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The minimum deterrent & beyond

The first 40 years of the nuclear age, dominated by the Cold War, witnessed the staggering buildup of nuclear weapons in U.S. and Russian arsenals. In 1987 the arsenals reached a combined total of about 70,000. U.S. weapons peaked at 32,000 in 1966; Soviet weapons peaked somewhere between 40,000 and 50,000 in 1986. Equally remarkable has been the decline from those heights: both countries, having reduced their stockpiles to 10,000 by 2002, agreed to cut the number of “operationally deployed strategic warheads” to 2,200 by 2012. The United States has already reached this limit, but retains 700 tactical weapons and a reserve of 2,500 active and inactive weapons, not treaty-limited, making for a grand total of 5,200. While comparable data are not available from Russia, it is likely that their stockpile will soon approach a similar level, representing the lowest number of weapons between the United States and Russia since the early days of the buildup, around 1959.

A massive exchange between U.S. and Soviet nuclear arsenals during any part of the past half-century would have risked near or total destruction of the world’s civilization. That this did not

happen was mainly due to the fear that resorting to use of such weapons by one side would quickly lead to an escalation, since each side would seek to destroy the other’s not-yet-used forces, as well as to retaliate in response to destruction already under way. The level of devastation that would have occurred is unimaginable, but several models have attempted to describe some of the consequences. One model, for example, concluded that to destroy 25 percent of the population of Russia, the United States, Britain, France, and Germany would need fewer than 250 large weapons. Millions more fatalities and further disruption of transportation, energy supply, communications, food supplies, and medical aid, as well as the breakdown of government, commerce, trade, social order, and civil life, would follow, while delayed fatalities and illnesses from radioactive fallout would peak and then subside only slowly over centuries.¹

Alas, the potential for this level of destruction still remains, despite the seven-fold reduction in U.S. and Russian weapons that has occurred. Therefore a primary goal in the next decades must be to remove this risk of near global self-destruction by drastically reducing nuclear forces to a level where this outcome is not possible, but where a

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deterrent value is preserved – in other words, to a level of minimum deterrence. This conception was widely discussed in the early years of the nuclear era, but it drowned in the Cold War flood of weaponry. No matter how remote the risk of civilization collapse may seem now – despite its being so vivid only a few decades ago – the elimination of this risk, for this century and centuries to come, must be a primary driver for radical reductions in nuclear weapons.

As the Cold War risks of catastrophic damage receded, the risk of destruction at the other end of the scale – attacks on single cities – sharply increased. These attacks might come either from new, hostile nuclear-weapons states or from nuclear terrorists stealing or buying a weapon or acquiring enough fissile material to make a primitive weapon themselves. Since the mid-1990s, vigorous efforts have been made through negotiations and sanctions, so far unsuccessful, to block North Korea and Iran from going nuclear; bombing from Israel attempted to block Syria from going nuclear. Nuclear terrorists have focused mostly on stealing or buying enriched uranium through the underground from Russia: the International Atomic Energy Agency (IAEA) lists 18 confirmed attempts.² The security of Russia's fissile materials has improved substantially over the last 15 years, but much remains to be done since Russia has the world's largest stockpiles of nuclear weapons and fissile materials, spread over hundreds of sites.

Not only have these accelerated risks helped restimulate long-standing opposition to nuclear weapons, from “ban the bomb” groups that originated in the 1960s, for example, but they have also increased advocacy of “a nuclear-free

world” from new groups, including former governmental officials and others well acquainted with nuclear matters. (Google lists 234 million references to “nuclear-free.”)

The vision of a nuclear-free world caught hold at the governmental level more than 40 years ago, most notably through the 1968 Non-Proliferation Treaty (NPT), which required that “[e]ach of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament.” Eighteen years later, in 1986, the Reykjavik Summit gave further hope for government action toward total nuclear disarmament, even hope for a new treaty. At the Summit, Gorbachev suddenly proposed the elimination of all nuclear weapons if space-based defenses would be abandoned as well; Reagan, however, could not agree to this condition, and hopes for a new treaty failed.

