FAUSTIAN BARGAIN 2000:

WHY 'STOCKPILE STEWARDSHIP' IS FUNDAMENTALLY INCOMPATIBLE WITH THE PROCESS OF NUCLEAR DISARMAMENT

by Andrew Lichterman
and Jacqueline Cabasso

Revised and Updated
May 2000

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Western States Legal Foundation is a founding member of the
Abolition 2000 Global Network to Eliminate Nuclear Weapons

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Western States Legal Foundation (WSLF) is a non-profit, public interest organization founded in 1982, which monitors, analyzes, and challenges U.S. nuclear weapons programs and policies with a focus on the national nuclear weapons laboratories. WSLF recognizes that, even if never again used in war, nuclear weapons negatively impact the environment, the economy, the role of violence in society, and democracy itself. Rather than enhancing our "national" security, nuclear weapons threaten our fundamental human security. WSLF seeks to abolish nuclear weapons, compel open public environmental review of nuclear technologies, and ensure appropriate management of nuclear waste. Grounded in nonviolence and rooted in both international and environmental law, the principle guiding WSLF's activities is democratization of decision making affecting nuclear weapons and related technologies. WSLF is a founding member of the Abolition 2000 Global Network to Eliminate Nuclear Weapons.

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TABLE OF CONTENTS

INTRODUCTION

Our first edition of *Faustian Bargain*, released at the Nuclear Nonproliferation Treaty (NPT) Preparatory Committee meeting in April 1998, concentrated on the obstacles posed to nuclear disarmament by the facilities and programs the United States claimed were necessary to maintain its nuclear weapons stockpile while purportedly complying both with the recently signed Comprehensive Test Ban Treaty (CTBT) and with its NPT obligations to move towards elimination of nuclear arsenals. The official position at the time was that the United States was not designing new nuclear weapons, and although there was considerable variation and ambiguity in official statements concerning the pace of nuclear disarmament, the U.S. government still was trying to portray itself as serious, if cautious, about nuclear disarmament.

Although at the time there already was considerable evidence that the U.S. was in fact recommitting itself to nuclear weapons as a core element of its military forces, both in policy and in practice, and evidence as well that the U.S. was indeed engaging in continuing nuclear weapons research and design efforts which would result in the deployment of weapons with improved military capabilities in the near term, we chose to take the relatively conservative approach of listing the incompatibilities between the types of steps to nuclear disarmament put forward by many commentators and the capabilities of the new nuclear weapons facilities and programs then going forward in the U.S. nuclear weapons complex. We provided evidence that despite official rhetoric designed to give the impression that nuclear weapons were being de-emphasized, military doctrine documents suggested that the role of nuclear weapons in some ways was being expanded, with extensive planning in progress for using nuclear weapons in a "counterproliferation" role against possessors of weapons of mass destruction, including non-nuclear weapons states. We also provided evidence that there were ongoing weapons design activities well suited to this expanded nuclear weapons role – for example the design and deployment of the B61-11 gravity bomb, a modification of an existing design to create a variable yield, earth-penetrating weapon which could be delivered by the B-2 Stealth bomber. We explored some of the long-term dangers posed for a nuclear disarmament regime by the new generation of nuclear weapons laboratory testing and simulation facilities, such as the possible development of "pure fusion" nuclear explosives which would not require fissile materials. Nonetheless, we took the somewhat optimistic position of framing these activities as practical obstacles to a path to disarmament, implying that these activities were the consequence of institutional inertia and the ability of powerful public institutions in complex societies to obtain resources even when their activities were not wholly consistent with the policies of their government.

In the intervening years, it has become clear that there was a struggle within the U.S. government during the early to mid-1990's over the "proper" role for nuclear weapons. This struggle was to determine whether nuclear weapons would remain a central part of U.S. military plans for the indefinite future, and whether their role would in fact be expanded to include a central role in U.S. plans to counter weapons of mass destruction (and hence in military planning in the regions and conflicts where U.S. forces are likely to be most active);[1] or whether instead there would be a sustained effort to reduce nuclear forces first to a residual arsenal intended and with its force structure adapted solely for the task of deterring the use of nuclear weapons by others, and then, taking the enhanced stability and changed world of greatly reduced levels of

nuclear threat in all aspects as the basis from which to eliminate nuclear arsenals altogether. The evidence is overwhelming that those in favor of keeping and continually modernizing a large, diverse, and flexible nuclear arsenal aimed not only to deter use of nuclear weapons but to deter, and perhaps pre-empt, a wide variety of perceived military threats, largely have won.[2] Although there is some debate over the details, it appears that on fundamental matters – the decisions to keep a stockpile of deployed and reserve nuclear weapons numbering in the thousands for the foreseeable future, to retain and where thought necessary construct the facilities to rebuild an even larger nuclear arsenal, and to pursue a vigorous program of nuclear weapons development aimed both at obtaining new information about how nuclear weapons work and at refining nuclear weapons to achieve new military capabilities for expanding nuclear weapons roles – the nuclearists have prevailed.

