

LOOK BEFORE YOU LEAP*
**A Practicable Step towards Reduction and Possible Eventual Elimination of
Assembled Nuclear Explosives Holdings**

Clifford E. Singer

There are those who believe that future generations cannot live with the existence of assembled nuclear weapons, and others who believe they cannot live without them. To bridge the gap between these opposing views could be a significant contribution to our thinking about international security. This article suggests a method for accomplishing this. The answer given here to the question of whether future generations can or cannot live with assembled nuclear weapons is neither “yes” nor “no” but rather, “we do not know.” The reasons for this are simple, and the consequences outlined here are of practical as well as conceptual importance.

In particular, we examine here the possibility of a sufficient number of countries subscribing to the principles of a declaration (and/or treaty) with the following features. Beginning at a date certain early in the next century, each party subscribing to the principles of the declaration would agree to a universal limit on the number of its assembled nuclear explosive. At specified intervals this limit would be reduced by a certain factor, with the important *caveat* that any country could give a specified amount of notice of the reasons why a reduced limit is unacceptable. Each assenting country would agree to cooperate on ensuring that qualitative modifications of nuclear arsenals and other holdings of special nuclear materials do not unduly compromise international security. Once reduced, numerical limits on a country’s nuclear explosives holdings would increase only in case of advance notice of relevant extraordinary events which have jeopardized a country’s supreme national interests. A mechanism for selecting the specified dates and numbers needed for such a declaration is outlined here. The widespread adoption of the principles of such a declaration (and/or ratification of a similar treaty) could overcome an important psychological and organizational impediment in the way of a global approach to management of nuclear explosives.

INTRODUCTION

To say that future generations cannot live with assembled nuclear weapons in substantial numbers can mean either that they cannot abide their existence or literally that millions or billions will eventually die from their effects. The latter might seem obvious, for even a small but finite fixed continuing probability of the large scale use of nuclear weapons must eventually result in catastrophe.¹ In other words, if the chance of the use of nuclear weapons does not continually decrease at a sufficient rate, that use will eventually occur and may result in massive casualties. However, as long as such a

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probability continually diminishes at a sufficient rate, as some would argue it has over the last decade but others would dispute, it is yet possible that nuclear catastrophe can be avoided indefinitely.

It has also been argued that governments maintaining substantial nuclear arsenals are not indefinitely tolerable because they are morally indefensible, politically illegitimate, and/or inherently oppressive. Indeed it is well known that religious and other institutions and individuals have questioned the morality of the current situation.² It is also clear that institutions that govern and manage anything to do with radioactive materials have had their credibility repeatedly and widely questioned through and beyond the Cold War.³ This includes questions about abuse of the rights of individuals as well as the proper management of public health and security.⁴ Nevertheless, the moral, political, or individual rights implications of maintaining nuclear weapons are but a part of a complex fabric of ethical and institutional problems, and it is difficult at best to forecast how future generations will balance one against the other. Similarly, foreknowledge that future generations will see assembled nuclear weapons as essential to international security assumes the indefinite continuation of some previous approaches to national and international governance in a world of continually evolving economies and systems of governance.⁵

It is not the purpose of the present paper to add yet another contribution to the theoretical debate on this issue, as in the author's opinion it is ultimately unresolvable. Rather, it is to suggest one particular framework under which those whose intuition lies on either side of the debate can work together to deal with the practical problems posed by existing and potential nuclear explosive devices. For one thing that there is a wide consensus about is that the Cold War left a residue of a larger number of nuclear weapons and their delivery systems than is currently necessary or ideal from a security point of view. Moreover, this number is unlikely in practice to be reduced to zero within a few years, and probably not until a new, post-Cold War generation takes over responsibility for political, military, and technical oversight of existing arsenals. The reasons for this result partly from the political difficulty of building trust in alternate security arrangements and partly from the technical difficulty of obtaining high enough confidence that the special nuclear materials usable in nuclear weapons are not in fact assembled into operational nuclear explosives.

