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REVISITING 'MINIMAL NUCLEAR DETERRENCE': LAYING THE GROUND FOR MULTILATERAL NUCLEAR DISARMAMENT

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SUMMARY

● The prospects for nuclear arms control appear dim following Russia's invasion of Ukraine. Instead of continued reliance on nuclear deterrence, the resulting new awareness of nuclear risks should inform bold nuclear disarmament measures in the long term.

Drawing on previous debates on 'minimal nuclear deterrence', this paper argues that nuclear deterrence is possible at low numbers, and hence reliance on nuclear deterrence is not an obstacle to significant progress in nuclear disarmament. In particular, there is scope for reducing the vast Russian and United States nuclear arsenals, which risk planetary-scale destruction and stand in the way of multilateral nuclear disarmament. At the same time, recent military-technological evolution has raised the bar for minimal nuclear deterrence by questioning the survivability of nuclear forces.

In addition to making recommendations on how to address such strategic challenges, the paper addresses some conceptual dilemmas traditionally associated with minimal nuclear deterrence.

I. Introduction

Current debates on nuclear weapons are characterized by normative arguments for disarmament on one side and security-based arguments for deterrence on the other. In addition to the disarmament commitments under the 1968 Treaty on the Non-Proliferation of Nuclear Weapons (Non-Proliferation Treaty, NPT), the former arguments build on the 2017 Treaty on the Prohibition of Nuclear Weapons (TPNW), which rejects nuclear deterrence as inherently illegal and immoral. While acknowledging the NPT-based commitments in principle, the latter argument holds that disarmament would be premature due to the imperfections of the current international order. As a result, nuclear disarmament and deterrence have come to appear mutually exclusive.

This gap has widened still further following Russia's invasion of Ukraine in February 2022. The resulting war, which has involved nuclear threats by Russia's President Vladimir Putin, has contributed to increased militarization, including stronger arguments in favour of nuclear deterrence in Europe. At the same time, the crisis has highlighted the inherent fragility of nuclear deterrence, awakening the world to the danger of large-scale nuclear escalation for the first time since the end of the cold war. While some regard the bolstering of nuclear deterrence as an appropriate response, for others the situation further stresses the urgency of nuclear disarmament.[1] At the moment, however, the odds are against disarmament. The Russian–United States strategic stability talks, which were launched in June 2021, created hopes that the decade-long deadlock in bilateral arms control might finally be broken, but the talks were suspended as part of the breakdown of relations between the west and Russia in February 2022.[2] Thus, further Russian–US

[1] See e.g. Johnson, R., 'Ukraine war shows that nuclear deterrence doesn't work: We need disarmament', Open Democracy, 24 Mar. 2022.

[2] Detsch, J., 'Biden halts Russian arms control talks amid Ukraine invasion', *Foreign Policy*, 25 Feb. 2022.

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arms control, which remains the main mechanism for generating practical disarmament steps, appears unachievable in the short term.

Rather than continuing to rely on existing deterrence practices in the hope that nuclear risks will never materialize, the new awareness of such risks should inform bold arms control proposals that could be implemented in the longer term, or when the political window for diplomacy among major nuclear-armed states opens again. Drawing on previous debates on 'minimal nuclear deterrence', this paper seeks to contribute to such proposals by challenging the view that the perceived need for deterrence prevents significant progress on nuclear disarmament. The concept of minimal deterrence was frequently used in US arms control debates immediately after the cold war and around the time of the 2010 New START negotiations, when there appeared to be a political window for ambitious arms control measures. Grounded on the assumption that deterrence is possible at low numbers, minimal nuclear deterrence advocates made elaborate proposals on reducing Russian and US nuclear arsenals. The goal was to optimize nuclear deterrence by limiting the role of nuclear weapons to the core function of retaliation in kind, taking inspiration from China and other countries that had settled for relatively small nuclear forces. In addition to improving cost-effectiveness and mitigating the catastrophic consequences of deterrence failure between Russia and the USA, deep cuts in the world's largest arsenals were viewed as a necessary interim step to enable progress towards multilateral disarmament.[3]

The paper starts from the assumption that many insights from the previous minimal nuclear deterrence discussions are still valid and can help to invigorate the rather stale current debate on practical approaches to disarmament. At the same time, the paper takes issue with what critics have identified as inherent dilemmas and paradoxes with minimal nuclear deterrence, notably in relation to its implications for nuclear targeting practices. It also discusses the current military-technological challenges that have raised the bar for minimal nuclear deterrence by calling into question the survivability of second-strike nuclear forces. This problem can be illustrated by the recent expansion of nuclear forces in China, as its traditional nuclear restraint had long been viewed as the prime example of minimal nuclear deterrence in practice.[4] Therefore, in addition to the challenge of moving towards minimal nuclear deterrence in Russia and the USA, the paper also discusses changes in Chinese nuclear policy.

Insights from minimal nuclear deterrence discussions can help to invigorate the rather stale debate on practical approaches to disarmament

Section II discusses the theory of minimal nuclear deterrence, drawing on existing analytical literature that includes advocacy for the notion as well as critical arguments that question its feasibility. Among other things, the discussion highlights a controversy among analysts over the suggested incompatibility of minimal nuclear deterrence with 'counterforce' targeting and the meaning of 'countervalue' targeting. Section III examines the prac-

[3] Evans, G. and Kawaguchi, Y., *Eliminating Nuclear Threats: A Practical Agenda for Global Policymakers*, Report of the International Commission on Nuclear Non-Proliferation and Disarmament (International Commission on Nuclear Non-Proliferation and Disarmament: Canberra/Tokyo, 2009).

[4] Sevastopulo, D. and Mitchell, T., 'Xi–Biden agreement on nuclear talks clouded by "deep distrust"', *Financial Times*, 17 Nov. 2021.

tical challenges of nuclear minimalism in Russia, the USA and China, in particular Chinese and Russian concerns related to recent US advances in strategic offensive and defensive weapons. Finally, section IV makes recommendations on how to overcome those challenges and how to address some of the more enduring dilemmas associated with the idea of minimal nuclear deterrence.

II. Revisiting the theory of minimal nuclear deterrence

Minimal nuclear deterrence is generally understood as the smallest possible nuclear weapons arsenal perceived to be sufficient for the purpose of deterrence. The idea that relatively small arsenals are enough to deter can be seen to have guided the policies of most nuclear-armed states, with the notable exception of Russia and the USA. After the cold war, when the goal of winning an apocalyptic nuclear war that had driven Soviet and US nuclear expansion had come to appear obsolete, minimal nuclear deterrence began to be viewed as a model for nuclear reductions in both states.[5] While minimal nuclear deterrence proposals fell short of the more ambitious efforts at complete nuclear disarmament discussed by the Soviet and US leaders in 1986, they would have gone further than merely reducing the number of deployed warheads, which was done in the 1991 Strategic Arms Reduction Treaty (START I), the 2002 Strategic Offensive Reductions Treaty (SORT), and the 2010 New START Treaty. In particular, the concept of minimal nuclear deterrence gained traction in US analytical debates in the early 1990s and around the time of the negotiation of New START, when there was a political window for arms control. This section defines minimal nuclear deterrence based on the existing analytical literature, and highlights some key dilemmas and controversies around the concept, as well as its enduring analytical relevance—including in connection with the more recent calls for 'no-first-use' (NFU) and 'sole purpose' policies in the USA.[6]

The objectives of minimal nuclear deterrence

The normative arguments and rationales behind minimal nuclear deterrence proposals vary. While many sources view the minimization of global nuclear arsenals primarily as an intermediate step towards complete nuclear disarmament, others highlight the importance of drastic nuclear cuts for risk reduction or base their arguments for such cuts on cost-effectiveness.

The most recent minimal nuclear deterrence proposals involving ambitious timelines for nuclear weapon reductions date from the time of the New START negotiation. A 2009 report by the International Commission

[5] Although arguments for minimal nuclear deterrence or 'finite deterrence' were made in the USA during the cold war, for example by Chief of Naval Operations Admiral Arleigh Burke in the early 1960s, they were eventually overshadowed by the logic that highlighted the need for large arsenals. Burr, W., '"How much is enough?": The US Navy and "finite deterrence"', National Security Archive, George Washington University, 14 Oct. 2021.

[6] While it is sometimes difficult to differentiate between them, no-first-use (NFU) represents a commitment never to use nuclear weapons other than to retaliate following a nuclear attack, whereas a 'sole purpose' policy is a declaration of purpose rather than a pledge to limit actions to that purpose. See Panda, A. and Narang, V., 'Sole purpose is not no first use: Nuclear weapons and declaratory policy', War on the Rocks, 22 Feb. 2021.

on Nuclear Non-Proliferation and Disarmament argues for a two-phase approach to nuclear disarmament, with minimization as the short- to medium-term goal and elimination as the ultimate aim. The report envisages that the minimization point, whereby the number of nuclear warheads globally would be reduced to 2000, could be reached by 2025. It also calls for an urgent debate 'on the conditions necessary to move from the minimization point to elimination, even if a target date for getting to zero cannot at this stage be credibly specified'.[7] Another study from 2009 argues that the primary driver of radical nuclear reductions should be to remove 'the risk of a near global self-destruction'.[8] The study envisages that 'the explosive yield of the United States and Russia could be reduced by 94 percent by the end of 2025', at which point the two countries having demonstrated their own commitment should take the 'lead in seeking a treaty that would embrace the other three original nuclear states (Britain, France, and China) and the other states with significant arsenals'. The study further argues that, without such a multilateral minimal nuclear deterrence treaty, the long-term risk of worldwide destruction cannot be eliminated and advances towards a nuclear-free world cannot be achieved.[9] Although not reflected in subsequent policy practice, the idea of a 15-year timeline in the above proposals could still inspire future arms control efforts that aim to minimize global nuclear arsenals.