Although very major reductions in nuclear arsenals did follow the end of the Cold War, there is no evidence that the major nuclear states are moving toward complete divestiture. Nevertheless, urging radical reductions in nuclear arsenals and, ultimately, their elimination grew. Perhaps the most detailed, early proposal by experts was that of the Australian government-sponsored Canberra Commission on the Elimination of Nuclear Weapons.³ In 1999, Paul Nitze, long an advocate of a hard line nuclear posture, questioned the deterrent itself, saying, “I can think of no circumstances under which it would be wise for the United States to use nuclear weapons, even in retaliation for their prior use against us.” Then in 2007 four highly placed former government leaders – George Shultz, William Perry, Henry Kissinger, and Sam Nunn – furthered Nitze's convic-

tion and proposed “the goal of a world free of nuclear weapons,” specifying a number of steps to be taken in that direction. Many leading former officials of both parties along with qualified others have added their support to the group’s 2007 statement or to a supplementary statement from 2008.⁴ Importantly, this later statement reemphasized that a nuclear-free world is a distant goal rather than a state certain to be accomplished within a given time.

Four former defense ministers and four former foreign ministers of Britain joined this call in 2008, and Prime Minister Gordon Brown went on record proposing concrete steps that states could take jointly to help create the conditions necessary for the abolition of nuclear weapons. Most recently, President Obama added his endorsement, in his April 5, 2009, speech in Prague: “I state clearly and with conviction America’s commitment to seek the peace and security of a world without nuclear weapons. I am not naive. This goal will not be reached quickly – perhaps not in my lifetime. It will take patience and persistence. But now we, too, must ignore the voices that tell us that the world cannot change.” Numerous endorsements followed, for example by German Foreign Minister Steinmeier, who noted that Helmut Schmidt and three other foreign policy leaders had affirmed this position.⁵

Thus, the goal of a world free of nuclear weapons has become the second principal driver toward radical weapons reduction. Reflecting on the path that might lead to this twin goal – ending the risk of civilization collapse and preparing for the zero option – makes clear that any such course must involve the committed cooperation of Russia and the United States in three stages. First, the two nations must see that it

is to their advantage to take the lead together in undertaking drastic reductions in their nuclear arsenals, which account for 96 percent of the world’s weaponry. To prepare for these reductions, the United States and Russia should first adjust their arsenals to a common level; provide accurate inventories of all nuclear weapons; and establish new means of enhancing transparency, inspection, and verification to monitor accurately the progress of reductions. Second, once sufficient reductions have been made to demonstrate their own commitment, the United States and Russia should 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 (at present, India, Israel, and Pakistan); the treaty would incorporate scheduled reductions aimed at reaching the very low level constitutive of a minimum deterrent. The third phase would consist of reducing weapons to the designated levels of a minimum deterrent. Without reductions on this scale, neither can the long-term risk of worldwide destruction be eliminated, nor can advances toward a nuclear-free world be realized.

Completing these three phases would certainly take time – at least two decades or more. Yet taking this time to reach levels of minimum deterrent is necessary, because only then can the real problems of going on to zero be addressed. Can complete global participation be attained? If not, how can one deal with nuclear states unwilling to join? How can the risk of hidden weapons or the resort to rebuilding weapons, especially by countries facing defeat in wartime, be dealt with? Can inspection and verification systems be devised that will ensure per-

petual compliance and be affordable? Can allies and friends long dependent on the United States' deterrent capability adjust to the disappearance of that capability? It is futile to try to answer such questions now because the political world order will have been changed so much if a minimum deterrent level is achieved; no one can now foresee how stresses and tensions, old and new, will reshape the world a few decades hence. Finding answers to these questions will be a task not for this generation, but for the next.⁶

What follows is a brief examination of one path for reaching a minimum deterrent in this generation. The aim is not to advocate this particular example, but rather to illustrate in concrete terms the magnitude of the steps needed and some of the impediments that will be met.

The destructive power of nuclear arsenals is measured commonly in terms of *numbers* of weapons. When levels remain in the many thousands this metric is convenient and adequate. But if weapons are radically reduced to only those needed for a minimum deterrent or less, then the number of weapons cannot be the only factor: the *yield* of weapons must be considered as well. Maintaining a balance by numbers would only be a formality, not real progress, and would favor the retention of higher-yield weapons.