Thus, a central tenet of the present paper is that future generations will have to make their own decisions concerning the nuclear explosives that our generation bequeaths to them. As a result, we are unlikely to fore-ordain that the world of our children or grandchildren will or will not be free of assembled nuclear weapons. The best that we can do is to set up a process which may facilitate dealing with the problems posed by the current existence of nuclear explosive devices in a comprehensive and persistent manner. We admit in particular, therefore, that we are unlikely to be able to predetermine whether a future world will or will not be free of nuclear weapons by a date certain.⁶ What we may be able to do is to set up a process by which the world can, at any time, better face the consequences of a collective decision that it currently contains more nuclear weapons than are necessary from the points of view of national and international security.

CLARIFYING THE PURPOSE OF NUCLEAR ARMS CONTROL

Of course, there are currently a number of processes that already deal with various aspects of the question posed here. These include periodic reviews of the Nuclear Nonproliferation Treaty (NPT),

discussions on the establishment of additional nuclear weapons free zones, the search for a way to implement a comprehensive test ban treaty, discussions concerning a ban on the production of fissile materials usable in weapons programs, discussions concerning the possible content of a third strategic arms limitation treaty, etc.⁷ However, through many of these discussions weaves a common thread of tension concerning their ultimate purpose. Is the goal really the elimination of nuclear weapons (e.g., as stated in the NPT), or is it the indefinite management of a world containing nuclear weapons? The difficult enough task of producing treaty text and management institutions and procedures often appears confounded by this underlying disagreement on the overall purpose of the exercise.⁸ What is proposed here is that it might be useful to find a practicable vehicle for addressing this tension head on, in addition to working around it as best one can.

The assumption made here is that a practicable vehicle for reaching consensus concerning the ultimate purpose of nuclear arms control must come to grips with both the extended time scale of the overall exercise and inescapable uncertainty concerning how future generations will manage it. Because the exercise outlives individual participants, its direction is eventually determined by the bodies politic, which, by various mechanisms in various countries, ultimately determine its outcome. In addition to focusing attention of the active participants in arms control negotiations on a common purpose, it might also consequently be useful if a much broader public could have a clearer idea of the underlying goal. To these ends, the current proposal focuses on the particular question of the number of nuclear explosive devices held by any country, without neglecting more complex and qualitative questions. It allows for particular and readily and broadly understandable progress towards reductions in this number, but it also recognizes that successive reductions will not in fact occur unless holders and potential holders of assembled nuclear explosives feel secure enough to commit to lower limits at the time they are to come into effect.

The sample text presented here is in the form of a declaration that could be supported by non-sovereign organizations and/or supported or adopted by any number of governments. With minor modifications, it can also be cast in the form of an international treaty. This text is designed to be compatible with enduring security interests and current domestic politics of all countries with a particular interest in nuclear weaponry. (This means primarily those not already non-weapons signatories to the NPT, although the language presented here is not even reliant on the continued existence of the NPT.) To these ends and those discussed above, the concomitant text must be (a) nondiscriminatory, (b) conditioned upon the prevailing international security environment, and (c) simple enough to be broadly understandable and unambiguous. The text (with notes lettered *a*, *b*, *c* . . . given immediately thereafter) appears in Figure 1. It is nondiscriminatory in the sense that it applies equally to all potential adherents. This is also compatible with the thrust of arguments that have been presented both during the most recent NPT review on other occasions by India and Pakistan and many non-weapons signatories to the NPT.⁹

Not only is the signing of the type of declaration or treaty described here likely to be contingent on a broader international security context, continuation through stages of reduced limits on assembled nuclear explosives holdings would also undoubtedly be contingent on a number of events. First adherents should not perceive themselves to be threatened by a serious threat against which they feel it essential to continually refuse to reduce limits on their holdings of assembled nuclear explosives. Second, they would need to perceive others' procedures for accounting for special nuclear materials adequate to avoid unacceptable threats to their security. Substantial further reduc-

DECLARATION CONCERNING NUCLEAR EXPLOSIVES HOLDINGS

ARTICLE I *Limits on Possession of Nuclear Explosive Devices*

1. Beginning in (____)^a the number of nuclear explosive devices held by any country subscribing to this Declaration will be no more than (____).^b
2. Subject to the limitations under Article II of this Declaration, the limit on the number of nuclear explosive devices held by any country subscribing to this Declaration [hereinafter, Adherent] shall be reduced by a factor of (____)^c at the end of every subsequent (____)^d year period.