Most nuclear-armed states already subscribe to the principle of minimal deterrence, or to corresponding notions

While the need for disarmament and nuclear risk reduction arguably underlies most arms control proposals, economic considerations often take centre stage in domestic discussions. For example, one of the justifications for India's minimal nuclear deterrent posture has been that it allows the country to invest more in conventional forces.[10] Similar arguments for reducing the US nuclear arsenal highlight the high cost of modernizing redundant or obsolete systems—money which could instead be spent on conventional forces or on clean energy, healthcare and education.[11]

Quantifying minimal nuclear deterrence

Minimal nuclear deterrence is mostly defined in terms of numerical limits on warheads. In the proposals for minimizing the US arsenal, the limit typically ranges from a few hundred to up to 1000 nuclear warheads.[12] This is roughly in line with the practice of most nuclear-armed states, which

[7] Evans and Kawaguchi (note 3).
[8] Doty, P., 'The minimum deterrent and beyond', *Daedalus*, vol. 138, no. 4 (2009), pp. 130–39.
[9] Doty (note 8).
[10] Prabhakar, W. L., 'The challenge of minimal nuclear deterrence', Stimson Center, 2002.
[11] Gottemoeller, R., *Negotiating the New START Treaty* (Cambria Press: Amherst, 2021), p. 6; and Korda, M., *Alternatives to the Ground-based Strategic Deterrent* (Federation of American Scientists, 2021).
[12] For example, the following warhead numbers are mentioned in previous suggestions for minimal nuclear deterrence in the USA: 311, by Forsyth, J. W., Saltzman, B. C. and Schaub, G., 'Minimum deterrence and its critics', *Strategic Studies Quarterly*, vol. 4, no. 4 (winter 2010), pp. 3–12; 500, by Laderman, S., 'Minimal nuclear deterrence: A nuclear arsenal reduction plan for the United States', Massachusetts Institute of Technology, June 2012; 900, by Cartwright, J. E., 'Modernizing US nuclear strategy, forces and posture for the 21st century', Testimony to the House of Armed Service Committee, Subcommittee on strategic forces, 13 Mar. 2013; and 1000, by Lewis, J., 'Minimum deterrence', *Bulletin of the Atomic Scientists*, 1 July 2008

already subscribe to the principle of minimal deterrence, or to corresponding notions. The arsenal sizes of France, India, Pakistan, the United Kingdom and, until recently, China, are less than 300 warheads. The nuclear arsenals of Israel and North Korea, which do not officially subscribe to minimal nuclear deterrence, are even smaller.[13]

Alternatively, some analysts define the minimum in terms of the aggregate yield of a given country's nuclear arsenal, which according to one proposal would be 512 kilotons.[14] One of the most recent definitions of minimal nuclear deterrence—or what the author refers to as 'accountable deterrence'—is based on both numbers and yields: 'roughly 300 weapons with the lowest necessary yields' to minimize the humanitarian and environmental risks in case deterrence fails.[15] Others refrain from setting a precise numerical limit, noting that numbers are 'important, but by and large . . . a dependent variable'.[16]

Some have used the concept of minimal nuclear deterrence to refer to limits on deployed warheads, but this arguably stretches the concept too far.[17] As suggested above, the logic of minimal deterrence is markedly different from previous nuclear arms control treaties between the Soviet Union/Russia and the USA, which focused on reducing the number of deployed nuclear warheads through verified limits on delivery vehicles. For example, START I in 1991 limited the number of each side's strategic nuclear delivery vehicles to 1600, attributing a fixed number of nuclear warheads to each delivery system, with the total not to exceed 6000.[18] New START, in turn, limited the number of strategic nuclear warheads deployed on 700 delivery platforms to 1550, although the counting rules, which assumed that each bomber only carried one nuclear warhead despite the fact that they typically carry more, in principle allowed for a higher number.[19] Most importantly from the point of view of minimal nuclear deterrence, these treaties overlooked large numbers of non-deployed nuclear warheads. For example, despite having complied with the New START limits on deployed warheads, in 2021 Russia and the USA had a military stockpile of 4495 and 3800 nuclear warheads, respectively,

The logic of minimal deterrence is markedly different from previous nuclear arms control treaties, which overlooked large numbers of non-deployed nuclear warheads

[13] SIPRI, 'Modernization of world nuclear forces continues despite overall decrease in number of warheads: New SIPRI Yearbook out now', Press release, 17 June 2019; Kile, S. M. and Kristensen, H. M., 'World nuclear forces', *SIPRI Yearbook 2019: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2019), pp. 287–355; Kile, S. M, and Kristensen, H. M., 'World nuclear forces', *SIPRI Yearbook 2020*, pp. 325–85; and SIPRI, 'Global nuclear arsenals grow as states continue to modernize: New SIPRI Yearbook out now', Press release, 14 June 2021.

[14] Doty (note 8).

[15] Perkovich, G., 'Toward accountable nuclear deterrents: How much is too much?', Carnegie Endowment for International Peace, 11 Feb. 2020.

[16] Lodgaard, S., 'Opening addresses', ed. S. Sur, *Nuclear Deterrence: Problems and Perspectives in the 1990s* (United Nations Institute for Disarmament Research: Geneva, 1993), pp. xiii–xv.

[17] See e.g. Cimbala, S. J., 'Chasing its tail: Nuclear deterrence in the information age', *Strategic Studies Quarterly*, vol. 6, no. 2 (summer 2012), pp. 18–34.

[18] VERTIC and United Nations Institute for Disarmament Research (UNIDIR), *Coming to Terms with Security: A Handbook on Verification and Compliance* (VERTIC and UNIDIR: Geneva and London, 2003).

[19] Kristensen, H., 'New START Treaty has new counting', Federation of American Scientists, 29 Mar. 2010.

including both deployed and reserve warheads.[20] The practice of storing large numbers of reserve nuclear warheads is clearly not compatible with the logic of minimal nuclear deterrence.

Ensuring a survivable second-strike capability

Minimal nuclear deterrence proposals typically highlight the exclusively retaliatory function of nuclear weapons.[21] Based on the narrowest definition, the minimal requirement for nuclear forces is the ability to deliver a second strike to respond to nuclear aggression. For example, one of the authors of a 1993 United Nations Institute for Disarmament Research report explains that minimal nuclear deterrence is 'predicated on the view that the only sensible rationale for possession of nuclear forces is to deter others from using theirs'.[22] While this and most other sources suggest that minimal nuclear deterrence is in line with the NFU policy for nuclear weapons, others argue that it would also allow for the first use of nuclear weapons to counter conventional aggression (see below).

A retaliatory capability is only considered credible if the second-strike forces can survive a first strike. In theory, the smallest number of nuclear weapons required to create a credible deterrent effect 'is two: one that an adversary might be able to take out with a first strike and one that it knows it cannot'.[23] In practice, however, this number is viewed as insufficient. Indeed, one of the main arguments against small nuclear arsenals is that they are less survivable and, hence, less credible than large arsenals.[24] This argument is based on the logic that a counterforce attack that seeks to eliminate an adversary's entire nuclear arsenal would be easier against a few tens or hundreds of nuclear weapons than against thousands of such weapons. Insofar as small nuclear arsenals are seen as easy targets for pre-emptive strikes, they can be seen to contribute to crisis instability by creating an incentive to 'use them or lose them' before the anticipated adversary attacks.[25]

While some degree of redundancy is therefore viewed as necessary for maintaining second-strike nuclear forces, survivability primarily depends on the quality and configuration of nuclear weapons rather than their numbers. All nuclear-armed states have sought to protect their arsenals against counterforce attacks. One way they do this is through *concealment*, or the practice of deploying nuclear warheads on submarines, mobile land-based missile launchers or stealthy aircraft to make their detection and tracking more difficult. Another method is *hardening*, which means placing nuclear weapons in deep underground facilities that are reinforced with

[20] In addition, the numbers in the Russian and US inventories—6255 and 5550 warheads, respectively—included warheads awaiting dismantlement. Kristensen, H. and Korda, M., 'United States nuclear forces' and 'Russian nuclear forces', *SIPRI Yearbook 2021: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2021), pp. 335–45 and 346–57.

[21] See e.g. Nalebuff, B., 'Minimal nuclear deterrence', *Journal of Conflict Resolution*, vol. 32, no. 3 (1988), pp. 411–25; and Doty (note 8).

[22] Lodgaard (note 16).

[23] Forsyth, Saltzman and Schaub (note 12).

[24] See e.g. Arbatov, A., 'The debate on minimal deterrence', ed. S. Sur, *Nuclear Deterrence: Problems and Perspectives in the 1990s* (United Nations Institute for Disarmament Research: Geneva, 1993), UNIDIR/93/26, pp. 117–121.

[25] Heginbotham, E. et al., *China's Evolving Nuclear Deterrent: Major Drivers and Issues for the United States* (RAND Corporation: Santa Monica, CA, 2017), pp. 5–6.

materials capable of withstanding the effects of counterforce strikes.[26] The concealment of nuclear weapons in ballistic missile submarines (SSBNs) is generally viewed as the most effective of these methods. The UK has opted for a sea-based nuclear deterrent that relies solely on SSBNs, while most nuclear-armed states have combined a sea-based deterrent with air- and land-based systems.[27] Provided that nuclear-armed states are confident in the effectiveness of these methods—and assuming that their nuclear policy is based on deterrence by retaliation—their perceived security needs can be met with small nuclear arsenals.

Despite being preoccupied with the minimum arsenal size for credible nuclear deterrence, in general, advocates of minimal nuclear deterrence tend to regard the psychological deterrent effect primarily as linked to the existence of nuclear weapons rather than technical details pertaining to their quantity, quality, configuration or readiness.[28] Describing this logic, one analyst writes that: 'an enemy who can be deterred, will be deterred by the prospect of a counterattack, even if it consists of only a few nuclear weapons'.[29] As others point out, this psychological effect does not even require a guaranteed response to a first strike; it is sufficient to create 'first-strike uncertainty', meaning uncertainty in the minds of potential adversaries about their ability to successfully destroy the entire nuclear arsenal in a pre-emptive strike.[30] This also suggests that nuclear parity, which has long been a central consideration in Russian–US arms control, is largely irrelevant for deterrence. Indeed, several minimal nuclear deterrence advocates argue against the need to match adversary capabilities.[31]

Nuclear targeting at low numbers

Minimal nuclear deterrence and the underlying focus on the retaliatory role of nuclear weapons tends to be associated with *countervalue* targeting, a practice whereby nuclear weapons are aimed at high-value targets. While these have traditionally been seen as urban population centres, minimal nuclear deterrence advocates often point out that countervalue targets can also include key infrastructure related to energy production and transportation, conventional military forces or military-industrial targets.[32] *Counterforce* targeting, in contrast, holds at risk the adversary's

[26] See e.g. Lieber, K. A. and Press, D. G, 'The new era of counterforce: Technological change and the future of nuclear deterrence', *International Security*, vol. 41, no. 4 (Spring 2017).

