

The Concept of Virtual Nuclear Arsenals and “a World without Nuclear Weapons”*

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Abstract

Proposed by J. Schell and others in the Cold War era, the concept of virtual nuclear arsenals has been a subject of debate. From the standpoint of the theory of nuclear disarmament, the concept has been questioned on the basis of justifying the nuclear threat, infringing on the irreversibility requirement of disarmament, and fixating the discriminatory structure of nuclear weapons. On the other hand, from the viewpoint of the theory of nuclear deterrence, the problem of instability and feasibility inherent in the concept and the idea of reconstructing nuclear arsenals that will decrease second strike capability have been under harsh criticisms. Attempting to find new inter-linkages between the debates of nuclear disarmament and deterrence theories over the vision of “a world without nuclear weapons” proposed by the US Obama administration, this study sets out to examine the implications that the concept of virtual nuclear arsenals may have on the current international security environment from the two aspects of: nuclear deterrence and disarmament; and nuclear non-proliferation.

From the end of the Cold War to the early post-Cold War era, a debate surrounding the concept of virtual nuclear arsenals/forces took place among experts, including scholars of international politics and nuclear scientists. One of the starting points of this concept is thought to be the new idea of “weaponless deterrence” proposed by Jonathan Schell in 1984. Schell argued for a nuclear arms control policy in which all nuclear weapons were verifiably dismantled and put under state control, although in crises, nuclear weapon states were allowed to reconstruct their nuclear arsenals with a lead-time of several weeks to several months.¹ Later, other scholars, including Avner Cohen and Joseph Pilat,² Michael Mazarr,³ John Baylis and Robert O’Neill,⁴ discussed the impact of virtual nuclear arsenals on nuclear non-proliferation and strategic stability. Against the backdrop of the reductions of nuclear arsenals of the United States (US) and Russia in the post-Cold War era and the indefinite extension of the Treaty on the Non-Proliferation of Nuclear

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¹ Jonathan Schell, *The Abolition* (1984) reprinted in *The Fate of the Earth and the Abolition*, Stanford: Stanford University Press, 2000, p. 118.

² Avner Cohen and Joseph F. Pilat, “Assessing Virtual Nuclear Arsenals,” *Survival*, Vol. 40, No. 1, Spring 1998.

³ Michael J. Mazarr, ed., *Nuclear Weapons in a Transformed World: The Challenge of Virtual Nuclear Arsenals*, New York: St. Martin’s Press, 1997.

⁴ John Baylis and Robert O’Neill, eds., *Alternative Nuclear Futures: The Role of Nuclear Weapons in the Post-Cold War World*, New York: Oxford University Press, 2000.

Weapons (NPT), the potentials and problems inherent in the concept of virtual nuclear arsenals were examined from a variety of angles. Nevertheless, the debate surrounding virtual nuclear arsenals disappeared into the shadows as the interest of major nuclear weapon states continued to shift from nuclear disarmament to nuclear non-proliferation following the nuclear tests by India and Pakistan in 1998, North Korea's withdrawal from NPT in 2003, a decline in US political commitment to multilateral nuclear disarmament efforts under the George W. Bush administration, and furthermore, the impasse at the NPT Review Conference in 2005 when the future of the NPT regime itself came under threat. Virtual nuclear arsenals hardly made it into substantial debates during this time, neither in the context of promoting nuclear disarmament nor maintaining nuclear deterrence for the future.⁵

However, in today's world that is approaching a "nuclear tipping point,"⁶ as demonstrated by the exposure of a series of NPT violations and the detection of the nuclear black market, there is an idea which has begun to draw growing international attention. The idea is that in light of increasing global nuclear proliferation concerns, the safety and reliability of nuclear weapons are assured in order to maintain US nuclear deterrent into the future, while explaining the need to reduce dependence on nuclear weapons and take steps toward nuclear disarmament going forward under the US's initiative. This is evidenced from President Barack Obama's Prague speech in 2009⁷ and the Hoover Project⁸ as well as the *Wall Street Journal* pieces contributed by former White House heavyweights, including George Shultz, William Perry, Henry Kissinger, and Sam Nunn.⁹

These series of proposals made by US diplomatic and defense establishments to create "a world without nuclear weapons" have prompted a search for future inter-linkages between nuclear disarmament and deterrence theories. Nonetheless, they have once again exposed the US's growing dilemma that nuclear disarmament and "a world without nuclear weapons" must be conceived from a long-term timeframe and that until nuclear disarmament and "a world without nuclear weapons" are achieved, the US must continue to maintain a nuclear deterrent that overwhelms other states. Furthermore, as argued by James Schlesinger¹⁰ and Brent Scowcroft et al.,¹¹ there

⁵ For the few examples from recent years, see George Perkovich and James M. Acton, eds., *Abolishing Nuclear Weapons: A Debate*, Washington D.C.: Carnegie Endowment for International Peace, 2009.

⁶ Mitchell B. Reiss, "The Nuclear Tipping Point: Prospects for a World of Many Nuclear Weapons States," in Kurt M. Campbell, Robert J. Einhorn and Mitchell B. Reiss, eds., *The Nuclear Tipping Point: Why States Reconsider Their Nuclear Choices*, Washington D.C.: Brookings Institution Press, 2004, p. 4.

⁷ "Remarks by President Barack Obama, Hradcany Square, Prague, Czech Republic," The White House, Office of the Press Secretary, April 5, 2009. http://www.whitehouse.gov/the_press_office/Remarks-By-President-Barack-Obama-In-Prague-As-Delivered/

⁸ George P. Shultz, Steven P. Andreasen, Sidney D. Drell and James E. Goodby, eds., *Reykjyavik Revisited: Steps Toward a World Free of Nuclear Weapons*, Stanford: Hoover Institution Press, 2008.

⁹ George P. Shultz, William J. Perry, Henry A. Kissinger and Sam Nunn, "A World Free of Nuclear Weapons," *Wall Street Journal*, January 4, 2007; George P. Shultz, William J. Perry, Henry A. Kissinger and Sam Nunn, "Toward a Nuclear-Free World," *Wall Street Journal*, January 15, 2008; and George P. Shultz, William J. Perry, Henry A. Kissinger and Sam Nunn, "How to Protect Our Nuclear Deterrent," *Wall Street Journal*, January 19, 2010.