Alternatively, explosive yield could be used as the primary metric to reduce (but not eliminate) uncertainty. The most convenient measure of explosive yield is the weight in tons of the explosive TNT required to produce the explosive force of a given warhead. The yield of individual weapons is measured in thousands of tons (KT) or millions of tons (MT) of TNT. The U.S. stockpile is at least 500 MT⁷; Russia's stockpile may

be greater. It is unlikely that either side would specify the exact yield assigned to various weapons, but agreement might be reached in assigning ranges to weapon yield – weapons with a yield below 10 KT, say, or between 10 and 30 KT. Furthermore, arrangements allowing inspectors access to fissile material removed from dismantled weapons would provide a rough estimate of total yield, based on comparisons between yield from dismantled weapons and previously declared total yield. These and other measures would greatly reduce the uncertainty about destructiveness when relying on numbers alone. Even so, were the levels of a minimum deterrent reached, some limitation of numbers, even for the lowest-yield weapons, would be necessary since 20 weapons of 5 KT yield, for example, would in many circumstances be more damaging than one 100 KT weapon.

Initially, a very ambitious preliminary step would be necessary to bring Russian and U.S. nuclear arsenals to the same approximate levels and prepare for accurate monitoring of subsequent reductions. Two changes would need to be introduced in concert with what the Strategic Offensive Reduction Treaty (SORT) now in operation requires. One, all nuclear weapons, strategic and tactical, active and inactive – in effect, any that is not dismantled, not just those that are operationally deployed strategic warheads – would need to be included. Two, as explained above, the total explosive yield of the remaining nuclear arsenals would need to be used as the primary metric, rather than the number of weapons.

In tabulating necessary reductions for each step, we have chosen 512 MT as the beginning yield in order to keep the numbers simple. (The exact megaton yield to assume for a minimum deter-

rent is somewhat open to question, depending on what actions are to be deterred.) As will be discussed later, we have assumed that with balanced reductions of nuclear arsenals to less than 1 percent of current values, deterrence would be restricted to a single mission – that is, to deter the use of nuclear weapons or, if that fails, to be capable of retaliation in kind. We have also assumed that damage resulting from forbidden first use or in retaliation would not exceed that of larger past wars. The explosive power used in each of the world wars and the Vietnam War is estimated to be just under 2 MT. Hence, we have chosen 2 MT as the minimum deterrent, although 1 MT might be more appropriate, as damage from nuclear weapons would surely be compressed in time relative to a conventional war, thereby allowing much less time for partial recuperation. If the time came when this choice had to be made, input from an analysis of what was thought to be necessary to cover the reduced deterrence needs as then envisioned would be required.

The period of time needed for Russia and the United States to agree on this framework and adjust their inventories to the 512 MT limit (or some other agreed upon number) is unpredictable; we have optimistically chosen five years and called this Step 0. During this period, the inventory of all nuclear weapons existing in 2010 would be established as an essential guide to what is destroyed and what remains at each step of the reduction schedule.

It would be necessary to work out how the successor to the present Strategic Arms Reduction Treaty (START) would relate to seeking equal levels of total yield in Step 0. And further, agreement would have to be reached on the state in the dismantlement process at

which a weapon is no longer a weapon, and which components, other than fissile material, must be rendered unavailable for weapons use.

A series of five-year steps, paced by reductions in total yield, would follow Step 0. However, an equal reduction in each of the four steps is not practical, since it would mean large reductions in all steps followed by a precipitous fall at the end. Instead, we have proposed an inverted progressive approach, reducing yield in each step by a factor of three-quarters of the limit reached in the previous step. This schedule, in terms of megaton yield, is shown in Table 1. The goal of reaching 2 MT by 2035 assumes that Step 1 begins in 2015 and that each subsequent step takes five years. Following this hypothetical schedule, the explosive yield of the United States and Russia would be reduced by 94 percent by the end of 2025, at which point further reductions would depend on the introduction of a comprehensive treaty that includes all, or nearly all, nuclear states.

Since dismantling weapons is very time consuming (one U.S. gravity bomb contains nearly 7,000 parts) and requires specially constructed facilities to convert plutonium pits to scrap, additional time (perhaps 10 years) may be needed to complete the dismantlement.⁸ While the megaton limit does not specify the numbers of weapons, it is of interest to see what the numbers would be if all weapons were, say, 15 KT each (the yield of the Hiroshima weapon) or 100 KT; we have shown these numbers at the end of Step 4 (133 and 20, respectively) in the two columns at the right of the table. We have shown one further step in reductions if a lower minimum deterrent level were chosen.⁹

The other seven nuclear states are currently estimated to have about 1,000

Table 1
A Schedule for Reductions to a Minimum Deterrent by Russia and the United States