[27] France has a dyad of sea- and air-based deterrent, whereas North Korea's relies on land- and sea-based deterrent. Other nuclear-armed states maintain a triad of sea-, air- and land-based nuclear delivery vehicles, although there is some uncertainty over whether Israel's submarines are nuclear-armed. See e.g. Kristensen, H. and Korda, M., 'Israeli nuclear forces', *SIPRI Yearbook 2021* (note 20), pp. 391–394.

[28] See e.g. Forsyth, Saltzman, and Schaub (note 12); and Prabhakar (note 10).

[29] Lewis (note 12).

[30] Wu, R., 'Living with uncertainty: Modeling China's nuclear survivability', *International Security*, vol. 44, no. 4 (spring 2020), pp. 84–118.

[31] See e.g. Lodgaard (note 16); Richardson, J., 'Shifting from a nuclear triad to a nuclear dyad', *Bulletin of the Atomic Scientists*, 1 Sep. 2009; and Pande, S., 'Chinese nuclear doctrine', *Strategic Analysis*, vol. 23, no. 12 (2000).

[32] Oelrich I., 'The next step in arms control: Eliminate the counterforce mission', *Bulletin of the Atomic Scientists*, 1 Jan. 2012; Kristensen, H., Norris, R. S. and Oelrich, I., 'From counterforce to minimal nuclear deterrence: A new nuclear policy on the path towards eliminating nuclear weapons', Federation of American Scientists and the Natural Resources Defense Council, *Occa-*

respective nuclear forces and related command, control and communication (C3) systems, thereby potentially reducing or neutralizing its offensive or retaliatory nuclear capability.[33] The logic behind counterforce targeting goes beyond deterrence to anticipating its failure and to seeking to manage the resulting escalation. However, the distinction between countervalue and counterforce targets is not always clear, which has added to the controversy around minimal nuclear deterrence. For example, in contrast to the above definition, countervalue targeting is often seen as referring exclusively to the targeting of cities, whereas some sources label non-nuclear military infrastructure as counterforce rather than countervalue targets.

Countervalue targeting excluding cities

The intentional targeting of urban population centres is not only immoral but, as is widely acknowledged today, also against international law.[34] Based on the view that countervalue targeting can only mean targeting cities, minimal nuclear deterrence has been criticized on moral grounds.[35] Some observers argue that: 'the prohibition against targeting civilians means that strategists advocating countervalue targeting and minimum deterrence are advocating an illegal doctrine'.[36]

This narrow interpretation of countervalue targeting dates back to the early days of the cold war when the Soviet Union and the USA aimed nuclear weapons at each other's cities. In the words of one analyst, in the 1950s this was 'a matter of necessity because reconnaissance capabilities, flight time of weapons and accuracy were all insufficient'.[37] However, subsequent technological improvements allowed for a shift from the indiscriminate targeting of urban areas to greater precision and more select targets, including nuclear infrastructure.[38] Such technological evolution is generally seen as explaining the shift from countervalue to counterforce targeting, but the potential range of countervalue targets also broadened as a result. While several proposals for minimal nuclear deterrence stress that countervalue targeting at low numbers need not include cities, others go further by arguing that urban population centres must be excluded from any nuclear targeting plans.[39]

The intentional targeting of urban population centres is not only immoral but also against international law

Although moral and legal considerations should prevent the intentional targeting of populations, it is highly problematic to claim that one nuclear targeting practice is more ethical than another. First, weapons of mass destruction do not by definition distinguish between military and civilian

sional Paper no. 7 (Apr. 2009); and Brown, M., 'Responses', ed. S. Sur, *Nuclear Deterrence: Problems and Perspectives in the 1990s* (United Nations Institute for Disarmament Research: Geneva, 1993), UNIDIR/93/26, pp. 128–130.

[33] Oelrich (note 32).

[34] See e.g. Arbatov (note 24); Lewis (note 12); and Sagan, S. D. and Weiner, A. S., 'The rule of law and the role of strategy in US nuclear doctrine', *International Security*, vol. 45, no. 4 (Spring 2021), pp. 126–66.

[35] Boyer, Y., 'Questioning minimal deterrence', ed. S. Sur, *Nuclear Deterrence: Problems and Perspectives in the 1990s* (United Nations Institute for Disarmament Research: Geneva, 1993), UNIDIR/93/26, pp. 101–104.

[36] Sagan and Weiner (note 34).

[37] Arbatov (note 24).

[38] Arbatov (note 24).

[39] Oelrich (note 32); Kristensen, Norris and Oelrich (note 32); Brown (note 32); and Perkovich (note 15).

targets, meaning that they violate the fundamental principle of distinction in international humanitarian law.[40] Adding to the discrimination problem, military targets are often located within or near civilian population centres. Insofar as nuclear forces and related infrastructure can be detected, they are typically hardened and therefore difficult to destroy, which calls for the need to direct several nuclear weapons at a single location.[41] Moreover, given the vast nuclear arsenals of Russia and the USA, even a limited counterforce attack with a low-yield nuclear weapon and reduced fallout could always escalate to an all-out nuclear war, resulting in the destruction not only of cities but also potentially of all life on Earth. Thus, referring to the principle of distinction as well as to proportionality and precaution, the TPNW regards any nuclear weapon use, or threat of such use, as illegal.[42]

Even a limited counterforce attack could escalate to all-out nuclear war, potentially destroying all life on Earth

Controversy over counterforce targeting

While acknowledging the need for countervalue targeting at low numbers, advocates of minimal nuclear deterrence are divided on the issue of counterforce targeting. As noted above, counterforce targeting is associated with the ability to wage nuclear war after deterrence has failed, which implies the need for a range of flexible options to control escalation rather than just survivable second-strike nuclear forces. Reflecting the uncertainty about escalation pathways and thresholds for nuclear weapon use, as well as the tendency to assume that one's own actions are defensive in contrast to the other's potentially aggressive intent, theoretical explanations of 'escalation control' tend to be rather fuzzy.

In general, escalation control, which is sometimes also called 'flexible response' based on the North Atlantic Treaty Organization's (NATO) nuclear strategy during the cold war, is understood as efforts to manipulate the threat of limited nuclear strikes to deny the adversary confidence in their ability to win a conflict.[43] On the one hand, this idea is portrayed as defensive, notably pertaining to a situation where a losing party in a military conflict resorts to the first use of nuclear weapons, or the threat of their use, to respond to aggression by a conventionally superior adversary.[44] On the other hand, threatening limited nuclear strikes can also function as a tool of aggression, to deter a retaliatory response to conventional military operations.[45]

Five countries—France, Pakistan, Russia, the UK and the USA—currently retain the option of first use of nuclear weapons as part of their doctrines.[46] A limited first use of nuclear weapons is also considered essential for US nuclear security guarantees, or 'extended nuclear deterrence', by several US

[40] See also Sagan and Weiner (note 34).

[41] Perkovich (note 15).

[42] Treaty on the Prohibition of Nuclear Weapons, opened for signature 20 Sep. 2017, entered into force 22 Jan. 2021, Preamble.

[43] Miles, A., 'Escalation dominance in America's oldest new nuclear strategy', War on the Rocks, 12 Sep. 2018.

[44] Mendelson, J., 'NATO's nuclear weapons: The rationale for "no first use"', Arms Control Association, 1999.

[45] Luik, J. and Jermalavičius, T., 'A plausible scenario for nuclear war in Europe, and how to deter it: A perspective from Estonia', *Bulletin of the Atomic Scientists*, vol. 73, no. 4 (2017).

[46] While China and India explicitly rule out the first use option, Israel and North Korea are ambiguous on the scenarios in which they would use nuclear weapons.

allies in Asia and Europe.[47] The underlying assumption is that the threat of a nuclear strike is more credible and less likely to provoke further escalation if it is limited in terms of its target and destructive force, and hence might convince the adversary to back down. In line with this assumption, Russia, Pakistan and the USA also possess so-called non-strategic or low-yield nuclear weapons that enable such limited strikes.[48] Although the recent nuclear threats by Russia to deter third parties from intervening in the war on Ukraine can be seen as an example of escalation control, it has not signalled a readiness for such strikes by visibly deploying tactical nuclear weapons.[49]

In addition to being able to conduct a limited first nuclear strike or to provide a 'measured response' to such a strike by an adversary, escalation control calls for an ability to progressively increase the severity of the nuclear response if needed.[50] Insofar as the focus shifts from 'de-escalation' to pursuing an ability to win a nuclear war at various levels of escalation, the strategy can be called 'escalation dominance'.[51] In the words of one author, 'it is possible to view escalation dominance as a stronger form of flexible response rather than a distinct strategy, but there is an important conceptual distinction between casting doubt on the adversary's ability to win and convincing him that he will lose if the conflict plays out'.[52] Rather than just outdoing the adversary in risk-taking, escalation dominance thus seems to presume superior capabilities that could also enable pre-emptive strikes.

Efforts to manage escalation, and in particular efforts to dominate it, significantly increase the qualitative and quantitative requirements of nuclear forces compared to what would be needed for deterrence by retaliation. An extreme example is the cold war arms race, which was mainly driven by extensive counterforce targeting predicated on the goal of winning a nuclear war. In addition to seeking to match the other side in terms of the number and quality of its nuclear weapons, the Soviet Union and the USA perceived a constant need to modernize their nuclear forces to reduce their vulnerability to the other side's counterforce attacks and to increase their own potential to conduct such attacks.[53] At the same time, it was clear that in reality there could be no winners in such a nuclear Armageddon, which would ultimately destroy both sides. Drawing on this historical experience, all minimal nuclear deterrence proposals reject extensive counterforce targeting.