¹⁰ Melanie Kirkpatrick, "Why We Don't Want a Nuclear Free World: The Former Defense Secretary on the U.S. Deterrent and the Terrorist Threat," *Wall Street Journal*, July 13, 2009. <http://online.wsj.com/article/SB124726489588925407.html> (accessed February 18, 2011)

¹¹ Jackson Diehl, William J. Perry, and Brent Scowcroft, "U.S. Nuclear Weapons Policy: Report of a CFR-Sponsored Independent Task Force," *Council on Foreign Relations*, May 28, 2009. <http://www.cfr.org/us-strategy-and-politics/us-nuclear-weapons-policy-report-cfr-sponsored-independent-task-force/p19526>

are warnings about “a world without nuclear weapons”—for example, that the promotion of nuclear disarmament may on the contrary lead to global destabilization. In particular, it has come to light that not only the US but also the international community as a whole must find answers to challenges, namely—reducing the risk of human error- or technical failure-related use of nuclear weapons that are under the launch-on-warning setup, including contingency and false recognition; executing the nuclear disarmament negotiation obligations of nuclear weapon states as bargaining means for non-nuclear weapon states to execute their nuclear non-proliferation obligations; preventing the proliferation of loose nukes; and blocking the theft or illegal transfer of nuclear weapons and nuclear-related materials by or to non-state actors, including international terrorists.

Amid such debates among nuclear weapon states regarding “a world without nuclear weapons,” this paper gives spotlight once again to the significance and challenges of virtual nuclear arsenals and attempts to fundamentally examine the potential impact of the concept of virtual nuclear arsenals on the process toward “a world without nuclear weapons.” To do so, I will first lay out the discussions surrounding the concept of virtual nuclear arsenals. Next, I will review the ideas presented by the concept of virtual nuclear arsenals in response to the traditional logic of nuclear deterrent, while referring also to the criticisms from the supporters of nuclear deterrence theory. Lastly, I will examine where the concept of virtual nuclear arsenals lies in the debate surrounding “a world without nuclear weapons” in light of its relationship to global nuclear disarmament and non-proliferation.

Revisiting the Concept of Virtual Nuclear Arsenals

From reductions of nuclear arsenals to “a world without nuclear weapons”: Finding inter-linkages

To explore the concept of virtual nuclear arsenals, I would like to first examine the challenges of “a world without nuclear weapons” faced by today’s international community. The concept—“a world without nuclear weapons” proposed by President Obama—itself was by no means a new one. However, boosted by the support given by many practitioners, along with politicians and scholars from across the globe including the aforementioned former White House heavyweights, the concept, as an actual security issue, became a subject of vigorous debates from a variety of perspectives not only within the US but also among allies.¹² As a result, the vision of “a world without nuclear weapons” met high expectations and despair in the end from nuclear disarmament proponents as well as confusion, backlash, or cynical criticisms from the supporters of nuclear deterrence theory. This was made clear also in the sort of paradoxical visions presented in the executive summary of the Nuclear Posture Review (NPR) Report of the US released in April 2010, which are: (1) Reducing the role and numbers of US nuclear arsenals; (2) Reassuring allies and partners on the US extended deterrence commitment; (3) Enhancing strategic stability;

¹² In recent years, the National Institute for Defense Studies has also organized international conferences on similar themes. The conferences discussed the impact of the vision of “a world without nuclear weapons” on the nuclear policies of various countries from a range of perspectives. The National Institute for Defense Studies, International Symposium on Security Affairs 2009 Report, “Major Powers’ Nuclear Policies and International Order in the 21st Century,” 2010.

and (4) Moving demonstrably toward the ultimate goal of the elimination of nuclear weapons.¹³ Thus, while it was groundbreaking that the proposal of “a world without nuclear weapons” sparked international interest in nuclear disarmament and deterrence, a definite solution to the question—how to achieve “a world without nuclear weapons”—which everyone can agree upon has not yet been obtained.

Perry and Scowcroft et al. note that aiming for “a world without nuclear weapons” requires the following initiatives: (1) Revitalizing US strategic dialogue with nuclear-armed powers, particularly Russia and China; (2) Strengthening the international nuclear non-proliferation regime; (3) Reassuring the US extended nuclear deterrence; (4) Maintaining the credibility of the US nuclear deterrent; and (5) Ensuring the security of nuclear weapons and weapons-usable materials worldwide.¹⁴ With respect to (1), strategic dialogue channels are indeed opening up, including the conclusion of the New Strategic Arms Reduction Treaty (START) between the US and Russia following repeated bilateral consultations in 2010¹⁵ and the commencement of high-level nuclear strategy consultations between the US and China,¹⁶ to name a few. With regard to (2) and (5), concrete outcomes are beginning to be manifested, as epitomized by the funding boost to the International Atomic Energy Agency (IAEA) that is responsible for nuclear safeguards¹⁷ and the success of the Nuclear Security Summit in 2010.¹⁸ However, regarding taking the core concept of nuclear deterrence summed up in (3) and (4) to the next step in particular, it is not necessarily easy to make observable progress. New prescriptions of some kind will inevitably be demanded in order to find realistic inter-linkages to move from global reductions of nuclear arsenals, to the ultimate elimination of nuclear weapons, while maintaining the necessary deterrent.

Three types of the concept of virtual nuclear arsenals

In this section, based on my understanding of the issues, I would like to organize the conventional, leading discussions on the concept of virtual nuclear arsenals into three broad types. In the first type, non-nuclear weapon states, which have decided not to develop nuclear weapons while having the minimum technological platform and sufficient amount of fissile material stockpiles considered necessary for developing and possessing nuclear weapons, is deemed to constitute

¹³ Sukeyuki Ichimasa, “Beikakusenryakushishin NPR2010 wo Yomu (Reading the US Nuclear Strategy Guidelines NPR 2010),” in *Shukan e-world (Weekly e-world)*, April 21, 2010 issue.

¹⁴ William J. Perry, Brent Scowcroft and Charles D. Ferguson, “Op-Ed: How to Reduce the Nuclear Threat,” *Wall Street Journal*, May 27, 2009.