ARTICLE II *Exemptions from Lowered Limits*

1. Any Adherent may exempt itself from a lowering of the limit on the number of nuclear explosive devices it may possess by giving notice (____)^e years in advance of the effective date of such lowered limit. This notice shall include a statement of the reasons for its refusal to accept a lower limit.
2. The limit on the number of nuclear explosive devices held by any active Adherent shall not be increased.

ARTICLE III *Use of Special Nuclear Materials*

1. Each Adherent will enter in good faith into those negotiations necessary to provide assurances to other Adherents that international security will not be compromised by qualitative modifications of that country's nuclear arsenal.
2. As long as it subscribes to this Declaration, each Adherent will cooperate with measures necessary to assure other Adherents that special fissionable materials and tritium not required for nuclear explosive devices allowed under this Declaration shall not be used for construction of nuclear explosive devices.

ARTICLE IV *Additional Agreements*

This Declaration is intended to complement rather than substitute for other measures, including agreements and policies which further limit the production, testing, possession, or means of delivery of nuclear weapons.

ARTICLE V *Cancellation of Adherence*

Countries assenting to this Declaration will adhere to all of its provisions unless extraordinary events, related to the subject matter of this Declaration, have jeopardized the supreme interests of that country. Notice of cancellation of active adherence will be given to all other Adherents (____)^f days in advance, along with a statement detailing these extraordinary events.

^a The earliest starting date contemplated here is in 2000; the latest is in 2025.

^b The largest starting limit contemplated here is 25,000; the smallest is 1,000.

^c The largest reduction factor contemplated here is 4; the smallest is 1.06 (with any resulting fractional limits rounded down).

^d The longest time between limit reductions contemplated here is 25 years; the shortest is 1 year.

^e The most required advance notice contemplated here is 7 years and the shortest is 1 year. Adherents will agree that a statement of such notice should precipitate international conferences to review and try to overcome problems that provoked it. (Notice may also be given at any time subsequent to receipt of such notice from another Adherent, when such receipt substantively impacts a decision to accept lowered limits.)

^f The shortest interval for withdrawal on grounds of supreme interests suggested here is 3 days; the longest is 180 days.

FIGURE 1 The proposed text for a “Declaration Concerning Nuclear Explosives Holdings.”

tions would likely be contingent on well established histories of stability and transparency.¹⁰ This admittedly leaves to the future the details of sticky questions, such as the interaction of nuclear deterrence and the threat of other weapons of mass destruction, the minimum number that might be viewed necessary for prestige or security against conventional attack, etc. In the context of initiating the type of program discussed here, however, the simplicity allowed by such deferral may be as much a virtue as a fault.

SIMPLICITY

One possible concern about this approach is that underlying its apparent simplicity and potential universality is the complex panoply of auxiliary agreements just touched upon. This is understood here, and is unlikely to be lost on the world at large. The intention is to promote a common understanding that universal military denuclearization is indeed the ultimate goal, while realizing that successive steps in this direction must be built upon adequate previous accomplishments rather than just on air, whether thin or hot. The purpose of declaring a maximum target interval between successive stages of a nuclear weapons build down is not to ignore or vainly attempt to circumvent the difficulty of these accomplishments. Rather, it recognizes that deadlines can be useful in focusing international attention on accomplishing practical steps forward, both for the political and technical personnel involved and for the publics at large.

Another concern is the possible adoption of a timetable which is either unrealistically short or unnecessarily long. Plausible upper and lower limits in this regard are within the ranges given in the notes following the preceding sample declaration text. On the one hand, reductions by a factor of four much faster than every ten years (or the equivalent for smaller reduction factors at more frequent intervals) could create various unmanageable strains. This is possible even in the narrow organizational domain of technical monitoring of agreements on weapons grade nuclear materials, civilian nuclear programs, nuclear explosive assemblies, and ancillary facilities, delivery systems, etc. Widespread evolution of domestic political processes to accommodate a faster pace of military denuclearization could very well be even more problematic.