On this basis, several advocates of the notion also argue that there is no place in minimal nuclear deterrence for any kind of counterforce targeting.[54]

[47] See e.g. Becker, J. D, 'Strategy in the new era of tactical nuclear weapons', *Strategic Studies Quarterly*, vol. 14, no. 1 (Spring 2020), pp. 117–140; and Trezza, C., 'Mission possible: Revisiting the no first use of the nuclear weapon', Commentary, European Leadership Network, 6 Apr. 2021.

[48] In addition, the UK's sea-based deterrent has a low-yield nuclear option. Kristensen, H. and Korda, M., 'British nuclear forces', *SIPRI Yearbook 2021* (note 20), pp. 358–62.

[49] Horovitz, L. and Wachs, L., 'Russia's nuclear threats in the war against Ukraine', SWP Comment no. 29 (Apr. 2022).

[50] Morgan, F. E. et al., *Dangerous Thresholds: Managing Escalation in the 21st Century* (RAND Corporation: Santa Monica, CA, 2008).

[51] Morgan et al. (note 50); and Fitzsimmons, M., 'The false allure of escalation dominance', War on the Rocks, 16 Nov. 2017.

[52] Miles (note 43).

[53] Perkovich (note 15); and Oelrich (note 32).

[54] See e.g. Brown (note 32); and Oelrich (note 32).

Others, however, believe that the more limited notion of escalation control may be compatible with minimal nuclear deterrence. For example, while noting that deterrence does not require 'a state . . . to demonstrate a capacity to win a nuclear war', a group of authors argues that a minimal US nuclear deterrence posture should 'provide the needed flexibility for escalation control and strategic signaling'.[55]

Given the potentially slippery slope between escalation control and dominance—particularly at low numbers, which could blur the line between low and high levels of escalation—counterforce targeting poses a challenge to minimal nuclear deterrence. At the same time, however, assuming that second-strike nuclear forces can indeed survive counterforce strikes and that leaders are not suicidal, far-reaching counterforce targeting plans based on escalation dominance lack credibility. From this perspective, escalation control does not create the need to match adversary capabilities even if the latter is pursuing escalation dominance. Although recent military-technological evolution has significantly increased the potential for successful counterforce attacks—including by means of precision-strike conventional weapons and cyber capabilities—this has not removed first strike uncertainty, which arguably still makes such attacks unlikely.[56]

That is not to say that a nuclear war will not occur or that one could be limited. Indeed, the existence of non-strategic and low-yield weapons may lower the threshold for their first use in conflict.[57] Contrary to the logic of escalation control, the adversary might respond not by backing down, but by escalating further, by either launching a limited strike of its own or resorting to more extensive retaliation. There is simply no way to predict the outcome of this gamble, which could lead to a global-scale disaster even if the nuclear exchange remained limited.[58] Alternatively, nuclear war could occur either by accident or because leaders might not be deterred even by risks that seem unacceptable.

It can be argued that short of nuclear disarmament, the best way to reduce nuclear risks is to minimize the level of destruction in unlimited escalation

Therefore, it can be argued that short of complete nuclear disarmament, the best way to reduce nuclear risks is to minimize the level of destruction involved in unlimited escalation. This is why some proponents of minimal nuclear deterrence argue that the overall yield of nuclear weapon arsenals, alongside their numbers, should be capped. Ultimately, however, the discussion on containing the catastrophic consequences of nuclear weapon use leads to the fundamental question: why threaten such use in the first place? This is especially the case if similar military effects can be achieved with conventional weapons.

Minimal nuclear deterrence and damage limitation

A related concept to that of escalation control and dominance is damage limitation, which means efforts by one side in a nuclear war to protect itself

[55] Forsyth, Saltzman, and Schaub (note 12).

[56] See e.g. Lieber and Press (note 26); and Snyder, R., 'New era or new error? Technology and the future of nuclear deterrence', *International Security*, vol. 43, no. 3 (2019), pp. 190–193.

[57] Rofer, C., 'Low-yield nukes are a danger, not a deterrent', *Foreign Policy*, 11 Feb. 2020.

[58] Robock, A. et al., 'How an India–Pakistan nuclear war could start, and have global consequences', *Bulletin of the Atomic Scientists*, vol. 75, no. 6 (2019), pp. 273–79.

against the devastation caused by such a war by both offensive and defensive means. In addition to limited nuclear strikes, which can be used to control escalation either through signalling or by taking out the adversary's nuclear forces, damage limitation is seen as including various defensive means, such as 'ballistic missile defense, air defenses against enemy bombers, anti-submarine warfare, and civil defense'.[59] Insofar as these defensive means are effective at negating the second-strike forces of the other side, they can be seen as adding credibility to both escalation control and dominance—and also as enabling pre-emption—by reducing the cost of waging a nuclear war.

Thus, damage limitation challenges the fundamental principles of nuclear deterrence by suggesting that nuclear war could indeed be waged and even won without necessarily risking unacceptable damage to oneself. In particular, it challenges minimal nuclear deterrence as the concept of damage limitation is typically used to describe a potential US strategy towards adversaries with relatively small nuclear arsenals, notably North Korea.[60] In fact—reminiscent of arguments in the 1960s that presented emerging Chinese nuclear capabilities as the rationale for the early development of US strategic missile defences—in the 2000s such defences have been justified primarily in terms of the perceived nuclear threat from North Korea.[61] Proponents of the strategy argue that: 'damage limitation capabilities, a combination of strike and missile defense armaments . . . would allow the United States to disarm the majority of North Korea's nuclear weapons capability and prevent significant retaliatory strikes against US cities'.[62] Critics, however, note that the effectiveness of US ballistic missile defences is questionable, which implies a need to focus on counterforce strikes; and that the pursuit of a damage limitation strategy might contribute to crisis instability and new arms races involving not only North Korea, but also other US adversaries concerned about the effectiveness of their deterrents vis-à-vis the USA.[63]

Damage limitation challenges deterrence by suggesting that nuclear war could be waged and even won without risking unacceptable damage to oneself

Although there is a similar discussion in the USA with respect to China, in this connection there is even more scepticism about the wisdom of emphasizing damage limitation over mutual deterrence. As two analysts explain, recent 'improvements in missile accuracy have increased the US ability to destroy fixed targets, and US ballistic missile defense technologies have continued to mature' in a way that appears to provide 'some capability to lower the costs of an all-out Chinese nuclear attack'.[64] At the same time, they note that this capability is being reduced by China's recent development of more survivable nuclear delivery systems, and argue that the USA should

[59] Purcell, R., 'A history of damage limitation in US nuclear war planning', *Global Security Review*, 23 Jan. 2020.

[60] Glaser, C. L. and Fetter, S., 'Should the United States reject MAD? Damage limitation and US nuclear strategy toward China', *International Security*, vol. 41, no. 1 (2016), pp. 49–98.

[61] Kaplan, F., *The Wizards of Armageddon* (Simon & Schuster: New York, 1983); US Department of Defense (DOD), Office of the Secretary of Defense, *Ballistic Missile Defense Review Report* (US DOD: Arlington, VA, Feb. 2010); and US DOD, Office of the Secretary of Defense, *2019 Missile Defense Review* (US DOD: Arlington, VA, Jan. 2019).

[62] Manzo, V. A. and Warden, J. K., 'Want to avoid nuclear war? Reject mutual vulnerability with North Korea', War on the Rocks, 29 Aug. 2017.

[63] Kirss, A., 'Why damage limitation isn't the answer to the North Korean threat', War on the Rocks, 19 Sep. 2017

[64] Glaser and Fetter (note 60).

'continue to meet the requirements for conventional deterrence without relying on the threat of nuclear escalation'.[65]

While there is no extensive discussion on damage limitation in the existing literature on minimal nuclear deterrence, observers have long identified strategic missile defences as a complicating factor in nuclear weapon reductions. For example, the above-cited source who describes the minimum number of nuclear weapons as a dependent variable argues that this number depends, 'for instance, on . . . ballistic missile defences'.[66] Another observer writes that while 'nuclear retaliatory forces, even at minimum deterrent levels, can conceivably provide for numbers of surviving and defence-penetrating warheads', 'defences that are too capable against either side's nuclear retaliatory forces could drive military planners into launch-on-warning doctrines, increased expenditures on offensive countermeasures to defenses, or additional deployments of offensive weapons'.[67] As argued below, US strategic missile defences—in combination with the global trend for increasingly accurate long-range weapons and other potentially effective counterforce capabilities—can already be seen to have contributed to arms racing in a way that has raised the bar for minimal nuclear deterrence.

Summarizing the theory of minimal nuclear deterrence

To summarize the discussion in this section, minimal nuclear deterrence means the lowest possible number of nuclear weapons deemed sufficient for a credible retaliatory capability; that is, a capability that can survive a nuclear first strike. Estimates vary on what that number should be but, in most cases, it is set at a few hundred nuclear warheads. While numerical reductions could pave the way for further progress on disarmament and help to contain the catastrophic consequences of deterrence failure, the latter objective would also require limiting the overall yield of nuclear weapons. Minimal nuclear deterrence seems incompatible with extensive counterforce targeting, which could provide a theoretical capability to dominate escalation or pre-emptively disarm opponents.

However, existing minimal nuclear deterrence definitions vary on whether the mission of nuclear weapons should focus exclusively on deterrence by retaliation or retain the option of first use in certain situations. Ultimately, this controversy is related to disagreements on nuclear targeting and strategy. While some argue that there is no place whatsoever for counterforce targeting and escalation control in minimal nuclear deterrence, others believe that limited nuclear weapon use might be required in regional conflicts defined by conventional asymmetry. Although escalation control can in practice be hard to distinguish from escalation dominance at low numbers, this paper argues that the latter strategy is hardly credible insofar as the other side's second-strike nuclear forces remain survivable. In other words, escalation control does not necessarily lead to arms racing based on efforts to match adversary nuclear capabilities, meaning that it could indeed be compatible with minimal nuclear deterrence. However, at least in theory

[65] Glaser and Fetter (note 60).

[66] Lodgaard (note 16); and Arbatov (note 24).