¹⁵ “Exchange of Instruments of Ratification for the New START Treaty,” U.S. Department of State, February 5, 2011. <http://www.state.gov/secretary/rm/2011/02/156041.htm>

¹⁶ Moring Joe, “Gates Discusses Nuclear Policy with China,” Ploughshares Fund. <http://www.ploughshares.org/news-analysis/morning-joe/gates-discusses-nuclear-policy-china>

¹⁷ Peter Crail, “IAEA Budget Gets Modest Boost,” *Arms Control Today*, September 2009. http://www.armscontrol.org/act/2009_09/IAEAbudget

¹⁸ Hillary Rodham Clinton, “DipNote: Nuclear Security Summit Advances Our Goal of a World Free From Nuclear Danger,” U.S. Department of State Official Blog, April 15, 2010. http://blogs.state.gov/index.php/site/entry/world_free_from_nuclear_danger; and “Assessing Obama’s Nuclear Security Summit: Takeaways from Experts at Harvard Kennedy School’s Belfer Center,” Belfer Center for Science and International Affairs, April 14, 2010. http://belfercenter.ksg.harvard.edu/publication/20072/assessing_obamas_nuclear_security_summit.html

virtual proliferation.¹⁹ One of the examples of this type is from 2008, when then IAEA Director General Mohamed ElBaradai referred to developed nuclear states, such as Japan and Sweden, as “virtual nuclear powers.”²⁰ The second type is another form of the aforementioned virtual nuclear powers. Here, the concept of virtual nuclear arsenals refers to non-nuclear weapon states assessing their own nuclear weapon development capabilities and admitting that they are virtual nuclear powers capable of arming themselves at any time. The third type is the concept of virtual nuclear arsenals represented by Schell’s proposal, which describes the mechanisms of nuclear arms control and new nuclear deterrence. This last type proposes to take the operationally deployed nuclear forces on hair-trigger alert off the readiness posture, conduct detargeting, separate and manage individually the nuclear warheads and the means of delivery, and to allow the reconstruction of dismantled nuclear arsenals in the event of a contingency. As such, the third type diverges considerably from the first two in both the nature and objective of the discussions. For reasons of expediency, this paper defines each of the three types of the concept described above as follows: (1) Virtual nuclear arsenals (states) which have decided to maintain their statuses as non-nuclear weapon states, while admitting they possess potential nuclear weapon development capabilities; (2) Virtual nuclear arsenals focusing on the potential nuclear weapon development capabilities of countries of proliferation concerns; and (3) Virtual nuclear arsenals as a new means of nuclear arms control and nuclear deterrence which all nuclear-armed states should adopt.

Type 1, which concerns especially non-nuclear weapon states’ acquisition of nuclear deterrent, have been discussed among states that possess the minimum technological platform deemed necessary for the development of nuclear weapons. For example, the Foreign Policy Research Institute of Sweden’s publicly available research output from the Cold War era offers an indifferent assessment of Sweden’s nuclear weapon development capabilities from a technological perspective and presents the advantages and disadvantages of nuclear armament from the viewpoint of diplomatic security.²¹ Some point out that discussions took place among states, such as the Republic of Korea, Taiwan, Germany, and Canada, regarding their own potential nuclear weapon development capabilities, while certainly the discussions ranging from political debates to actual technological considerations were broad in scope.²² Even within Japan, it is understood that politicians have carried out discussions,²³ and universities, academic institutions, and other

¹⁹ Cohen and Pilat, “Assessing Virtual Nuclear Arsenals,” p. 129.

²⁰ “Virtual Nuclear Powers a Looming Threat, ElBaradei Warns,” Global Security Newswire, May 15, 2009. http://www.globalsecuritynewswire.org/gsn/nw_20090515_3217.php. For a similar phrase see also Michael Brown, “Nuclear Doctrine and Virtual Nuclear Arsenals,” in Mazarr, ed., *Nuclear Weapons in a Transformed World: The Challenge of Virtual Nuclear Arsenals*, p. 39.

²¹ Foreign Policy Research Institute of Sweden, ed., *Sueden no Kakuheiki Mondai (The Issue of Sweden’s Nuclear Weapons)*, trans. Kajima Institute of International Peace, Kajima Institute of International Peace, 1977, pp. 1-368.

²² Hiroki Sugita, *Kensho Hikaku no Sentaku: Kaku no Genba wo Ou (Reviewing Japan’s Decision to Pursue Non-Nuclear Weapon State)*, Iwanami Shoten, 2005, pp. 138-155.

²³ Maria Rost Rublee, *Nonproliferation Norms: Why States Choose Nuclear Restraint*, Athens: University of Georgia Press, 2009, p. 75.

organizations have conducted research²⁴ on ideas similar to the concept of virtual nuclear arsenals. Looking at the Japanese examples alone reveal that a number of scenarios were conceived, for example: the idea that while states would maintain their statuses as non-nuclear weapon states under the NPT regime, they should retain the freedom to develop nuclear weapons in case such a security need arises and expect virtual nuclear arsenals to play a role during contingencies;²⁵ and the idea that while having the capability to possess nuclear weapons, states should promote nuclear disarmament negotiations from a firm position based on moral grounds that they will not arm themselves with nuclear weapons.²⁶

From the standpoint of criminal proliferators, Type 2 would embrace the transitory situation toward nuclear weapon development. In regard to its relationship with the concept of virtual nuclear arsenals, some point out that because of the loophole inherent in NPT, theoretical studies on nuclear weapon development are essentially not banned under the treaty. Based on this comprehension, it is noted that it would be difficult to impose regulations or bans on potential proliferators.²⁷ These risks of military diversion, nonetheless, may be contained to an extent by strengthening export control and international norms on non-proliferation.

On the other hand, it can be said that the virtual nuclear arsenals argued primarily among the proponents of nuclear disarmament and supporters of nuclear deterrence theory from the end of the Cold War to the early post-Cold War eras was exclusively the concept represented by Type 3. This concept presents a new structure of nuclear posture—allowing nuclear weapon states to have the capabilities to assemble (reconstruct) nuclear weapons in a few weeks' time, stockpiles of fissile material to do so, skilled nuclear weapon technicians, and assembly facilities in a state of readiness. In the event that nuclear weapons become necessary, states would be able to assemble nuclear weapons with a lead-time of several weeks to several months and then deter or cope with crises.²⁸ In other words, it can be said that while this concept can reduce the risk of actual use of nuclear weapons on the one hand, on the other hand it was expected to maintain strategic stability between nuclear weapon states and de-facto nuclear weapon states—one of the impediments to promoting nuclear arms control and nuclear disarmament—and increase predictability by cementing the status quo power distribution. According to Mazarr who reviewed the concept of virtual nuclear arsenals, while also paying attention to the theory of nuclear deterrence and the discussions on nuclear arms control and nuclear disarmament, the concept has the advantages of: (i) Reducing the political and military role of nuclear weapons and their status in international