Step	Duration	Yield in MT	If Weapons Were 15 KT	If Weapons Were 100 KT
0	2010 – 2015	512		
Adjustment Reductions Begin				
1	2015 – 2020	128	8,533	1,280
2	2020 – 2025	32	2,133	320
All Nuclear States Join				
3	2025 – 2030	8	533	80
4	2030 – 2035	2	133	20
Further Reductions?				
5	2035 – 2040	0.5	33	5

weapons. Consequently, the success of this plan necessarily requires these states' participation no later than by the end of Step 2. However, the question of what constitutes appropriate reduction goals for these states is trickier. Since this illustrative proposal assumes a 40-fold reduction in numbers and a 250-fold reduction in yield from the two dominant powers, it is arguable that the others should accept much lower limits, scaled by size of their arsenals at that time. Or the reduction rates used above might be applied to only the five original nuclear powers, with negotiated lower levels for the others. If no consensus on customized solutions such as these can be reached, it may be preferable to agree on the same reduction schedule (three-quarters elimination at each step) for all nuclear states, rather than to abandon the whole process, since the vast experience and the many nuclear tests of the five original nuclear states give them an inherent technical advantage, even if the same rules apply to all.

Although the impediments to negotiating and implementing a minimum deterrent treaty are intimidating, they are not unlike those faced by arms control efforts in the past, or by the introduction of those treaties already in force or being negotiated now. For example, concentrating most of the weapons reductions (perhaps 10,000) in the first 10 years (Steps 0 and 1) may seem too ambitious. However, Russia and the United States eliminated nearly 50,000 weapons in the 20-year period, 1988 to 2008. And SORT currently envisions a two-third reduction of deployed operational strategic weapons (from 6,000 to approximately 2,000) in 10 years; the follow-on to SORT is expected to call for additional reduction by one-third to one-half. Further, the oft-forgotten Intermediate-Range Nuclear Forces Treaty of 1988 saw 2,692 nuclear-armed missiles removed from Europe and Russia in three years.

Two existing treaties, the NPT along with the Comprehensive Test Ban Treaty

(CTBT), have contributed much to create an environment that makes radical reductions and the goal of a minimum deterrent treaty possible; yet the future of these two treaties is troubled. However, if Russia and the United States were to commit to a reduction program such as the one outlined here, some of this trouble could be avoided.

Although the CTBT of 1996 is not yet in force, many of its functions are in place because the Treaty's Preparatory Commission created a CTBT Organization. This organization has greatly improved the network of monitoring stations to detect nuclear tests, and has created a worldwide data center and an on-site inspection capability. Its operating budget is based on annual contributions of signatories. Thus, the Treaty now operates largely on a voluntary basis, no doubt in part because of its broad popular support – judged to be near 80 percent. However, that 10 of the 44 states that need to ratify the Treaty to bring it into force haven't done so¹⁰ threatens its chance of becoming a much-needed, established part of the arms control environment. It is unfortunate and unwise that the United States failed to ratify the Treaty in 1999, but President Obama is now leading a renewed effort to do so. Such support seems vital to persuading some of the other non-ratifying states to ratify, and to sustaining the voluntary operation that so far has maintained nearly complete compliance until means can be found to bring the Treaty into force.

Whether or not the United States ratifies the CTBT within the coming year has become crucial to the advancement of a draw-down both in physical weapons and in the role of nuclear weapons in national security policy. Only by ratifying the Treaty can the United States signal that it is prepared to move into a new era

of a nearly nuclear-free world. Without such confirmation, President Obama would be denied the leadership role that is essential to the redirection of arms control on the scale envisioned here.

The NPT, entered into force in 1970, is the central means by which the spread of nuclear weapons can be contained. This Treaty has led nine states to abandon their intention to become nuclear-armed states. However, the four de facto nuclear states (India, Israel, North Korea, and Pakistan) are not party to the NPT. Moreover, of the 189 signatories of the NPT, 66 have not ratified the 1997 Additional Protocol, which gives IAEA inspectors greater authority to visit declared and undeclared nuclear sites. Here, too, the United States has a leadership role to play in winning over signatories to the Additional Protocol and strengthening the Treaty at its Five Year Review Conference in 2010.