[67] Cimbala, S. J., 'Chasing its tail: Nuclear deterrence in the information age', *Strategic Studies Quarterly*, vol. 6, no. 2 (Summer 2012), pp. 18–34.

it is possible that defensive damage limitation systems, notably missile defence, could ultimately change this, creating a formidable challenge to minimal nuclear deterrence. This point is discussed further in section III.

III. Challenges for nuclear minimalism in practice

As noted in section II, nuclear deterrence can be credible even at low numbers insofar as second-strike forces are regarded as survivable and the main mission of nuclear weapons is to deter rather than prevail in a nuclear war. Indeed, most nuclear-armed states have settled for relatively small arsenals based on this logic. Russia and the USA, however, applied a very different logic when building their arsenals, which during the cold war consisted of tens of thousands of warheads.[68] Even though the two countries subsequently reduced their arsenals and apparently moved away from the cold war pursuit of an ability to win a nuclear war, these arsenals remain large, consisting of thousands of nuclear warheads. This section examines the practical challenges facing Russia and the USA in moving towards minimal nuclear deterrence. While the greatest challenges are likely to be of a political nature, not least the perceived prestige benefits associated with large nuclear arsenals, the focus of this section is limited to strategic considerations linked to the survivability of second-strike nuclear forces. In addition to Russia and the USA, the section also examines the recent nuclear expansion in China, which has called its traditional policy of nuclear minimalism into question.

Prospects for minimal nuclear deterrence in Russia and the USA

Russia and the USA together possess over 90 per cent of the world's total of approximately 13 000 nuclear weapons.[69] Both countries maintain a nuclear triad; that is, a force structure consisting of land-based intercontinental ballistic missiles (ICBMs), sea-based submarine-launched ballistic missiles (SLBMs) and nuclear-capable aircraft. Although the bilateral arms control process has been deadlocked since the negotiation of New START, officials and experts on both sides have previously suggested that there is room for further reductions in their nuclear arsenals.[70] At times, they have also indicated an openness to discussing verified limits involving non-deployed nuclear warheads, which would go beyond the accustomed arms control model of reducing deployed strategic warheads through limits on delivery vehicles.[71] In this context, it is useful to outline previous proposals for deep cuts and the responses to such proposals in Russia and the USA to provide an

[68] The US stockpile reached its peak in 1966 at over 32 000 nuclear warheads, whereas the Soviet Union had 45 000 warheads in 1986. Norris, R. S. and Kristensen, H. M., 'Global nuclear stockpiles, 1945–2006', *Bulletin of the Atomic Scientists*, July/Aug. 2006.

[69] Kristensen and Korda (note 20).

[70] See e.g. 'Obama's aims to reduce nuclear threat', Reuters, 12 Feb. 2013; and Orlov, V. A, Timerbaev, R. M. and Khlopkov, A. V., [Problems of nuclear non-proliferation in Russian–US relations: History, opportunities and prospects for further cooperation], PIR Center, 2001 (in Russian).

[71] See e.g. Acton. J. M., MacDonald, T. and Vaddi, P., 'Reimagining nuclear arms control: A comprehensive approach', Carnegie Endowment for International Peace, 16 Dec. 2021; and Arms Control Association, 'START III framework at a glance', Fact sheet, Jan. 2003.

insight into how the two states could move towards minimal nuclear deterrence should they decide to pursue that objective in the future.

Challenges from the US perspective

The prevailing view of successive US administrations has favoured the maintenance and modernization of the entire nuclear triad and regarded any nuclear reductions as conditional on reciprocal steps by Russia. At the same time, domestic critics view the ongoing modernization as costly and as limiting the possibilities for future nuclear cuts. These concerns have inspired much of the recent debate on how to optimize the US nuclear arsenal.

Several arms control advocates in the country have called for the removal of the land-based leg of the triad, arguing that ICBMs are not only obsolete, but also destabilizing.[72] More specifically, siloed ICBMs are vulnerable to counterforce attacks due to their fixed and known locations. While hardening complicates counterforce strikes against ICBMs, an adversary could still destroy them by launching multiple nuclear weapons against one location. Siloed ICBMs have traditionally been regarded as having high deterrent value due to their level of readiness, which means that they can be launched 'under warning', before they are reached by incoming adversary missiles. Critics point out that it is this combination of vulnerability and high alert level that makes ICBMs particularly dangerous, which is why they should be either eliminated or significantly reduced.[73] The contrary view is that ICBMs are still important for maintaining the high threshold for nuclear attack against the USA, as the task of conducting successful counterforce strikes against 450 hardened missile silos would be more daunting than a strike against the other two legs of the triad.[74]

Arms control advocates in the USA have called for the removal of the land-based leg of the triad, arguing that ICBMs are not only obsolete, but also destabilizing

The sea-based leg is generally viewed as the most important of the three. SLBMs mounted on SSBNs are regarded as the most survivable means of delivering nuclear weapons.[75] The 2018 US Nuclear Posture Review states that 'SSBNs are, at present, virtually undetectable, and there are no known, near-term credible threats to the survivability of the SSBN force'.[76] Furthermore, in March 2022 the Commander of US Strategic Command noted that the SSBN fleet presents 'a highly effective, survivable, worldwide launch capability with continuous and virtually undetectable strategic deterrent patrols'.[77] While some point to future advances in anti-submarine warfare, as well as cyberattacks and artificial intelligence as potential challenges to the survivability of the sea leg, such concerns remain

[72] Richardson (note 31); Ploughshares Fund, 'Perry and Collina statement on air force contract award for new nuclear ICBM', 8 Sep. 2020; and Perkovich, G. and Vaddi, P., *Proportionate Deterrence: A Model Nuclear Posture Review* (Carnegie Endowment for International Peace: Washington, DC, 2021).

[73] See e.g. Ploughshares Fund (note 72); and Perkovich and Vaddi (note 72).

[74] Kroenig, M., 'The case for the US ICBM force', *Strategic Studies Quarterly*, vol. 12, no. 3 (Fall 2018), pp. 50–69.

[75] See e.g. Richardson (note 31).

[76] US DOD, Office of the Secretary of Defense, *Nuclear Posture Review* (US DOD: Arlington, VA, 2018).

[77] Statement of Charles A. Richard, Commander of the United States Strategic Command, Before the House Armed Services Committee on Strategic Forces, 1 Mar. 2022; and Osborn, K., 'Columbia-class: The most "stealth" US Navy submarine ever?' *National Interest*, 23 June 2020.

speculative.[78] Moreover, the most advanced technology for detecting an adversary's SSBN capabilities currently seems to be possessed by the USA rather than its adversaries.[79]

Provided that advanced nuclear submarines continue to be highly survivable in the face of emerging technologies, the USA could in principle follow the British example of relying solely on its sea-based deterrent. Most proponents of deep cuts would nevertheless maintain the air leg alongside the SSBNs, not least because nuclear-capable aircraft are viewed as essential for the credibility of US extended nuclear deterrence commitments.[80] Indeed, the air leg is rarely questioned due to its historical role in signalling for the purposes of escalation control, as symbolized in particular by the regional presence of heavy B-52 bombers and tactical air-deliverable nuclear weapons in Europe.[81]

In addition to extended deterrence requirements, some ICBM critics argue that the air leg should be kept as insurance 'in the unlikely event that new threats emerge that could put the submarines at risk'.[82] Although the survivability of nuclear aircraft is also called into question by adversaries' advanced air defences, new stealthy systems such as the B-21 Raider and Long-Range Standoff Weapon (LRSO) are seen as enhancing the survivability of the air leg.[83] However, the air leg also has its critics who question the wisdom of investing in costly stealth technology and highlight the vulnerability of airbases to airstrikes.[84] Another argument against the air leg is that its signalling role has decreased in importance in the post-cold war context.[85] A related argument against keeping tactical nuclear weapon systems in the air leg is that they have become militarily obsolete, and now mainly have a political role.[86] Clearly, these latter arguments have been undermined by the war in Ukraine, which has increased the perception of the importance of extended nuclear deterrence and the related signalling through nuclear-capable aircraft in Europe.

Challenges from the Russian perspective

It seems that there has been no comparable discussion on minimal nuclear deterrence or the identification of potential areas for deep cuts in Russia, even though Russian officials and experts have also engaged in arms control debates. They typically stress that nuclear arms control cannot be separated

[78] Rose, F. A. and Bahney, B., 'Reassuring allies and strengthening strategic stability: An approach to nuclear modernization for Democrats', War on the Rocks, 16 Apr. 2019; Wirtz, J. J., 'Nuclear-armed submarines and US defence strategy: The future of the maritime deterrent', *The Strategist*, 20 May 2020; and Miller, F., 'Addressing fears about the Nuclear Posture Review and Limited Nuclear Use', War on the Rocks, 28 Feb. 2018.

[79] Owen, C. R., 'Invisible nuclear-armed submarines, or transparent oceans? Are ballistic missile submarines still the best deterrent for the United States?', *Bulletin of the Atomic Scientists*, vol. 75, no. 1 (2019), pp. 30–35.

[80] Richardson (note 31); and Perkovich and Vaddi (note 72).

[81] North Atlantic Treaty Organization, 'Bomber task force Europe: Strategic bombers soar through NATO's eastern flank, complete successful 2-month rotation', 18 Apr. 2022.

[82] Collina, T., 'Welcome to America's "nuclear sponge"', *Defense One*, 3 Feb. 2017.

[83] Perkovich and Vaddi (note 72).

[84] Watson, D. E., 'Rethinking the US nuclear triad', *Strategic Studies Quarterly*, vol. 11, no. 4 (winter 2017), pp. 134–50; and Laderman (note 12).

[85] Watson (note 84).