²⁴ Christopher W. Hughes, *Japan's Remilitarization*, New York: Routledge, 2009, p. 105; Sugita, *Kensho Hikaku no Sentaku*, pp. 68-76; Makoto Momoi, "Nihon no Senryaku (Japan's Strategy)," in Masataka Kosaka and Makoto Momoi, eds., *Takyokukajidai no Senryaku: Samazamana Mosaku (Strategy in the Multipolar Era: A Variety of Searches—Vol. II)*, The Japan Institute of International Affairs, 1983, pp. 470-475; and Shinichi Ogawa, "Sainshiteiru Nihon no Kakubusoron wo meguru Giron nitsuite (The Resurfacing Debate on Japanese Nuclear Armament Theory)," *Briefing Memo*, 2003, pp. 1-6, <http://www.nids.go.jp/publication/briefing/pdf/2003/200304.pdf>

²⁵ Junnosuke Kishida, *Kaku (Nuclear)*, Gakuyo Shobo, 1975, pp. 156-168; and Atsuhiko Yatabe, *Kakuheiki Fukakusan Joyakuron (NPT Theory)*, Yushindo, 1971, pp. 134-140.

²⁶ Yonosuke Nagai, *Heiwa no Daisho (Trade-off of Peace)*, Chuokoron-Shinsha, 1967, pp. 131-132; and Mataka Kamiya, "Nuclear Japan: Oxymoron or Coming Soon?" *Washington Quarterly*, Vol. 26, No. 1, Winter 2002-03, pp. 63-75.

²⁷ Cohen and Pilat, "Assessing Virtual Nuclear Arsenals," p. 131.

²⁸ Perkovich and Acton, *Abolishing Nuclear Weapons: A Debate*, pp. 122-124.

politics; (ii) Removing the risk of nuclear weapon launches caused by false recognition or accident or by ignoring the order of the commander; and (iii) Contributing to stopping nuclear proliferation and improving the regional security environment. When all nuclear weapons are dismantled, and it becomes a routine posture to store their means of delivery, warhead parts, and other materials separately, all virtual nuclear powers would monitor one another for the reconstruction of nuclear arsenals and deter each other from violating. Mazarr contends that under such a structure, states would comply with the nuclear dismantlement agreement.²⁹ In light of the above, the paper’s discussion will now focus on the concept of virtual nuclear arsenals illustrated in Type 3 and its implications as a so-called international non-proliferation regime.³⁰

The Concept of Virtual Nuclear Arsenals and its Implications for Nuclear Deterrence

Deterrence and the transition to a virtual nuclear arsenal regime

As a roadmap for a transition to virtual nuclear arsenals, Mazarr notes in broad terms that a three-phase process is necessary. In the first phase of a transition to virtual nuclear arsenals, all states which declared possession of nuclear weapons would keep means of delivery, including submarine launched missiles and mobile missiles, and a reserve of operational nuclear arsenals. In the second phase, the operational readiness of the nuclear arsenals would gradually be relaxed and dissolved, for example, by removing guidance systems. In the third phase when the full transition to virtual nuclear arsenals is completed, no nuclear weapon ultimately would exist in assembled form.³¹ From the standpoint of securing the stability of the virtual nuclear arsenal regime, Mazarr contends that all long range strategic missiles, which could significantly damage states’ ability to reconstruct nuclear arsenals due to the threat of surprise first attack, should be prohibited.³²

Then, in the actual process of dismantling nuclear weapons in accordance with this roadmap, what changes would nuclear deterrent undergo? Mazarr explains that the deterrence of a virtual nuclear arsenal regime works through two mechanisms. In the first mechanism, virtual nuclear weapon states would always monitor each other to ensure that other states do not develop nuclear weapons secretly; should it be confirmed that nuclear weapons were developed or nuclear arsenals were reconstructed, other virtual nuclear powers would also swiftly reconstruct nuclear arsenals, and thereby, states would deter one another from nuclear attack. In the other mechanism, virtual nuclear weapon states would deter other states from non-compliance through psychological threat, i.e., the undeniable possibility that if there is non-compliance with the virtual nuclear arsenal agreement, former nuclear weapon states would withdraw from the virtual nuclear arsenal regime

²⁹ Michael J. Mazarr, “Virtual Nuclear Arsenals,” *Survival*, Vol. 37, No. 3, Autumn 1995, p. 22.

³⁰ Regarding international regimes, see the definition provided by Stephen D. Krasner: “Sets of implicit or explicit principles, norms, rules, and decision-making procedures around which actors’ expectations converge in a given area of international relations.” Stephen Krasner, “Structural Causes and Regime Consequences: Regimes as Intervening Variables,” in Stephen Krasner, ed., *International Regimes*, Ithaca: Cornell University Press, 1982, p. 2.

³¹ Michael J. Mazarr, “The Notion of Virtual Arsenals,” in Mazarr, ed., *Nuclear Weapons in a Transformed World: The Challenge of Virtual Nuclear Arsenals*, pp. 14-15.

³² Michael J. Mazarr, “Virtual Nuclear Arsenals: A Second Look,” in Mazarr, ed., *Nuclear Weapons in a Transformed World: The Challenge of Virtual Nuclear Arsenals*, p. 386.

and reconstruct all of their nuclear arsenals.³³ In order to secure the viability of deterrence, the critical elements become the lead-time required for reconstructing nuclear arsenals and the scale of the reconstructed nuclear arsenals. For the reason that establishing a certain time lag for the reconstruction of nuclear arsenals leads to strategic stability, Schell notes that a delayed response of at least eight weeks to load 200 nuclear warheads onto cruise missiles or six weeks to load 100 nuclear warheads onto military aircrafts is necessary.³⁴

From the standpoint of conventional international regime, it can be argued that the extent of the inclusiveness of the regime is an especially vital question for nuclear weapon states participating in the regime of virtual nuclear arsenals. For example, from a liberal institutionalism perspective, in an international regime which assumes anarchy, states that do not wish to participate in the regime are free not to be included based on an agreement among the actors and moderate obligations.³⁵ Taking into account the issue that the existence of countries such as India, Pakistan, and Israel is posing to the international community in the context of the NPT regime, the questions of whether or not room should be left for states to exist inside or outside of the virtual nuclear arsenal regime and whether states should be allowed to have reservations about participating in the regime merit careful consideration.