If the treaty expected to follow on from the original START, which was ratified in 1991, is secured, that, too, would greatly ease what must be done in Step 0 of the minimum deterrent treaty outlined here. The same is true if a fissile materials cut-off treaty were to be developed. Of the several treaties that collectively aim to control and reduce nuclear weapons, central is the one that radically reduces nuclear arsenals to a minimum deterrent level or beyond. This treaty would best provide the strategic framework to coordinate all the others and diminish the role of nuclear weapons in the security policies of the nuclear states – and to deter non-nuclear states from believing that nuclear weapons are a shortcut to power and prestige.

Clearly, there are other impediments to overcome and initiatives to undertake. These include negotiating treaties dealing with a fissile material production cutoff; introducing a regime to secure

and reduce the large stocks of fissile materials and to monitor the flow of fissile materials through the reactor fuel cycle in the hundreds of power reactors worldwide; providing services for nuclear fuel and the disposal of used fuel from nuclear power reactors of non-nuclear states; expanding the IAEA; improving inspection and verification techniques; and finding effective ways to share intelligence, ensure enforcement, and deal with possible violations.¹¹

General Kevin Clinton, who heads the U.S. Strategic Command, recently pointed out that the 2,200 operationally deployed strategic warheads now permitted by SORT are needed to carry out the missions developed under presidential guidance and policy directives. Such guidance is apparently based on the 2006 National Security Strategy, which continues wide-scale targeting of Russia's offensive strategic forces and command centers (that is, counterforce targeting along with targeted attacks on infrastructure such as transportation hubs, major industries, and communications centers). Numerous non-Russian targets are also included in various strike options developed by the Department of Defense. In April 2009, General Clinton noted that he cannot reduce the number of needed warheads without revised White House guidance.

Reducing weapons to a minimum deterrent level means substantially reducing nuclear missions, including counterforce targeting, which, at any rate, struggles with diverse demands and redundancy, a consequence of incomplete intelligence. Furthermore, counterforce targeting may not reach submarine-based, mobile land-based, or other well-hidden weapons. Abandoning counterforce targeting would

take away the United States' first-strike capability, aimed at preempting attacks by Russia's nuclear forces. However, while current U.S. declaratory policy maintains that it is necessary to threaten the first use of nuclear weapons for the sake of deterrence in a number of scenarios, including deterrence of attacks by chemical and biological weapons and by large-scale, conventional military force, some experts have begun to argue convincingly that movement to a no-first-use doctrine would be in the best interests of the United States.¹² For these reasons, the missions for which U.S. nuclear forces could justifiably be used should contract to a single one: to retaliate after a nuclear attack on the U.S. or its allies. The minimum deterrent must be determined for this single mission alone, not for obsolete missions or those better left to conventional forces.

At present the United States extends protection by nuclear forces to 28 members of NATO, as well as to Israel, Japan, South Korea, and Australia. According to the NATO Treaty, "The Parties agree that an armed attack against one or more of them in Europe or North America shall be considered an attack against all . . . and to assist the Party or Parties so attacked by taking . . . such action as it deems necessary, including the use of armed force, to restore and maintain the security of the North Atlantic area." On this basis the United States can deem necessary the use of its nuclear forces in support of armed attack – nuclear or non-nuclear – against any member state. The NATO Treaty is of course 1949 language, with which the United States aimed to deter Soviet attacks in Europe. But now the Treaty justifies the United States' continuing to deny making a no-first-use nuclear pledge, even against non-nucle-

ar attacks, in a NATO that now includes the Baltic states and most of the Balkans (and that would include, if some had their way, Georgia and Ukraine). Absurd as such possibilities may be, the move toward a minimum deterrent should be the occasion for clarifying that retaliation after a nuclear attack is the only mission for U.S. nuclear forces. This should apply as well to those non-NATO countries that the United States has expressed a similar commitment to protect.

Of course, constriction on extended nuclear deterrence should be discussed in advance with the states affected. Already there are indications that allies' reactions to dramatic reductions will vary. The German Foreign Minister has just called for the United States to remove its tactical nuclear weapons in Germany, and polls show this to be a popular view throughout Western Europe. By contrast, the Japanese Ministry of Defense has expressed opposition to deep cuts and has insisted, for example, that a U.S. nuclear weapon system in Japan that the United States would prefer to terminate be retained, no doubt in part because of uncertainties about the future of nuclear forces and growth in other Asian countries, including China. Yet it is quite likely that Russian-U.S. reductions would make the enlargement of Chinese

nuclear forces unnecessary, and if Steps 3 and 4 were reached, would reduce Chinese nuclear forces.