[86] Blechman, B. and Rumbauch, R., 'Bombs away: The case for phasing out US tactical nukes in Europe', *Foreign Affairs*, vol. 93, no. 4 (July/Aug. 2014), pp. 163–74.

from other issues affecting strategic stability. In the words of one expert, 'the scope of the [potential New START follow-on] agreement . . . is much more important' than warhead thresholds.[87] This Russian view has partly contributed to the broad agenda of the Russian–US strategic stability talks, which includes not only nuclear weapons but also non-nuclear weapons with strategic effects, such as missile defence and precision-strike weapons, as well as the militarization of space.[88]

In particular, Russia has repeatedly expressed concern that US precision-strike weapons and missile defences could undermine its nuclear deterrent.[89] More specifically, precision-strike weapons could be used to eliminate Russian nuclear forces, whereas missile defence could neutralize any remaining nuclear missiles after their launch. This concern is based on the same kind of damage limitation capabilities that some US experts believe could be used to establish escalation dominance over North Korea or China. While unlikely ever to threaten the vast nuclear arsenal that Russia possesses today, the perceived threat from US damage limitation capabilities would become more concrete if Russia were to significantly reduce its nuclear arsenal. This view has contributed to the scepticism surrounding US deep cut proposals, which Russia has tended to view as 'an attempt to provide the US with a strategic advantage' based on superior non-nuclear strategic capabilities.[90]

Russia's survivability concerns are exacerbated by its heavy reliance on the land-based leg of the nuclear triad.[91] Unlike the USA, Russia has mobile ICBMs, which are less vulnerable to counterforce attacks than silo-based missiles. However, it also continues to invest in silo-based ICBMs, many of which are loaded with multiple independently targetable re-entry vehicles (MIRVs).[92] Some western observers argue that Russia could enhance the survivability of its ICBMs by de-MIRVing its silo-based missiles and investing more on mobile platforms.[93] However, such arguments seem to miss the strategic logic behind the Russian nuclear posture, which is based on an expectation that a massive counterforce attack against Russia would not be able to hit all its ICBM targets at once, leaving enough time for a prompt retaliation with the remaining ICBMs which would be more effective when MIRVed. Silo-based ICBMs are also better equipped for carrying an extra payload of missile defence countermeasures, such as decoys. In addition, MIRVing functions as a countermeasure to missile defence, as it is much harder to intercept several incoming warheads than one. Further adding to the deterrence value of the land-based deterrent, Russia's new Sarmat

[87] Arbatov, A., Oznobishchev, S. and Bubnova, N. (eds), *Russia: Arms Control, Disarmament and International Security*, IMEMO Supplement to the Russian Edition of the SIPRI Yearbook, 2018 (Primakov National Research Institute of World Economy and International Relations, Russian Academy of Sciences, IMEMO: Moscow, 2019).

[88] Bugos, S., 'US, Russia to continue strategic stability dialogue in 2022', Arms Control Association, 21 Dec. 2021.

[89] President of Russia, 'Meeting with heads of international news agencies', Press conference, 17 June 2016.

[90] Pechatnov, Y., [A retrospective analysis of the evolution of containment concepts], *Arms and Economics*, vol. 19, no. 1 (2010), pp. 11–18 (in Russian).

[91] See e.g. Woolf, A. F., *Russia's Nuclear Weapons: Doctrine, Forces, and Modernization*, Congressional Research Service Report to Congress R45861, 21 Apr. 2022.

[92] Woolf (note 91).

[93] Oelrich (note 32).

ICBM can carry the Avangard hypersonic glide vehicle, which is specifically designed to evade US missile defences.[94]

Despite these considerations, some suggest that Russia might agree to reduce its ICBM force as part of reciprocal limits with the USA.[95] For example, insofar as the deployment of hypersonic weapons eases Russian concerns over missile defence, their deployment might create room to reduce the number of MIRVed ICBMs.[96] However, bilateral ICBM reductions are unlikely to go far as long as Russia's strategic stability concerns related to US missile defences remain unaddressed.[97] Indeed, Russian nuclear arms control proposals typically highlight the need for parallel limits on missile defence.[98]

Bilateral ICBM reductions are unlikely to go far if Russia's strategic stability concerns about US missile defences remain unaddressed

Noting the difficulty of subjecting the Russian ICBM force to arms control limits, some Russian experts have suggested that, in theory, it might be easier for the country to give up the air leg of the triad.[99] In this connection they have highlighted the vulnerability of Russian aircraft to conventional precision strikes.[100] Although Russia has been developing more stealthy aircraft, such as a modernized version of the Tu-160 bomber and the PAK-DA, which is still under development, these efforts are arguably subject to similar questions to those raised by the critics of the US air leg.[101]

It is also possible that Russia could agree to reduce its large arsenal of non-strategic nuclear warheads, which do not seem to have critical importance for deterrence, as they are reportedly held in storage. In practice, however, Russia is likely to link such reductions to other issues relevant to its above-mentioned survivability concerns rather than reciprocal cuts in the much smaller stockpile of US non-strategic nuclear weapons. It has also been suggested that non-strategic nuclear weapon reductions by Russia could be linked to concessions on missile defence by the USA.[102]

For the same reasons as in the USA, Russia is likely to view SSBNs as essential for deterrence. Unlike Soviet-era SSBNs, the new class of Russian SSBNs is reportedly highly stealthy.[103] While this makes Russia's sea-based

[94] Podvig, P., 'In defense of silo-based MIRVed ICBMs', Russian Strategic Nuclear Forces blog post, 2 June 2021.

[95] See Perkovich and Vaddi (note 72); and Zagorskiy, A., [Radical reduction of nuclear weapons will strengthen the security of Russia], *Russian International Affairs Council*, 21 Oct. 2013 (in Russian).

[96] Perkovich and Vaddi (note 72).

[97] See Perkovich and Vaddi (note 72); Pifer, S., 'Should US missile defenses be a part of arms control negotiations with Russia?', *National Interest*, 26 Jan. 2021; and Erästö, T. and Korda, M., 'Time to factor missile defense into nuclear arms control talks', SIPRI Commentary, 30 Sep. 2021.

[98] For example, a 2001 proposal by Orlov, Timerbaev and Khlopkov (note 70) on reducing (deployed) nuclear warheads to 1000–1500 would also have included US guarantees to limit its missile defence system, and an opportunity for Russia to retain the strategic offensive capabilities necessary to surpass that system, including MIRVs.

[99] Arbatov, A., [A bet on nuclear forces], [Independent military review], 22 Dec. 2000 (in Russian); and Savelev, A. G., [Political and military-strategic aspects of the START-1 and START-2 treaties], IMEMO, 2000, pp. 49–50 (in Russian).

[100] Arbatov (note 99).

[101] Woolf (note 91); Kristensen, H. and Korda, M., 'Russian nuclear forces', *SIPRI Yearbook 2021* (note 20), pp. 346–57; and Episkopos, M., 'Russia's PAK-DA stealth bomber is almost ready', *National Interest*, 8 May 2021.

[102] Pifer (note 97).

[103] Miasnikov, E., 'Can Russian strategic submarines survive at sea? The fundamental limits of passive acoustics', *Science & Global Security*, vol. 4 (1994), pp. 213–251; Hersman, R., Brewer, E. and

deterrent more survivable against counterforce strikes, the idea of a monad consisting only of the sea leg seems much less likely than in the USA. This is partly due to geography, as Russia has less access to the high seas than the USA.[104] Offence–defence considerations would also seem to militate against relying solely on the sea-based leg, as US missile defences could still neutralize Russian SLBMs after launch, but also because Russia might view US anti-submarine warfare capabilities as having the potential to undermine its sea-based deterrent.[105]

Lowering the bar for minimal nuclear deterrence in China

Despite recent increases, China's nuclear stockpile, which exceeded 300 warheads in 2019 and reached 350 warheads in 2021, is still relatively small in comparison with those of Russia and the USA.[106] China's nuclear doctrine is also in line with minimal nuclear deterrence. According to its 2019 White Paper, China 'keeps its nuclear capabilities at the minimum level required for national security' and 'pursues a nuclear strategy of self-defense . . . by deterring other countries from using or threatening to use nuclear weapons against China'.[107] The White Paper also reaffirms China's long-standing NFU policy.[108] The focus in Chinese doctrine on deterrence by retaliation is consistent with the fact that its nuclear deterrence mainly relies on ICBMs, which are associated with countervalue targeting.[109] China also reportedly does not deploy any nuclear warheads on delivery systems.[110]

Nonetheless, China's nuclear stockpile has been growing in recent years. This growth, which is expected to continue, is part of efforts to build up China's sea- and air-based deterrence alongside land-based missiles. China had long pursued the development of SSBNs and maintained a nuclear-capable air force but until the 2010s, the former was not regarded as credible while the latter was considered non-operational.[111] By 2013, however, China had deployed a new and more stealthy JIN-class SSBN, regarded by the

Simon, M., 'Strategic stability and competition in the Arctic', *Center for Science and International Security (CSIS) Brief* (Jan. 2021); Matthew, M., Conley, H. A. and Bermudez, J. S., 'The ice curtain: Bringing transparency to the Arctic', *CSIS Brief* (Mar. 2020); and Roblin, S., 'Russia new stealth submarine is armed with 72 nuclear warheads', *National Interest*, 30 June 2019.

[104] Gottemoeller (note 11), p. 32; and Ostreng, W., 'The strategic balance and the Arctic Ocean: Soviet options', *Cooperation and Conflict*, vol. 12, no. 1 (1977), pp. 41–62.

[105] See e.g. Stancy Correll, D., 'A "persistent, proximate threat": Why the Navy is preparing for a fight under the sea', Navy Times, 10 Sep. 2021.

[106] SIPRI, Press release 17 June 2019 (note 13); Kile and Kristensen, *SIPRI Yearbook 2019* (note 13); SIPRI, Press release 14 June 2021 (note 13); and Kile and Kristensen , *SIPRI Yearbook 2020* (note 13).

[107] Chinese Ministry of National Defense (MND), *China's National Defense in the New Era* (MND: Beijing, 24 July 2019).

[108] Chinese MND (note 107).

[109] See e.g. Lewis, J. W. and Litai, X., *China Builds the Bomb* (Stanford University Press, 1988); Godwin, P. and Schulz, J., 'Arming the dragon for the 21st century: China's defence modernisation plans', *Arms Control Today*, Dec. 1993; and Johnston, A. I., 'China's new "old thinking": The concept of limited deterrence', *International Security*, vol. 20, no. 3 (Winter 1995/96), pp. 5–42.

[110] Kristensen, H. and Korda, M., 'Chinese nuclear forces', *SIPRI Yearbook 2021* (note 20), pp. 369–77.