If the concept of virtual nuclear arsenals is seen as none other than a new form of nuclear deterrent that strips away readiness,³⁶ the reconstruction of nuclear arsenals ahead of other states or a unilateral increase of the number of nuclear arsenals capable of reconstruction would gravely threaten the survival of the virtual nuclear arsenal regime. Therefore, verifying virtual nuclear powers' compliance with the agreement becomes an extremely essential political issue of contention, including the strengthening of verification and monitoring to ensure that nuclear energy for peaceful uses is not diverted to military uses. According to David Key, three verification environments are conceivable under a virtual nuclear arsenal regime—cooperative, adversarial, and coercive. On this basis, he argues: (1) it is necessary to first establish a verification baseline to which states can agree, and to make member states of the regime recall in advance the impact that the verification mechanism would have on security and the end result if the agreement is breached; and that (2) a verification baseline must be introduced to the concept of virtual nuclear arsenals, and the verification items and their criteria must be reviewed, including the dismantlement of nuclear weapons, the alert status, detargeting, operational testing, the management of fissile material that can be diverted for weapons purposes, and the specific lead-time required for the reconstruction of nuclear arsenals.³⁷ Based on a reliable verification baseline, verification and inspection would be executed over the long-term by consistently using the latest verification technology, while maintaining cooperative ties with the member states of the regime. However, most of today's

³³ Mazarr, "The Notion of Virtual Arsenals," in Mazarr, ed., *Nuclear Weapons in a Transformed World: The Challenge of Virtual Nuclear Arsenals*, p. 15.

³⁴ Schell, *The Abolition* (1984) reprinted in *The Fate of the Earth and the Abolition*, pp. 118-119.

³⁵ Sukeyuki Ichimasa, "WMD Fukakusan to Kokurenanporinioru Kihan no Keisei: Gabanansuron no Shizakara (Norm Building by the UN Security Council: UNSCR 1540 and Governance of WMD Non-Proliferation)," *Kokusaiseiji (International Politics)*, Vol. 155, 2009, p. 67.

³⁶ Mazarr, "Virtual Nuclear Arsenals: A Second Look," in Mazarr, ed., *Nuclear Weapons in a Transformed World: The Challenge of Virtual Nuclear Arsenals*, p. 371.

³⁷ David Key, "The Challenge of Inspection and Verifying Virtual Nuclear Arsenals," in Mazarr, ed., *Nuclear Weapons in a Transformed World: The Challenge of Virtual Nuclear Arsenals*, pp. 106-112.

international disarmament and non-proliferation verification organizations raise concerns about whether these demands can be sufficiently met.³⁸ Some experts point out the difficulties of such verifications, noting that it is infeasible both technologically and politically to comprehensively verify dismantled nuclear weapons and stocks of fissile material for weapons purposes.³⁹ In general, in order to introduce a robust verification system with high intrusiveness under arms control and disarmament treaties, reciprocal verifications and inspections by the parties, or the development of a rigorous confidential information protection mechanism by international organizations and other verification implementing agencies, is essential.⁴⁰ If a virtual nuclear arsenal regime is to be achieved and if it is to be sustained, it is crucial to examine an international verification system which allows for the quick detection and sharing of crises, including the clandestine reconstruction of nuclear arsenals and new horizontal proliferation of nuclear weapons.

While Mazarr sets forth that the survivability of dismantled nuclear arsenals is directly linked to confidence in deterrence,⁴¹ it is precisely the giving of sufficient considerations to the first requirement of establishing deterrence—the “capability”⁴² of deterrence—that is one of the indispensable prerequisites of the virtual nuclear arsenal regime. Therefore, in terms of maintaining the credibility of deterrence, there is real significance, for example, for virtual nuclear powers to carry out routine reconstruction drills based on appropriate confidence building measures and transparency.

Discussions on nuclear strategy and nuclear doctrine

As seen also from the discussions from the Cold War to the post-Cold War eras as well as discussions surrounding “a world without nuclear weapons” in recent years, it is becoming mainstream to aim to reduce the threat of nuclear arsenals or to gradually reduce nuclear arsenals by making revisions to the nuclear strategies and nuclear doctrines of nuclear weapon states, including, for example: the adaption of No First Use (NFU) policy or limiting the role of nuclear weapons to the sole purpose of nuclear deterrence; and the termination of launch-on-warning and the sharing of early warning information based on interstate agreements. However, these approaches require that nuclear weapon states have internalized nuclear disarmament norms and that states share relevant international norms, as well as that there is mutual consensus.

Existing nuclear weapon states will have to change their nuclear doctrines and war plans in drastic ways if the concept of virtual nuclear arsenals is to become a reality. In this regard, Michael Brown notes that in addition to the ways of exercising influence on international politics and redefining the role of nuclear weapons which are relied upon as the ultimate guarantors of national

³⁸ Ibid., pp. 118-120.

³⁹ Michael Wheeler, “Reconstitution and Reassembly,” in Mazarr, ed., *Nuclear Weapons in a Transformed World: The Challenge of Virtual Nuclear Arsenals*, pp. 132-133.

⁴⁰ Sukeyuki Ichimasa, “Kakugunshuku to Kensho: CTBT wo Jirei to shite (Nuclear Disarmament and Verification: CTBT as a Case Study),” paper presented at the Japan Association of Disarmament Studies 1st Annual Convention at Hitotsubashi University, August 29, 2009. <http://www.wilmina.ac.jp/ojc/disarmament/pdf/NL03.pdf>

⁴¹ Mazarr, “Virtual Nuclear Arsenals: A Second Look,” in Mazarr, ed., *Nuclear Weapons in a Transformed World: The Challenge of Virtual Nuclear Arsenals*, p. 384.