On the other hand, a commitment to work towards reductions equivalent to a factor of four only every 25 years (e.g., a factor of two only every 12 1/2 years . . . down to a c. six percent annual reduction¹¹) might be seen as a stimulus to do less than what otherwise might be practicable. This is part of the reason that Article IV was included in the declaration text given here. This Article should make it clear that additional agreements which go beyond the minimum specified military denuclearization measures are compatible with the text. There is also a technical imperative, with some practical implications, to this particular time scale. This is because it corresponds roughly to the half life of the tritium used in nuclear explosives of high yield to weight ratio. Under any agreement to work towards a build down no slower than this, the restart of tritium production would be a bellwether event that should attract considerable bureaucratic and international notice. Thus, while actually using tritium production agreements alone to force military denuclearization is well known to be problematic,¹² the half life of tritium is still potentially relevant. Consequently, both political and technical considerations suggest a lower limit on the specified build down rate of this order.

A further possible concern with the present suggestion revolves around the technical definition and political significance of “a nuclear explosive device.” We envision here an operational rather

than specificational definition. That is, procedures would be defined for assembling an international group of experts to devise one or more “inspection devices” whose operation would certify that a particular device was qualified as not being a “nuclear explosive device.” For plutonium implosion devices subject to reasonable shielding limits, physical limits on geometrical symmetry and mass of fissile material in an implosion device should make this manageable. The larger geometric variety of theoretically possible nuclear explosive devices containing highly enriched uranium might make such an operational definition somewhat more problematic, but imposing reasonable constraints upon the accumulation and configuration of highly enriched uranium should still allow the construction of such an operational definition. Attention would presumably be focused on the physical configuration and chemical state of any stored fissile materials, since the pieces of a “nuclear explosive device” might not necessarily all be stored in the same container or location. Note that an “inspection device” need not necessarily be designed if defined, constructed if designed, operated if constructed, nor report or store all of the information it processes if operated. The definition of a specified set of procedures for producing and operating a device which produces an operational “yes” or “no” answer is sufficient as long as countries declaring limits on their nuclear explosives holdings are convinced that this is adequate.

The political utility of a usable operational definition of nuclear explosive devices is another question. On the one hand, it is taken for granted here that a number of industrial countries will for the foreseeable future be able to rapidly construct many additional nuclear explosives no matter what the future of civilian and military nuclear industries.¹³ On the other hand, the political implications and practical danger posed by fertile, fissile, and fusionable materials can reasonably be said to change substantially when these materials have been fashioned into devices which can be armed and transported large distances in a matter of hours or minutes, whether this be within or outside of a pre-existing chain of command established for that purpose. Given a continuing technical ability to re-manufacture nuclear explosives, stimulus towards constructing a political and security environment which allows progressively more stringent limits on holdings of assembled nuclear explosives may be at least as important as reducing the holdings themselves. Thus, a concentration on numbers and mechanical configurations can be a small part of a means to an end as much as an end in itself.

ADVANTAGES AND DISADVANTAGES

It remains here to summarize potential advantages and disadvantages of promoting the type of “look before you leap” nuclear build down outlined here, and to briefly examine how its adoption might be implemented in practice.

Some potential advantages are as follows. First, the proposal is relatively simple and well defined and can be broadly understood. Thus, policymaker selectors as well as policymakers themselves should be better able to understand established goals and to judge whether they have been clearly agreed to and are being met.

Second, the proposal provides a potential mechanism for clarifying common goals of nuclear arms control in a manner more compatible with operational realities than some loftier international declarations and treaty preambles. Concerning operational realities, a starting limit in the neighborhood of 8,000 (including “spares”) at a year in the range 2003–2010 could constitute some progress in clarifying the current intentions of the US and Russia concerning deployed nuclear arsenals. Plan-

ning for a substantial numerical reduction a goodly time after this would primarily commit these countries to serious subsequent negotiations on nuclear weapons holdings compatible with some existing conceptual outlines of a START III treaty. Thus the operational realities here are broadly compatible with goals for these governments which are at least practicable, if currently muted. At the same time, the proposal made here leaves no nation beyond the pale of overall negotiations on nuclear arms control measures. It is also compatible with:

- the maintenance of independent European nuclear deterrence well into the readily foreseeable future;
- stated Chinese policy of producing nuclear weapons only because other countries have them;¹⁴
- India's insistence on progress towards non-discriminatory universal nuclear disarmament;
- Pakistan's stated willingness to participate in nuclear arms control initiatives if India does;¹⁵
- the type of time scale Israel likely visualizes in its willingness to at least contemplate a nuclear weapons free Middle East with adequate security arrangements;¹⁶ and
- a concept of "non-weaponized deterrence," at least wherever the technical lead time for weaponization is shorter than plausible political time scales for unraveling of an environment where actual holding of assembled nuclear explosives is not yet deemed essential.¹⁷