[111] China Power, 'Does China have an effective sea-based nuclear deterrent?', 28 Dec. 2015, updated 26 Aug. 2020; and Osborn, J., 'China activates an "airborne" leg for a nuclear triad', *National Interest*, 6 Nov. 2021.

USA as China's 'first credible at-sea second-strike nuclear capability'.[112] That said, some experts have noted that even the more modern Chinese SSBNs are still noisy, which calls into question their survivability.[113] At the same time, China has sought to increase the strategic role of its aircraft by increasing their range and stealth, as illustrated by the development of the H-20 bomber.[114] Moreover, China has reinforced its ICBM force through the development of more mobile missiles, MIRVing and, as revealed in 2021, the construction of new ICBM silos.[115] China has also developed intermediate-range precision-strike missiles and hypersonic weapons.[116]

The implications of these recent developments for China's minimal nuclear deterrent posture are contested. While some argue that they call into question that traditional posture, others believe they are driven mainly by efforts to ensure the credibility of the country's nuclear deterrent.[117] Like Russia, China views US precision-strike weapons and missile defences as a threat to its second-strike capability.[118] Given China's traditional reliance on vulnerable ICBMs and its small arsenal size, such survivability concerns are probably felt more acutely in China than in Russia. As noted above, stealthy SSBNs and aircraft, hypersonic weapons and a redundant ICBM force involving MIRVs can all be seen as enhancing survivability.[119] Thus, it could be argued that, rather than deviating from its previous minimal nuclear deterrence posture, China is merely adjusting that posture to a new strategic environment where survivability concerns are heightened by new and emerging technologies.

Like Russia, China views US precision-strike weapons and missile defences as a threat to its second-strike capability

At the same time, some of the new Chinese capabilities—notably the precision-strike missiles and hypersonic weapons—appear to create flexible options that would allow Chinese nuclear capability to be used for escalation control rather than just deterrence by retaliation. While this does not necessarily suggest a change in China's NFU policy, it would allow a more measured response to a limited first use of nuclear weapons by China's adversaries.[120] Indeed, Chinese experts who stress the need for *limited* rather than minimal nuclear deterrence have long argued that such flexible options are needed to credibly deter limited nuclear weapon use.[121] How-

[112] United States Office of Naval Intelligence, 'The PLA [People's Liberation Army] navy: New capabilities and missions for the 21st century', 2015.

[113] Zhao, T., 'Tides of change: China's nuclear ballistic missile submarines and strategic stability', Carnegie Endowment for International Peace, 2018.

[114] US Department of Defense, *Annual Report to Congress: Military and Security Development Involving the People's Republic of China 2021*, Office of the Secretary of Defense, 3 Nov. 2021; and Kristensen and Korda (note 110), pp. 369–377.

[115] Kristensen, H., 'Pentagon report: China deploys MIRV missile', *Federation of American Scientists*, 11 May 2015; and Korda, M. and Kristensen, H., 'A closer look at China's missile silo construction', *Federation of American Scientists*, 2 Nov. 2021.

[116] Kristensen and Korda (note 110), pp. 369–377.

[117] See e.g. Arms Control Association, 'China's nuclear expansion: The challenges, implications, and risk reduction options', Webinar, 19 Nov. 2021.

[118] Zhao, T., *Narrowing the US–China Gap on Missile Defense: How to Help Forestall a Nuclear Arms Race*, Carnegie-Tsinghua Center for Global Policy (Carnegie Endowment for International Peace: Washington, DC, 2020).

[119] Arms Control Association (note 117); and Kristensen and Korda (note 110), pp. 369–377.

[120] Kristensen, H., in webinar 'China's nuclear modernization: Motivations and regional implications', Georgetown University, 2 Nov. 2021.

[121] Johnston (note 109).

ever, the Chinese strategic community is reportedly sceptical that a nuclear war could ever remain limited, which is why the country has not pursued tactical nuclear weapons, even though it possesses capabilities with ranges and missions that could allow tactical use.[122] Instead of limited nuclear strike options, China reportedly views a combination of conventional missiles, cyberwarfare and counterspace capabilities as a preferable and more credible means of escalation control.[123]

Like other countries with smaller nuclear arsenals, China regards Russia and the USA as bearing the main responsibility for making progress on nuclear disarmament. Arms control involving Chinese capabilities is not therefore currently seen as pertinent. Although China has signalled an openness to strategic stability talks with the USA, it frequently argues that it will be ready to join the arms control process only after Russia and the USA have substantially reduced their current stockpiles.[124] In the meantime, and insofar as the Chinese nuclear expansion is indeed motivated by survivability concerns, China is unlikely to seek numerical parity with Russian and US arsenals. As in the case of Russian and US nuclear modernization, however, China can be expected to be reluctant to negotiate away any new nuclear systems having only just made long-term investments in them. Nonetheless, some new and evolving systems—notably SSBNs and hypersonic missiles—could eventually reduce the perceived need for redundancy in China's ICBM force.[125] The drivers of Chinese nuclear expansion could also be partly addressed by a potential future Russian–US arms control agreement, which will probably need to tackle survivability concerns shared by China and Russia.

China argues that it will be ready to join the arms control process only after Russia and the USA have substantially reduced their current stockpiles

The prospects for overcoming the challenges facing minimal nuclear deterrence

US second-strike nuclear forces, particularly those in its sea-based deterrent, are highly survivable. At the same time, US missile defences, to the extent that they are effective, might be able to provide some protection for the USA and its allies against nuclear strikes. In addition to providing the kind of damage limitation capability that might reduce the costs of limited nuclear escalation, missile defences can also be seen as reducing the need for retaliatory nuclear strikes. It could therefore be argued that, from the perspective of strategic security, the USA could afford to move towards minimal nuclear deterrence unilaterally or in cooperation with Russia. It would seem logical for the USA to base its minimal nuclear deterrence posture either on a monad reliant only on SSBNs or on a dyad of SSBNs and nuclear bombers, removing the land-based leg that many US observers regard as expendable.

[122] See Cunningham, F. S. and Fravel, M. T., 'Dangerous confidence? Chinese views on nuclear escalation', *International Security*, vol. 44, no. 2 (2019), pp. 61–109; and Woolf, A., 'Nonstrategic nuclear weapons', CRS Report to Congress RL3257, updated 7 Mar. 2022.

[123] Cunningham and Fravel (note 122).

[124] Reuters, 'US–China engagement to intensify, US national security adviser', 16 Nov. 2021; and Fu, C., Director-General, Department of Arms Control, Chinese Ministry of Foreign Affairs, Interview with Kommersant, 16 Oct. 2020.

[125] See Zhao (note 113).

Russia, by contrast, would probably find it more problematic to achieve deep cuts in its nuclear arsenal, given its survivability concerns about US missile defence and conventional precision strike systems. It would be essential to address such concerns in order to convince Russia of the strategic wisdom of moving towards minimal nuclear deterrence. In the meantime, Russia's development of an increasingly credible sea-based deterrent and of hypersonic weapons could ultimately reduce its perceived need for a redundant ICBM force. Russia could arguably also afford to significantly reduce its stockpile of tactical nuclear weapons and perhaps even remove the air leg of the triad, although such changes are likely to be linked to solutions to Russia's strategic stability concerns.

Similar concerns related to US strategic non-nuclear systems seem to constitute a major driver of China's recent nuclear expansion. It might not be possible to reverse that expansion until Russia and the USA have significantly reduced their arsenals, achieving greater parity in global nuclear arsenals and thereby paving the way for trilateral or broader multilateral arms control. A bilateral Russian–US agreement on deep nuclear cuts would probably also need to address some of the most pressing strategic stability issues, possibly by including some limits on US missile defences. Even if such limits did not reduce the number of US strategic interceptor missiles in a way that directly addressed China's survivability concerns, a Russian–US arms control agreement that involved strategic defences could create an important precedent for further limits and confidence-building measures in this area.

As in the case of Russia, China's development of stealthier SSBNs and hypersonic weapons could also reduce its survivability concerns—and with them its perceived need for a redundant ICBM force. To the extent that siloed ICBMs are no longer viewed as essential for survivability in the three states, each would arguably benefit from eliminating such systems to reduce the risks of large-scale nuclear war. In principle, however, it would be possible for Russia and the USA to achieve minimal nuclear deterrence—and for China to reverse its nuclear build-up—by reducing the number and yield of nuclear weapons while maintaining the nuclear triad.

IV. Ways forward

Rethinking deterrence

A move to minimal nuclear deterrence in Russia and the USA would require a significant shift in mindsets away from the historical pursuit of nuclear superiority to a clearer focus on deterrence by retaliation. While the adoption of an NFU policy—or 'sole purpose' policy, as previously discussed in the USA—would provide the most solid doctrinal basis for such a shift, the perceived need for escalation control by both states, as well as among US allies, might not allow this.

The role of nuclear threats as a tool of escalation control should nonetheless be reduced. Insofar as states see the need to maintain various rungs along the proverbial escalation ladder, these should be kept below the nuclear threshold by basing escalatory options primarily on non-nuclear weapons. China has previously been mentioned as an example of a nuclear-armed state that relies mainly on non-nuclear capabilities for escalation control, and several

states are currently developing similar conventional, cyber and space-based capabilities.[126] This is not to encourage the use of such non-nuclear capabilities, but to recognize that nuclear weapons are not the only, or even arguably the most credible, part of existing multi-domain deterrence strategies.

While the high threshold for use means that nuclear weapons lack credibility as a deterrent, they nonetheless involve enormous risks as they could still be used as a result of accident, miscalculation or the impaired judgement of leaders. One way to reduce the role of nuclear weapons in deterrence strategies would be to raise awareness of such risks by further exploring the humanitarian and environmental consequences of nuclear weapon use, particularly in regional contexts where nuclear weapon use is deemed most likely. In addition to building momentum for the longer-term goal of complete nuclear disarmament, a realistic understanding of such consequences should also inform future efforts to minimize nuclear arsenals by helping to determine a limit on the number and aggregate yield of nuclear weapons in line with existing minimal deterrence proposals.[127]

In contrast to nuclear deterrence, conventional deterrence—even when based on seemingly superior military capabilities—is always contested, in that the capacity of a state to deliver on its threat is subject to doubt.[128] Despite their uncontested ability to cause unacceptable damage, however, nuclear weapons cannot determine conflict outcomes either. Indeed, there are several examples of nuclear-armed states losing conventional conflicts or being attacked by adversaries that had calculated that their attacks would not lead to a nuclear response.[129] Such calculations might prove wrong in future, leading to tragic consequences.