⁴² T.V. Paul, “Complex Deterrence: An Introduction,” in T.V. Paul, Patrick Morgan and James J. Wirtz, eds., *Complex Deterrence: Strategy in the Global Age*, Chicago: University of Chicago Press, 2009, p. 2.

security, the following elements of the policies for operating nuclear weapons would have to be fully reviewed: (1) Timing of nuclear attack; (2) Targeting of attack; and (3) Sizing of arsenals. In particular, with regard to the latter review of operational policies, in addition to shifting away from the first use of nuclear weapons and launch-on-warning to NFU and delayed response, states would have to decouple the operations of conventional and nuclear weapons. Furthermore, if the transition to a virtual nuclear arsenal regime is achieved, it would be important for states to be prepared for the risk of a counter-force strike on dismantled nuclear arsenals and to increase the survivability of stored fissile material, dismantled nuclear warheads, and their means of delivery. In addition, states would have to review the massive, counter-nuclear attack operation emphasized by conventional nuclear doctrines and shift to selective strikes using conventional arsenals that newly and directly target the economic centers and military headquarters of enemy states.⁴³

In spite of these measures, it cannot be denied that the existence of only a few but operationally ready nuclear arsenals may be necessary as a psychological assurance against suspicions over agreement violations and concerns over the new horizontal proliferation of nuclear weapons. In light of this possibility, Mazarr notes that in the initial phase of the transition to virtual nuclear arsenals, the regime would have to allow states to keep small strategic nuclear-powered submarines that are loaded with, for example, 200 to 300 nuclear arsenals for the US and Russia, and around 100 for all other nuclear weapon states.⁴⁴ Moreover, he notes that if a full-scale transition to virtual nuclear arsenals is achieved, the regime would have to consider developing some kind of a new international security system, for example, a system of collective “nuclear” security.⁴⁵

Criticisms against the ideas on virtual nuclear arsenals and the theory of deterrence

As noted, a variety of approaches have been argued with regard to the deterrence inherent in the concept of virtual nuclear arsenals. However, it should be noted once again that the concept’s “weaponless deterrence” dimension has drawn fierce criticisms from supporters of nuclear deterrence and strategy scholars. In particular, the criticism, which is along the same lines of the criticism of minimum deterrence,⁴⁶ i.e., that the concept of virtual nuclear arsenals lacks credibility about the use of nuclear weapons—a major premise of the concept—and cannot constitute an effective nuclear deterrence,⁴⁷ must be considered. Kenneth Waltz says he cannot support the concept of virtual nuclear arsenals. He reasons that virtual nuclear arsenals are equivalent to deterrence without second strike capability, and notes the unstableness inherent in the system of virtual nuclear arsenals, i.e., the dangers of deterring by mutual monitoring and competitive

⁴³ Brown, “Nuclear Doctrine and Virtual Nuclear Arsenals,” in Mazarr, ed., *Nuclear Weapons in a Transformed World: The Challenge of Virtual Nuclear Arsenals*, pp. 46-49.

⁴⁴ Mazarr, “Virtual Nuclear Arsenals: A Second Look,” in Mazarr, ed., *Nuclear Weapons in a Transformed World: The Challenge of Virtual Nuclear Arsenals*, p. 374.

⁴⁵ *Ibid.*, p. 382.

⁴⁶ Tetsuya Umemoto, *Kakuheiki to Kokusaiseiji: 1945-1995 (Nuclear Weapons and International Politics: 1945-1995)*, The Japan Institute of International Affairs, 1996, pp. 113-116.

⁴⁷ John Baylis, “The Search for a Third Way,” in Baylis and O’Neill, eds., *Alternative Nuclear Futures: The Role of Nuclear Weapons in the Post-Cold War World*, pp. 80-81.

reconstruction of nuclear arsenals.⁴⁸ Colin Gray makes the case that it is difficult to conceive that nuclear deterrence would be realized, arguing that: the concept of virtual nuclear arsenals will likely lead to an end result that is disproportionate to today’s power distribution for the five nuclear weapon states and other de-facto nuclear weapon states; the delayed response that is a given condition of the mechanism of reconstructing nuclear arsenals will favor non-compliant states both politically and militarily; and no state would deem that a state is a “nuclear weapon state” because it retained nuclear weapons which are actually non-operational.⁴⁹ According to Michael Wheeler, dismantled nuclear arsenals are more vulnerable to attacks than nuclear arsenals that are operationally deployed; hence, it is difficult to deem them as an effective deterrent. Wheeler also criticizes that considering that even in today’s world, the building and maintenance of nuclear arsenals requires specialized, large-scale infrastructure, including means of delivery of nuclear warheads, targeting systems, reconnaissance systems, communications systems, procurement systems, and logistics support systems, the reconstruction of nuclear arsenals under a virtual nuclear arsenal regime is equivalent to developing nuclear arsenals from scratch and will prove to be futile.⁵⁰ George Perkovich and James Acton et al. contend that the monitoring and inspection of dismantled nuclear arsenals would increase the risks of inappropriate leakage of the storage facilities’ location, which would bring on a preemptive first strike by the enemy and accordingly cause a destabilization of deterrence.⁵¹

As such, from the perspective of the conventional theory of nuclear deterrence which has extended from the Cold War era, there is no way of getting around saying that the concept of virtual nuclear arsenals is in an extremely insufficient and unstable situation. On the other hand, however, if the concept of virtual nuclear arsenals is redefined as being in a transition phase toward “a world without nuclear weapons,” perhaps it would be possible to find subtle inter-linkages between the theories of deterrence and nuclear disarmament.

In light of the above awareness, the next section will examine the relationship between the concept of virtual nuclear arsenals and nuclear disarmament and non-proliferation.

Virtual Nuclear Arsenals and Nuclear Disarmament/Non-Proliferation

Implications for the vision of “a world without nuclear weapons”

An examination of the nuclear disarmament roadmap raises the following issues regarding mid- to long-term plans for the reduction of nuclear arsenals: When, by whom, and how will zero nuclear weapons be achieved? In recent years, a variety of approaches have been studied over these issues.

⁴⁸ Kenneth Waltz, “Thoughts on Virtual Nuclear Arsenals,” in Mazarr, ed., *Nuclear Weapons in a Transformed World: The Challenge of Virtual Nuclear Arsenals*, p. 311. Because the logic of minimum deterrence is in essence the logic of nuclear deterrent, the argument that nuclear threats will not dissipate should also be kept in mind. Jack Steinberger, Essam Galal, and Mikhail Milstein, “A Nuclear-Weapon-Free World: Is it Desirable? Is It Necessary?,” trans. Noriyuki Nakasuka in Joseph Rotblat, Jack Steinberger, and Bhalchandra Udgaonkar, eds., Michiji Konuma, Shoji Sawada, Eiichi Sugie, and Ikuro Anzai, trans., *A Nuclear-Weapon-Free World: Desirable? Feasible?*, Kamogawa, 1995, pp. 57-58.

