics of particular political and economic structures. Others have commented insightfully on the surprising number of ways in which the current pandemic has already exacerbated or multiplied existing dangers of dependence on nuclear weapons for defense. The significance of the TPNW to move from unquestioned acceptance of nuclear weapons to universal prohibition as a tool for ultimate elimination is heightened by such an awareness of the manifold impacts of global pandemic in the global social system.

I would add to such discussion one further element: the now unavoidable impact of climate disruption and its globally differentially distributed consequences for all aspects of our society and political systems. In a way, the current pandemic is by comparison a reasonably low-level system stress test, which has not yielded reassuring results. Climate disruption of a known level is now built into future history for at least another quarter century, assuming that climate mitigation regimes then decelerate emissions and adaptation is both effective and, on balance, positive.

Essentially we are still in a position where climate disruption in the rich and powerful countries of the world is not yet socially visible to the level we can expect in time. Of course, climate change is a matter of discussion, but nothing of the kind that will be reached when the richest parts of the world begin to experience the equivalents of three or more Hurricane Katrinas a year, with a generation of visceral fear in those populations of a kind more associated with the experience of ongoing war than with pandemic ameliorated by the prospect of vaccines.

Whatever the structure of regimes of mitigation and adaptation that emerge from the current relative stasis or at best slow burn on climate, there will be, by the time we reach that point defined by socially visible deep climate impacts in rich countries (to say nothing of The Rest), fear-driven policy, domestic and international. These developments will inevitably result in processes of blame, of displacement of accountability, and reciprocal dyads of resentment.

There has already been some examples of displacement of climate accountability from the richer carbon-indebted countries onto generally poorer tropical rainforest countries through the mechanism of paying such countries to not cut down their remaining tropical rainforest. Most examples have been something of a debacle for the understandable reason that in such countries rainforests are already a locus of competing interests—often violently so. As such there was an added burden on those socio-ecosystems of what was represented as 'a failure to provide carbon services contracted for,' as has often been the complaint of rich countries that have entered such contracts. Indeed at one point it looked as if some of those countries were about to offer foreign aid in the form of assistance to police forest management.

This laboured example may be useful to point out that whatever the concern we may have about the strains on management of the existing global nuclear weapons regime in the stress test of the pandemic, they are likely to be nothing compared to the likely long-lived structures of conflicts and attributed 'accountability' when climate disruption progressed further.

This deeply concerning possibility constitutes, for me, the strongest argument for the urgency of work on nuclear weapons prohibition and elimination. If we enter that period of climate conflict without something close to nuclear elimination, then the current pandemic stress test will seem but as nothing.

Table 1. Non-nuclear weapons possessing East Asian, Southeast Asian, and Pacific Islands states: status regarding nuclear weapons

Participant	Nuclear weapons status	TPNW status	
		Signature	Ratification, Accession (a)
Australia	South Pacific NWFZ / Nuclear Supporting State		
Brunei Darussalam	Southeast Asian NWFZ	26 Sep 2018	
Cambodia	Southeast Asian NWFZ	9 Jan 2019	
Cook Islands	South Pacific NWFZ		4 Sep 2018 a
Federated States of Micronesia	South Pacific NWFZ*		
Fiji	South Pacific NWFZ	20 Sep 2017	7 Jul 2020
Indonesia	Southeast Asian NWFZ	20 Sep 2017	
Japan	Nuclear Supporting State		
Lao People's Democratic Republic	Southeast Asian NWFZ	21 Sep 2017	26 Sep 2019
Kiribati	South Pacific NWFZ		
Malaysia	Southeast Asian NWFZ	20 Sep 2017	30 Sep 2020
Marshall Islands	South Pacific NWFZ*		
Mongolia	Mongolian NWF status		
Myanmar	Southeast Asian NWFZ	26 Sep 2018	
Nauru	South Pacific NWFZ	22 Nov 2019	23 Oct 2020
New Zealand [1]	South Pacific NWFZ	20 Sep 2017	31 Jul 2018
Niue	South Pacific NWFZ		6 Aug 2020 a
Papua-New Guinea	South Pacific NWFZ		
Palau	South Pacific NWFZ*	20 Sep 2017	3 May 2018
Philippines	Southeast Asian NWFZ	20 Sep 2017	
Republic of Korea	Nuclear Supporting State		
Samoa	South Pacific NWFZ	20 Sep 2017	26 Sep 2018
Singapore	Southeast Asian NWFZ		
Solomon Islands	South Pacific NWFZ		
Thailand	Southeast Asian NWFZ	20 Sep 2017	20 Sep 2017
Timor-Leste		26 Sep 2018	
Tonga	South Pacific NWFZ		
Tuvalu	South Pacific NWFZ	20 Sep 2017	12 Oct 2020
Vanuatu	South Pacific NWFZ	20 Sep 2017	26 Sep 2018
Viet Nam	Southeast Asian NWFZ	22 Sep 2017	17 May 2018

*These countries are not members of the South Pacific NWFZ, but are eligible to become so if they choose.

Sources: United Nations, Treaties, Disarmament, Treaty on the Prohibition of Nuclear Weapons, New York, 7 July 2017, status as 23 November 2020; *South Pacific Nuclear Free Zone Treaty (SPNWFZ) Treaty of Raratonga*, Nuclear Threat Initiative; *Southeast Asian Nuclear-Weapon-Free-Zone (SEANWFZ) Treaty (Bangkok Treaty)*, Nuclear Weapon Free Status of Mongolia, Nuclear Threat Initiative.

WMD IN ASIA-PACIFIC

The Asia-Pacific region impacts every dimension of the global agenda, with acute tensions, complex dynamics and military risks in Northeast Asia and Southern Asia, accompanied by the steady growth in the size and sophistication of regional nuclear arsenals, their means of delivery, and potentially destabilizing defensive systems. With the world's economic, political and security centres of gravity shifting, the region's stake in a secure world order – and its responsibility to contribute with ideas, policy proposals and vision – has grown commensurately.

WMD in Asia-Pacific offers a timely and comprehensive assessment of the WMD threats in the Asia-Pacific, including threats from nuclear, chemical and biological weapons. The book is a compilation of nineteen special reports published by the Asia-Pacific Leadership Network for Nuclear Non-Proliferation and Disarmament (APLN) in 2021 and early 2022. Twenty-one experts address critical issues and present assessments of the baseline status of, and trends in, vertical and horizontal proliferation of WMD across the region.

In surveying the WMD landscape, ***WMD in Asia-Pacific*** focuses on where wars involving WMD might begin in three locations – Southern Asia, the Taiwan Straits, and Korean Peninsula – while examining how asymmetric force structures and future proliferation may increase the risk of using WMD. The book also presents possible ways and strategies for reducing the risk that WMD – especially nuclear – might be used and offers related non-proliferation and disarmament strategies tailored to the Asia-Pacific.

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