Neither conventional nor nuclear deterrence can ultimately guarantee international stability

While neither conventional nor nuclear deterrence can ultimately guarantee international stability, any act of aggression would arguably be less likely in the absence of significant conventional asymmetries. In particular, countries that perceive severe regional security threats should seek to invest in their conventional deterrents rather than rely on nuclear weapons, which could turn a regional conflict into nuclear war. Even if US allies continue to see the need for security guarantees involving extended nuclear deterrence, the risk of nuclear escalation could be reduced by a Russian–US agreement to limit non-strategic nuclear weapons, in which case extended nuclear deterrence would rely mainly on the US SSBN force and the strategic component of the air leg. A Russian–US agreement to reduce tactical nuclear weapons would also help to reduce overall nuclear weapon numbers, given

[126] Mallory, K., 'New challenges in cross-domain deterrence', RAND Corporation, 2018.

[127] Perkovich (note 15).

[128] Wirtz, J. J., 'How does nuclear deterrence differ from conventional deterrence?', *Strategic Studies Quarterly*, vol. 12, no. 4 (Winter 2018); and Brustlein, C., 'Conventonalizing deterrence: US prompt strike programs and their limits', *IFRI Proliferation Paper* no. 52 (Jan. 2015).

[129] See, e.g. Wilson, W., 'Reconsidering nuclear deterrence', European Leadership Network, 1 Mar. 2022; Hoodbhoy, P. and Mian, Z., 'The India–Pakistan conflict: Towards the failure of nuclear deterrence', Special Policy Forum 9/11, 13 Nov. 2002; Narang, V. *Nuclear Strategy in the Modern Era: Regional Powers and International* Conflict (Princeton and Oxford: Princeton University Press, 2014); Schneider, B. R., 'Deterrence and Saddam Hussein: Lessons from the 1990–1991 Gulf War', United States Airforce (USAF) Counterproliferation Center, *Counterproliferation* Paper no. 47 (2009); Geller, D. S., 'Nuclear weapons, deterrence, and crisis escalation', *Journal of Conflict Resolution*, vol. 34, no. 2 (June 1990), pp. 291–310; and Danilovic, V., *When the Stakes are High: Deterrence and Conflict among Major Powers* (University of Michigan Press: Michigan, 2002).

that such weapons constitute a considerable proportion of the Russian arsenal.

Addressing survivability concerns

As is argued above, defensive damage limitation systems, notably missile defence, in combination with increasingly effective counterforce capabilities create a formidable challenge for minimal nuclear deterrence by suggesting that nuclear war could indeed be waged and won without risking unacceptable damage. Although current US missile defences are probably not effective enough to allow this, the mere possibility that they might be has already pushed China to modernize and expand its nuclear forces and is likely to make Russia reluctant to significantly reduce its arsenal.[130]

Those nuclear-armed states which are concerned about the survivability of their second-strike nuclear forces should seek to reduce vulnerability, notably by reducing reliance on ICBMs. From this perspective, nuclear modernization is a double-edged sword. On the one hand, it creates further obstacles to disarmament by perpetuating existing or planned nuclear postures, and possibly triggering new arms race dynamics insofar as others see the need to respond to their adversaries' new capabilities by developing their own. Some of the new systems, notably hypersonic weapons, could also contribute to crisis instability, meaning that they might make nuclear war more likely.[131] On the other hand, as suggested above, nuclear modernization could in some cases increase survivability, and could therefore create room to minimize nuclear postures by reducing the need for redundancy.

In theory, the most effective way to address Chinese and Russian survivability concerns would be for the USA to limit its strategic missile defences, although in practice this would be difficult given bipartisan domestic support for and opposition to any limits on these systems.[132] However, insofar as US decision makers see that China and Russia are unlikely to accept a situation in which the ratio between strategic offensive and defensive missiles favours the latter, they might see value in considering such limits—particularly if political winds shift in favour of arms control and disarmament. In principle, the limits could be set unilaterally by the USA based on a comprehensive assessment of the benefits and risks of pursuing a damage limitation strategy, and implemented as part of international arms control agreements, initially with Russia. Such agreements would probably need to include a slight numerical advantage in strategic offensive weapons for parties that do not possess significant strategic defence capabilities.

China and Russia are unlikely to accept a situation in which the ratio between strategic offensive and defensive missiles favours the latter

While limits on shorter-range conventional weapons might be harder to achieve, long-range precision-strike weapons, such as hypersonic weapons, should also be limited even when they are not nuclear-capable. Russian and US long-range precision-strike weapons could be subjected to the same

[130] Erästö and Korda (note 97).

[131] Acton, J. M., *Silver Bullet? Asking the Right Questions About Conventional Prompt Global Strike* (Carnegie Endowment for International Peace: Washington, DC, 2013).

[132] See e.g. Pifer, S., 'Missile defense theology beats common sense', Brookings Institution, 24 July 2013; and Gottemoeller (note 11), pp. 124–25.

limits as nuclear weapons as part of strategic arms control agreements.[133] At a point when China can be drawn into the arms control process, its hypersonic weapons should also be subject to similar limits.

Developing a methodology for verification focused on warheads

Given that minimal nuclear deterrence does not require parity, arms control, including warhead verification, is not in principle necessary to achieve it. Indeed, significant nuclear reductions were previously achieved through unilateral, albeit reciprocal, pledges in connection with the Presidential Nuclear Initiatives of the early 1990s, and SORT did not have a verification regime either.[134] In practice, however, it is hard to imagine bilateral Russian–US arms control moving forward without verification. As noted above, any further progress on multilateral disarmament would also depend on verifying that Russia and the USA have cut their nuclear arsenals, whereas global nuclear disarmament would require unprecedented verification measures, including a rigorous monitoring system to ensure timely detection of any attempts at new proliferation or the reconstitution of dismantled arsenals.[135] To prepare for this, it will be essential to develop technical solutions that go beyond the verification of delivery vehicles to verification of warheads, including their yields, the number of non-deployed warheads, and the process of their dismantlement. International initiatives that have sought to address warhead verification challenges should therefore receive continuing support.[136]

V. Conclusions

The concept of minimal nuclear deterrence is useful for demonstrating that a persistent belief in the security benefits of nuclear weapons is not necessarily an obstacle to significant progress on nuclear disarmament. This is particularly true in Russia and the USA, where arsenals could be significantly reduced by limiting the role of nuclear weapons primarily to deterrence by retaliation even if they choose to retain the first-use option for limited contingencies.

Clearly, minimizing Russian and US nuclear arsenals would not do away with the nuclear danger. Deterrence might still fail between them or between other nuclear-armed states, leading to either limited or large-scale nuclear weapon use. However, if nuclear arsenals in general were smaller—particularly in terms of yields rather than just numbers—then it might be possible to contain what would inevitably be the catastrophic consequences of nuclear

[133] See e.g. Woolf, A., *Conventional Prompt Global Strike and Long-Range Ballistic Missiles: Background and Issues*, CRS report to Congress R41464, 16 July 2021.

[134] Sokov, N. and Potter, W., 'Presidential nuclear initiatives, 1991–1992: An assessment of past performance and future relevance', *Toda Peace Institute*, Policy Brief no. 21 (Oct. 2018); and Arms Control Association, 'The Strategic Offensive Reductions Treaty (SORT) at a glance', Sep. 2017.

[135] Erästö, T., Komžaite, U. and Topychkanov, P., 'Operationalizing nuclear disarmament verification', SIPRI Insights on Peace and Security, no. 2019/3, Apr. 2019.

[136] These include the International Nuclear Disarmament Verification Initiative, initiated in 2014; UK–US cooperation, which has explored arms control verification since 2000; the Quad Nuclear Verification Partnership, which was based on a British–Norwegian initiative established in 2007, and the Group of Governmental Experts on Nuclear Disarmament Verification, established by the United Nations Secretary-General based on General Assembly resolution 74/50 of 12 Dec. 2019.

war and to prevent planetary-scale destruction. This would serve collective damage limitation based on the pursuit of a global common good, as distinct from national damage limitation strategies which can be destabilizing. While it is true that low-yield nuclear weapons may lower the threshold for use, the reality is that such weapons have already been deployed, which can be seen to further reinforce the argument for reducing overall yields. At the same time, the process of setting limits on nuclear weapon numbers and yields would help raise awareness of the magnitude of nuclear risks. These risks defy comprehension and are therefore, paradoxically, largely absent from current security debates, contributing to the tendency to overestimate the benefits of nuclear deterrence while downplaying its inherent fragility.

Thus, minimal nuclear deterrence in Russia and the USA should not be viewed as an end goal but rather as a means to an end: multilateral nuclear disarmament. It is nonetheless likely to be a necessary intermediate goal towards that ultimate objective, as it is difficult to imagine progress in multilateral arms control and disarmament without rough numerical parity between Russia, the USA and other nuclear-armed states. The logical next step following deep bilateral cuts would appear to be extending the nuclear arms control process to China, which can still be seen to subscribe to the principle of nuclear minimalism despite the recent expansion of its arsenal.

Abbreviations

C3	Command, control and communication
ICBM	Land-based intercontinental ballistic missiles
MIRV	Multiple independently targetable re-entry vehicle
NATO	North Atlantic Treaty Organization
NFU	No-first-use
NPT	1968 Treaty on the Non-Proliferation of Nuclear Weapons
SLBM	Sea-based submarine-launched ballistic missiles
SORT	2002 Strategic Offensive Reductions Treaty
SSBN	Ballistic missile submarines
START I	1991 Strategic Arms Reduction Treaty
TPNW	2017 Treaty on the Prohibition of Nuclear Weapons

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REVISITING 'MINIMAL NUCLEAR DETERRENCE': LAYING THE GROUND FOR MULTILATERAL NUCLEAR DISARMAMENT

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CONTENTS

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