⁴⁹ Colin Gray, “To Confuse Ourselves: Nuclear Fallacies,” in Baylis and O’Neill, eds., *Alternative Nuclear Futures: The Role of Nuclear Weapons in the Post-Cold War World*, p. 10.

⁵⁰ Wheeler, “Reconstitution and Reassembly,” in Mazarr, ed., *Nuclear Weapons in a Transformed World: The Challenge of Virtual Nuclear Arsenals*, pp. 133-137.

⁵¹ Perkovich and Acton, eds., *Abolishing Nuclear Weapons: A Debate*, pp. 120-121.

For example, the International Commission on Nuclear Non-Proliferation and Disarmament (ICNND), co-chaired by former Minister for Foreign Affairs of Japan Yoriko Kawaguchi and former Minister for Foreign Affairs of Australia Gareth Evans, addressed these issues in a report released in 2009. The report states that all nuclear weapon states and de-facto nuclear weapon states shall adopt NFU in their respective nuclear doctrines and set forth that the sole purpose of using nuclear weapons is to deter others from using such weapons,⁵² and that a political environment needs to be cultivated so that all nuclear-armed states can declare legally binding negative security assurances (NSAs).⁵³ Furthermore, it defines to 2025 as the minimization phase for reducing the total number of nuclear weapons, and proposes to first reduce the number of nuclear weapons possessed by the US and Russia, including non-deployed reserves, to a total of 1,000. At the minimization point, the objective would be to have a global total of no more than 2,000 weapons — equivalent to approximately one-tenth of the total number of nuclear weapons now possessed by the US and Russia and by other states. In addition, it proposes that all nuclear-armed states commit to NFU, deploy verifiable nuclear arsenals as a credible force posture, and make clear its alert status in their nuclear doctrines. Nonetheless, the report does not make clear the action plan or specific target year or reduction methods for the years up to the subsequent elimination phase.⁵⁴

A more ambitious vision is presented in the Global Zero Action Plan. Its objectives are: for the US and Russia to reduce their respective total number of nuclear weapons to 500 by 2021 as well as for other nuclear weapon states to freeze their nuclear warhead stockpiles until 2018 and carry out proportionate reductions until 2021; to strengthen safeguards on the civilian nuclear fuel cycle; and from 2019 to 2023, for all nuclear-armed states to establish a verification and compulsory enforcement system and to conduct negotiations to conclude a legally binding “global zero accord (on nuclear weapons),” and by 2030, complete the verified dismantlement of all nuclear weapons pursuant to the accord.⁵⁵ These positive approaches to nuclear disarmament are also discussed by scholars and practitioners from around the world. For example, Bruce Blair et al. propose that the US and Russia first reduce their number of nuclear warheads to 1,000 combined, and then, while reducing the instability factor by deactivating the launch-on-warning posture of strategic nuclear arsenals, that other nuclear-armed states should be requested to reduce their nuclear warhead stockpiles to 50% of current numbers.⁵⁶ Furthermore, Ivo Daalder and Jan Lodal present four steps to realize “a world without nuclear weapons”: the US must limit the role of nuclear weapons to deterring nuclear attacks by opponents; the US should reduce its total nuclear arsenal to no more than 1,000 weapons, including non-deployed reserves; the US must establish a comprehensive international nuclear-control regime; and the US must undertake a diplomatic effort regarding a global “logic of zero.”⁵⁷ As shown, there are a plethora of approaches that seek

⁵² Report of the International Commission on Nuclear Non-Proliferation and Disarmament, *Eliminating Nuclear Threats: A Practical Agenda for Global Policymakers*, Canberra: Paragon, 2009, p. 75.

⁵³ *Ibid.*, p. 177.

⁵⁴ *Ibid.*, pp. 72-77.

⁵⁵ Global Zero Commission, “Global Zero Action Plan,” February 2010. http://static.globalzero.org/files/docs/GZAP_6.0.pdf

⁵⁶ Bruce Blair, Victor Esin, Matthew McKinzie, Valery Yarynich and Pavel Zolotarev, “Smaller and Safer: A New Plan for Nuclear Postures,” *Foreign Affairs*, September/October 2010, Vol. 89, No. 5, pp. 10-11.

⁵⁷ Ivo Daalder and Jan Lodal, “The Logic of Zero,” *Foreign Affairs*, Vol. 87, No. 6, November/December 2008, pp. 81-82.

the gradual reduction of nuclear arsenals to future elimination of nuclear weapons. Nevertheless, there still remains numerous issues for which solutions have not been found, including: how should the mutual deterrence/mutually assured destruction relationship be dissolved; at what timing should nuclear weapons be dismantled and eliminated; how should knowledge of nuclear weapons production be managed; is the goal to eliminate all nuclear weapons from Earth or should states be allowed to leave in place a few nuclear weapons; if permission is granted for states to keep nuclear weapons, under what conditions and which states should be allowed to continue to hold nuclear weapons; will it be an international organization equipped with a new collective security mechanism that will manage the reserve of nuclear arsenals; how should compliance with the agreement on “a world without nuclear weapons” be verified; and how should emerging new nuclear menaces be dealt with.

At present, no solution is available which directly answers all of these questions. However, the concept of virtual nuclear arsenals offers useful perspectives for addressing these questions. For example, Mazarr notes that the physical elimination of nuclear weapons is not necessarily a requirement to reduce the role of nuclear weapons in international politics.⁵⁸ Nonetheless, in light of the various obstacles which are predicted to be faced in the process of achieving “a world without nuclear weapons,” the psychological hurdles of participating in a virtual nuclear arsenal regime that permits hedges through nuclear deterrence are, for nuclear weapon states and de-facto nuclear weapon states, likely lower than participating in nuclear disarmament aimed at eliminating nuclear weapons.