Third, incorporation of target time frames could provide an additional impetus for overcoming technical and political problems that might otherwise unnecessarily delay progress. There are historical examples of agreements with complex ramifications being reached relatively quickly given a joint commitment to proceed.¹⁸

Fourth, the irreversibility of successively smaller numerical limits—except in case of jeopardy to supreme national interest—holds out the hope of continued progress, at least in the absence of extraordinary complicating events. The importance of such hope is difficult to measure but easy to discount too heavily, and should not be overlooked.

Potential disadvantages of this proposal parallel and reflect some of the potential advantages. First, some governments or bureaucracies may not welcome a specific public commitment towards progress on more comprehensive arms control measures. To the extent that this reflects a desire to avoid political embarrassment, this can be mitigated by adopting longer time scales. To this extent it should also be viewed as an impediment in the path to adoption described below rather than a disadvantage of adopting the proposal per se. However, a concern is sometimes expressed that heightened public interest can lead to more rapid adoption of flawed implementation agreements rather than more leisurely adoption of better ones. The reader can judge whether institutional inertia is likely to sufficiently mitigate this putative disadvantage in the present context.

Second, it may be posited that underlying international disagreements about the ultimate purpose of nuclear arms control are so serious that progress can best be made in the context where the ultimate purpose remains ambiguous. This is a somewhat cynical view, but that alone does not make it incorrect. It seems likely, however, that very limited progress can actually be made under such circumstances. Something of a vampire syndrome is also possible, where these disagreements are indeed real but can be substantially reduced with sufficient public exposure. Thus, relatively little may be lost and much gained in the process of attempting to make more explicit the goals of nuclear arms control.

A third and related concern is that an attempt at a time bound approach to nuclear build down could “overload the agenda.” Even if hiding underlying disagreements on purpose is not essential to progress, it could be essential to timely progress. That is, extended discussion of this type of essentially procedural could take time and energy away from the practical work of negotiating the requisite individual detailed auxiliary agreements. On the other hand, some agreement on over-arching purpose and procedure could substantially facilitate the process of achieving related agreements with more technical substance. The increased attention on the whole process that consideration of this type of proposal could generate might facilitate progress on other needed agreements, rather than detract from progress on them. In other words, the purpose of the present proposal is neither to encompass nor to substitute for other agreements which would presumably be essential for its continuing success, but rather to complement them.

Fourth, the counterpart to providing a vehicle for hope for continued progress is the possibility of breeding despair and cynicism if proposed targets are not met. The antidote here is choosing targets and timing as realistically as possible, even in the face of a perceived moral or practical imperative to move faster. Mankind may need to live for centuries or even millennia with a real possibility that nuclear weapons will decimate civilian populations. It may be both more important and sufficient that we make steady progress in the direction of reducing this danger than that we make progress as rapidly as is theoretically conscionable or practicable. One danger posed by a very long time scale is that the issue may drop off the agenda almost altogether for part of a generation, but a solution to this is to target smaller reductions over smaller time intervals.

IMPLEMENTATION

No doubt it could be a long and rocky road to widespread official adoption of the type of declaration given here (much less of a treaty based on it). Filtering the attention of governmental decision apparatuses will be institutions with alternate and even contrary priorities and agendas. Suppose, nevertheless, that attention can be focused on this question. Even then, it will be a large psychological and institutional leap for many to even seriously contemplate a continual progress towards nuclear disarmament, however gradual and tentative. This can be expected despite the fact that the current proposal can be adapted so as to make no binding commitment beyond nuclear arms limitations being unilaterally adopted by all current holders of nuclear weapons technology. It is, indeed, the crafting of a mechanism for precipitating this psychological leap that is the essence of the present proposal.