The foregoing proposals, or alternative ways to the same goal, would have seemed fanciful at any earlier stage. It is only through the arrival of a new U.S. administration, with unprecedented goals in arms control combined with strong Russian interests in the same direction, and through the backing of so many experienced and responsible experts here and abroad that a serious debate on such matters may be near. The key will be what is decided at two critical points: will Russia and the United States join in taking down their own enormous arsenals, and will other nuclear states join with them in proceeding to a minimum deterrent level and possibly beyond? If India, Israel, Pakistan, or any newer nuclear state does not join in this transforming effort, will means be found to restrain that state from undoing the effort? In short, will the window that a rare confluence of events has opened be used to marginalize the role of nuclear weapons in the global search for a safer, more stable, and more secure world and to create the environment in which the elimination of nuclear weapons could become possible?

ENDNOTES

- ¹ Matthew McKinzie et al., *The U.S. War Plan: A Time for Change* (Washington, D.C.: National Resources Defense Council, June 2001), 126. More succinctly, the commander of the Strategic Air Command (SAC) once told the author, in answer to the question of what would be the difference if only half of the nuclear arsenals were used in an exchange, that "the difference would be between sand and gravel."
- ² Matthew Bunn, *Securing the Bomb 2008* (Cambridge, Mass.: Project on Managing the Atom, Harvard University, and Nuclear Threat Initiative, November 2008), 9; www.nti.org.
- ³ <http://www.dfat.gov.au/cc/index.html>.

- ⁴ George Shultz, William Perry, Henry Kissinger, and Sam Nunn, "A World Free of Nuclear Weapons," *The Wall Street Journal*, January 4, 2007, and "Toward A Nuclear-Free World," *The Wall Street Journal*, January 15, 2008.
- ⁵ See www.auswaertiges-amt.de/diploen/Infoservice; also, Helmut Schmidt, Richard von Weizacker, Egon Bahr, and Hans-Dietrich Genscher, "Toward a Nuclear-Free World," *International Herald Tribune*, January 9, 2009.
- ⁶ A detailed and objective study of these problems can be found in George Perkovich and James Acton, *Abolishing Nuclear Weapons*, Adelphi Paper No. 396 (London: International Institute for Strategic Studies, 2008).
- ⁷ The 500 MT number being assigned for both sides is lower than estimates of current force yields because the total number of warheads and their yields are not publicly known for both sides. Moreover, there is another uncertainty: as a current compilation of U.S. nuclear forces shows, most of the 14 weapon types now deployed by the United States have a broad range of selectable yields, often more than a hundredfold; see Robert Norris and Hans Kristensen, *Bulletin of the Atomic Scientists* (July/August 2009): 72–80. If these weapons could be reliably converted to the lower yield range, then the total force yield would be greatly reduced. If not, the use of the highest yield would perhaps double the force yield. Clearly, dealing with this would be a difficult negotiators' problem as the reductions proceeded. Our choice of 500 MT force yield remains a reasonable level to reach before serious parallel reductions begin, but it may involve large and uneven reductions for both sides to reach such a common level. The further reduction proceeds the more necessary it will be to take into account both numbers and yields.
- ⁸ Presently the United States is dismantling plutonium pits at a rate of 350 per year; at this rate, the backlog of currently retired warheads would not be dismantled until 10 years after the treaty deadline, that is, 2022, unless facilities are expanded.
- ⁹ See the recent, very extensive analysis of this problem in Hans M. Kristensen, Robert E. Norris, and Ivan Oelrich, *From Counterforce to Minimal Deterrence* (Federation of American Scientists/Natural Resources Defense Council, April 2009); www.fas.org. They conclude that 500 warheads reached by 2025 would constitute a minimum deterrent for the United States, with submarine deployment ending in 2020. However, their conclusions do not assume any parallel Russian reductions and therefore are not comparable to ours.
- ¹⁰ These 10 countries are China, Egypt, India, Indonesia, Iran, Iraq, Israel, North Korea, Pakistan, and the United States.
- ¹¹ The details of such initiatives are examined in the papers prepared for the conference that led to the proclamations of George Shultz and colleagues in *The Wall Street Journal*. These are now available in *Reykjavik Revisited: Steps Toward a World Free of Nuclear Weapons*, ed. George Shultz, Sidney Drell, and James Goodby (Stanford, Calif.: Hoover Institution Press, 2008).
- ¹² Scott D. Sagan, "The Case for No First Use," *Survival* 51 (3) (2009): 163–182.