From the perspective of the theory of nuclear disarmament that has aimed to gradually reduce nuclear arsenals with the ultimate goal of totally eliminating nuclear weapons,⁵⁹ the concept of virtual nuclear arsenals is essentially a thought experiment. In other words, it attempted to ensure a limited nuclear deterrent, and by extension, to displace the unstableness factor, by preliminarily removing the nuclear disarmament theory’s thesis of eliminating nuclear weapons and fundamentally denying the irreversible requirement of disarmament. On the other hand, even from the standpoint of the theory of nuclear disarmament, there are also those who positively regard the virtual nuclear arsenal regime and identify it as an inertia that would make nuclear weapon states pursue nuclear disarmament in the future.⁶⁰

It is by no means easy to predict the future of nuclear weapons. However, if it were assumed that the concept of virtual nuclear arsenals was realized and opportunities presented itself to find inter-linkages between the theories of deterrence and nuclear disarmament, then the situation would perhaps look like this: (1) In the initial phase toward a virtual nuclear arsenal regime, the remaining few operationally deployed nuclear arsenals are gradually being dismantled; or (2) The virtual nuclear arsenal regime is stabilized, and the former major nuclear weapon states are struggling to maintain their infrastructures for the reconstruction of their highly costly nuclear arsenals. In terms of (1), as Akio Watanabe points out, there should be prior understanding that

⁵⁸ Mazarr, “The Notion of Virtual Arsenals,” in Mazarr, ed., *Nuclear Weapons in a Transformed World: The Challenge of Virtual Nuclear Arsenals*, p. 13.

⁵⁹ Sukeyuki Ichimasa, “Negotiating Arms Control, Disarmament and Non-Proliferation and the UN System: An Essay on Structural Collision between Haves and Have-nots of the Nuclear Weapons,” *Kokuren Kenkyu (United Nations Studies)*, Vol. 10, 2009, p. 157.

⁶⁰ Perkovich and Acton, eds., *Abolishing Nuclear Weapons: A Debate*, p. 120.

the future virtual nuclear arsenal regime may be an extension of current international politics in the sense that it may be a world based on a great power concert.⁶¹ Furthermore, with regard to (2), there are questions which will need to be answered in some way: how long will nuclear weapon states need to foster and maintain the experts of their nuclear weapon complex and secure budgets for them in order to maintain virtual nuclear arsenals, and how long will they need to continue to keep their factories and facilities for assembling nuclear weapons; and will such assembly work be feasible in practice?⁶²

Impact on nuclear non-proliferation

In today's world, which is called Nuclear Power Renaissance and in which "a world without nuclear weapons" aroused strong international public interest, new nuclear proliferation has been a critical concern of the international community for a long time. The 2010 NPR Report and the 2008 US Nuclear Weapons Policy released by the Council on Foreign Relations of the US, for example, both note the importance of international cooperation to effectively thwart nuclear proliferation and nuclear terrorism over the long process toward the global elimination of nuclear weapons.⁶³ As was already discussed, under the virtual nuclear arsenal regime, it was deemed that virtual nuclear weapon states would respond to new vertical proliferation of nuclear weapons by monitoring one another's reconstruction as well as conducting routine verifications and inspections. Furthermore, as the dismantled nuclear arsenals would be stored individually, even if some arsenals were to be seized or sold or distributed illegally to the nuclear black market or elsewhere, the arsenals alone cannot be developed into weapons, and the risk of nuclear proliferation and nuclear terrorism would be considerably lower than the current situation.

From the perspective of nuclear weapons' political and military impact on horizontal proliferation, however, it must be stated that the concept of virtual nuclear arsenals also embodies aspects that argue the contrary. In today's world, a horizontal proliferation of nuclear weapons may be caused for several reasons, including: (1) States wish to increase their prestige by possessing nuclear weapons; (2) States possess nuclear weapons to reduce the threat of nuclear intimidation or expect that nuclear weapons would serve as a means of ensuring their survival; or (3) States seek military and psychological assurances from nuclear weapons in order to pursue their own diplomatic and security policies detached from their position as a beneficiary of extended nuclear deterrence. It should be taken into account that these nuclear proliferation motives may likewise be ways for non-state actors, including international terrorists, to challenge the existing international security order or to pose an asymmetrical threat to states and civil societies.

Nonetheless, the considerations made in this paper have shown that there are logics and intentions of nuclear weapon states at work when a transition to a virtual nuclear arsenal regime is made—namely, states would like to reduce the strategic and non-strategic risks arising from

⁶¹ Akio Watanabe, "A Japanese Reaction," in Mazarr, ed., *Nuclear Weapons in a Transformed World: The Challenge of Virtual Nuclear Arsenals*, p. 357.

⁶² Perkovich and Acton, eds., *Abolishing Nuclear Weapons: A Debate*, p. 121.

⁶³ Nuclear Posture Review Report, U.S. Department of Defense, April 6, 2010, p. iv. <http://www.defense.gov/npr/docs/2010%20nuclear%20posture%20review%20report.pdf>; and CFR Independent Task Force, "U.S. Nuclear Weapons Policy," Council on Foreign Relations, 2009, p. 43. http://i.cfr.org/content/publications/attachments/Nuclear_Weapons_TFR62.pdf

operationally dispersed large-scale nuclear arsenals, without significantly eroding their privileged positions as nuclear weapon states and their nuclear deterrent. In other words, the virtual nuclear arsenal regime, as it turns out, does not close the structural gap between the nuclear weapon “haves” and “have-nots” and sustains the power distribution of international politics which has existed as a result of nuclear weapons since the Cold War era. If so, then in terms of the horizontal proliferation factors discussed above, while the threat of nuclear intimidation in (2) would be substantively reduced, no changes would be made to motives (1) or (3) for proliferators. Hence, the virtual nuclear arsenal regime would have a limited impact on nuclear non-proliferation.

Conclusions

As examined so far, “a world without nuclear weapons” has been debated on a variety of levels, while ways are searched to both promote nuclear disarmament and non-proliferation and maintain nuclear deterrent, as well as to stabilize the international security environment in broad terms. The time has perhaps come to once again think deeply about the implications that the numerous issues have, including the idea of “weaponless deterrence” posed by the concept of virtual nuclear arsenals, the verification of compliance with the agreement, and the reconstruction of nuclear arsenals to deter non-compliance, and their counterarguments.

The concept of virtual nuclear arsenals has been a subject of debate. Proponents of nuclear disarmament have questioned the concept for justifying the nuclear threat, infringing on the irreversibility requirement of disarmament, and fixating the discriminatory structure of nuclear weapons. On the other hand, supporters of nuclear deterrence theory have harshly criticized the problem of instability and feasibility inherent in the concept and the idea of reconstructing nuclear arsenals that will decrease second strike capability.

Nonetheless, it is believed that there is value in revisiting the challenges raised by the concept of virtual nuclear arsenals to bridge the two worlds: the world not easily foreseeable even from current discussions on “a world without nuclear weapon states”—indeed, a world which lies somewhere between the “minimization phase” and “elimination phase” of the ICNND report and has a visible nuclear deterrent and; and the world which is moving toward nuclear disarmament.