It would indeed be surprising if a sufficient number of nuclear weapons capable governments were prepared to adopt such a declaration (or sign such a treaty) without extensive prior discussion in other forums. Non-governmental and/or international governmental organizations are more likely venues for early discussion and support of such a proposal. In some cases, the idea that a practicable mechanism for approaching steady progress towards nuclear disarmament could now be at hand may require a different kind of psychological leap: from a prompt abolitionist perspective into the practicalities of obtaining the broad official adoption of such a proposal. Those who would press for a faster pace than the fastest contemplated here may be hard pressed to explain how this might actually occur in practice.

A specific path for adoption something along the lines of the present proposal could proceed as follows. First, a number of interested non-governmental organizations could consider both the general approach and the specific range of numbers they could support in a declaration of the type outlined here. Second, one or more international governmental forums could repeat this process. With a specific suggested text prepared governmental consideration, it could then be determined if enough consensus exists to announce a willingness to join in such a declaration. With an overlapping set of agreeable numbers determined, a final text could then be prepared either in the form of an agreed to declaration or a treaty draft, or both.

The proposal made here is but one of innumerable others related to the future of nuclear explosives.¹⁹ Some of these have dealt specifically with gradually decreasing numerical limits on nuclear weapons holdings. Features that set the present proposal apart from many others are scope, specificity, flexibility, and timing. The present proposal deals not just with specific problems such as nuclear testing or fissile material production but with reductions and possible eventual elimination of nuclear explosive holdings themselves. It allows for specification of particular numerical limits and timing but provides flexibility to those who will not commit to them long before encountering the international environment in which they would take effect. As such, it may offer a useful overview of where nuclear arms control is heading, without trying to map out the route for a distant future in more detail than is presently practical.

What additionally sets this proposal apart from others is its timing. The end of the Cold War and 1997 in particular have painted a completely new backdrop for the consideration of such proposals. 1997 left the world with many signatures on complete text and with specified implementation mechanisms for a comprehensive nuclear test ban. However, 1997 left India, projected to become the world's most populous nation, still in disagreement with entry into force of the Comprehensive Test Ban Treaty (CTBT).²⁰ The next stated goal of many nations, a universal cut off of production of fissile materials that can be used in nuclear weapons programs, will be much more problematic, especially in the absence of an underlying agreement concerning the expected future of holdings of nuclear weapons and all previously produced fissile materials. In this context, the current proposal provides one potential mechanism for helping resolve disparate approaches to the future of nuclear explosives.

The present proposal should, in principle, not be fundamentally objectionable to any actual or potential nuclear weapons state, whether it be a signatory or critic of the NPT or CTBT. It would be interesting to see what objections might be raised in practice, and how they may be overcome.

NOTES

1. Among many references that essentially make this argument is “Statement of the Pugwash Council,” *Pugwash Newsletter* (July/October 1995): 21.
2. Examples include National Conference of Catholic Bishops, “Gods’ Promise and our Response,” in *Catholics and Nuclear War*, ed. P. Murnion (New York: Crossroad, 1983); “Summary and Perspective: with Some Observations on Informed Consent,” in *The Medical Implications of Nuclear War*, National Academy of Sciences Institute of Medicine (Washington: National Academy Press, 1986), 583.
3. As, for example, in Robert Lifton and Greg Mitchell, *Hiroshima in America, Fifty Years of Denial* (New York: C. P. Putnam’s Sons, 1995).
4. See Richard Falk, “Nuclear Weapons and the End of Democracy,” chapt. 3 in *The Promise of World Order*, (Philadelphia: Temple University Press, 1987).
5. A recent relevant debate is in Ken Waltz and Scott Sagan, *The Spread of Nuclear Weapons, A Debate*, (New York: W. W. Norton, 1995).
6. See George Rathjens, “The Conditions Necessary for Complete Disarmament—The Case for Partial Nuclear Disarmament,” in *A New Design for Nuclear Disarmament*, eds. William Epstein and Toshiyuki Toyoda (Nottingham: Bertrand Russell Peace Foundation, 1977).
7. Recent statements on these include “U.S. Arms Control Policy: Progress and Prospects,” *Arms Control Today* (March 1996): 7; Hans Blix, “The IAEA, United Nations, and the New Global Nuclear Agenda,” *IAEA Bulletin* (September 1995): 3.
8. The “lack of national consensus to negotiate” is cited as a barrier in George Bunn, “Nuclear Arms Control: Obstacles to Agreement,” in *Reassessing Arms Control*, eds. David Carlton and Carlo Schaert (New York: St. Martin’s Press, 1984), 81.
9. See Blix, “New Global Nuclear Agenda”; Arundati Ghose, “India’s Stand on CTBT,” *Times of India*, June 21, 1996.
10. While it seems likely to the author that a continuing process of reducing limits on nuclear weapons holdings might eventually most practically proceed in much smaller increments, space considerations limit us to commenting only on possible practical requirements reaching stages of reductions of factors of c. 4 from an early limit of, say, c. 8,000. A limit of c. 2,000 would likely require some type of subsidiary U.S.–Russian strategic arms control agreement (e.g. a third Strategic Arms Reduction Treaty), an limits of 500 or less would likely require a history of stable cooperation between countries holding a comparable number, and limits of c. 125 or less also considerable confidence in a universal regime controlling the stockpiles and production of fissile materials and tritium and sufficient transparency that the possibility of very-large-yield weapons does not become a concern.
11. Jeremy Stone, “Deep Reductions: Old Arguments Confront New Realities,” *Journal of the Federation of American Scientists*, (September 1989), 1, refers to this particular possibility and notes that percentage annual reductions were proposed by President Carter at the Vienna Summit (in a considerably different historical context than the present one at the signing of the SALT II Treaty in 1979).
12. David Albright and James Beard, “The Tritium Follies,” *Bulletin of the Atomic Scientists* (November 1989), 42, review the large initial stocks and some of the possibilities for reconfiguring arsenals to stretch out tritium supplies. These make controls on tritium alone a problematic arms control measure, unless it is at least implicitly assumed that no tritium is available for weapons purposes as would ideally be the case following the suggestion of Pervez Hoodbhoy and Martin Kalinowski, “The Tritium Solution,” *Bulletin of the Atomic Scientists* (July/August 1996), 41.
13. Among many comments on the irreversibility of the ability to construct nuclear weapons is Kathleen Bailey, *Strengthening Nuclear Nonproliferation* (Boulder: Westview Press, 1993).
14. See Sha Zukang, *Article IV of the Nuclear Non-Proliferation Treaty, A Chinese Perspective*, Director’s Series on Proliferation, Lawrence Livermore Laboratory, Livermore, CA, UCRL-LR-114070-5 (August 1994), 71.
15. Views of pundits and several officials on these questions are extensively reported upon in *Clippings on Nuclear in South Asia*, January through April 1996, and in *Regional Press Digest on Nuclear Issue in South Asia*, May 1996, from the Bangladesh Institute of International Studies, Dhaka and the Regional Center for Strategic Studies, Colombo.
16. This possibility is discussed, e.g., by Mohammed Shaker, *Prospects for Establishment of a Zone Free of Weapons of Mass Destruction in the Middle East*, Director’s Series on Proliferation, Lawrence Livermore Laboratory, Livermore, CA, UCRL-LR-114070-5 (October 1994), 21.

17. Stephen Cohen continues the theme of “non-weaponized” deterrence in “The Status of Regional Nuclear Programs,” in *Regional Security in South Asia*, ed. David Law (Kingston, Ontario: Queen’s University Centre for International Relations, 1995), 21.

18. An example is test ban negotiations in 1963; c.f. Marvin Goldberger, “The Future of Arms Control,” in *Reykjavik and Beyond*, National Academy of Sciences Committee on International Security and Arms Control (Washington: National Academy Press, 1988), 58.

19. An interesting recent example is from the Steering Committee Project on Eliminating Weapons of Mass Destruction chaired by Andrew Goodpaster, *An Evolving U.S. Nuclear Posture* (Washington: Henry Stimson Center, 1995).

20. John Burns, “India, Old Foe of Atom Arms, Stops Test Ban,” *New York Times*, August 17, 1996, p. A1, reports former Indian Prime Minister Gowda’s rejection of the CTBT. Former Indian Minister of External Affairs I. K. Gujral expanded upon the reasons for this, e.g. in written and oral comments delivered at the University of Illinois in Chicago on September, 1996, supporting the present author’s inference that some initiative supported by one or more declared nuclear weapons states, perhaps along the general lines described here, may be necessary and perhaps ultimately mostly sufficient for an eventual accommodation with India concerning its nuclear weapons option.