U.S. officials at the highest levels now emphasize that all of the current roles for nuclear weapons will continue for the foreseeable future, from the capability to destroy the military and industrial infrastructure of Russia to theater deployments for threat and potential use against possessors of chemical and biological weapons. Secretary of Defense William Cohen, in his February 2000 Annual Report to the President and Congress, stated that

> Deterring aggression and coercion on a day–to–day basis requires the capabilities needed to respond to the full range of crises, from smaller–scale contingencies to major theater wars. It also requires the maintenance of nuclear forces sufficient to deter any potential adversary from using or threatening to use nuclear, chemical, or biological (NBC) weapons against the United States or its allies, and as a hedge against defeat of U.S. conventional forces in defense of vital interests....[3]
>
> Nuclear forces are an essential element of U.S. security, serving as a hedge against an uncertain future and as a guarantee of U.S. commitments to allies. Accordingly, the United States must maintain survivable strategic nuclear forces of sufficient size and diversity--as well as the deployment of theater nuclear weapons to NATO and the ability to deploy cruise missiles on submarines--to deter or dissuade potentially hostile foreign leaders with access to nuclear weapons. The United States continues to work toward further agreed, stabilizing reductions in strategic nuclear arms. Once the Treaty on Further Reduction and Limitation of Strategic Offensive Arms (START II) has entered into force, the Department is confident that it can maintain the required deterrent at the force levels envisioned in a future treaty (START III), as agreed to in the March 1997 Helsinki Summit and reinforced at Cologne, Germany, in June 1999.[4]

Defense Secretary Cohen emphasizes as well that the political role of NATO nuclear deployments will continue – "U.S. nuclear forces based in Europe and committed to NATO provide an essential political and military link between the European and North American members of the Alliance, and permit widespread European participation in all aspects of the Alliance' s nuclear role.[5]"

A noteworthy aspect of Cohen's 2000 Report to Congress is the statement that requirements for these ambitious varied nuclear weapons missions all can be met, furthermore, with the reductions envisioned under START II and even START III.[6] And it is equally clear that the United States, despite self-serving statements made in contexts where it is under pressure

to show progress on disarmament, has no plans to reduce the essential character or significance of its nuclear arsenal. U.S. negotiating documents supporting Anti-Ballistic Missile Treaty (ABMT) negotiations summarizing arguments intended to persuade Russia that a "limited" U.S. ABM system would not be a threat to its nuclear deterrent stated that

> "Both the United States and the Russian Federation now possess and, as before, *will possess under the terms of any possible future arms agreements,* large, diversified, viable arsenals of strategic offensive weapons consisting of various types of ICBM's, submarine-launched ballistic missiles, and heavy bombers." (Emphasis added.)[7]

The determined pursuit of ballistic missile defenses by the dominant factions within U.S. policy elites, then, is occurring with full cognizance that ballistic missile defenses will make meaningful progress towards the *elimination* of nuclear arsenals (as opposed to the rationalization of arsenals driven to immense heights by the excesses of Cold War ideology[8]) impossible.

In addition, the more extreme nuclear weapons advocates in the in the United States – an influential group within the larger pro-nuclear faction which appears to be prevailing in most relevant policy disputes – are pushing for even more vigorous nuclear weapons development, and for a decisive repudiation of the Comprehensive Test Ban Treaty (CTBT). The defeat of CTBT ratification and the character of the debate which preceded it, often portrayed as an aberrant symptom of a national politics polarized by personal and petty animosities, in fact manifested the real state of affairs within U.S. elites on things nuclear. There are indeed factions within American political elites on these issues, but they are by no means temporary, nor explainable by the surface politics of Democrats and Republicans. Those believing that nuclear weapons should have a permanent and significant role in maintaining U.S. military preeminence are a well organized, powerful, and in the current political context dominant force in U.S. politics on national security affairs. Perhaps even more disturbing is the fact that the spectrum of opinion acceptable among political elites today runs from vigorous advocacy of nuclear explosive testing as a necessary tool for the development of (equally necessary) new nuclear weapons designs, on the one hand, to defense of the CTBT as a means of assuring U.S. nuclear weapons superiority for the foreseeable future on the other. Nuclear disarmament simply is not, in the jargon of the pundits who daily declare the limits of reasonable debate, "on the screen."

Senator Jesse Helms, a leading advocate of nuclear weapons and chairman of the Senate Foreign Relations Committee, warned that the CTBT

> will prevent the United States from developing new weapons to counter new technological advances by adversaries. Nuclear testing is essential to such modernization. Without it, the nuclear triad will become obsolete....
>
> Indeed, nuclear weapons modernization is generally driven either by new mission requirements, or by non-nuclear technological evolution in defensive systems. For instance, during the cold war, advances in air defense and anti-submarine warfare created needs for new weapons.....
>
> Without the ability to test and modernize, the airmen and sailors aboard our bombers and submarines will be put at increased risk as they try to perform their duties with obsolete technology. Senators should think carefully about the implications of the

CTBT, and the risk it poses-- not just to the nuclear weapons themselves--but to our servicemen.

Our clear, future need facing the United States is the requirement to develop new or modified warheads to respond to developments in missile defense--particularly in the area of directed energy. It would be impossible to adapt to such developments under a complete test ban. Further, without the ability to design new weapons, such as a warhead optimized to kill biological plagues or to destroy deeply-buried targets, the U.S. will be unable to respond to serious emerging threats to our security. I could not agree more with one of the former Directors of Lawrence Livermore National Laboratory, Dr. Roger Batzel, who warned that; 'A nuclear arsenal which is unable to keep pace with a changing security environment is unlikely, in the long run, to prove much of a deterrent.'[9]

This view is not an isolated one; it is echoed by many leading figures in the U.S. military and political establishment. Particularly noteworthy is the large number of influential people in military and "national security" circles both inside and outside the current government who, regardless of their public position on the CTBT, agree that the U.S. must maintain a nuclear arsenal for the foreseeable future, and that nuclear weapons with new military capabilities are likely to be needed in the future. [10]

The viewpoint of the Clinton administration on the CTBT was summarized by Secretary of State Madeline Albright in the wake of the ratification defeat, in a speech in which she made it clear to the Senate and the American people that the administration views the CTBT solely as a nonproliferation measure, not a step towards nuclear disarmament for the United States:

Our nation' s most experienced nuclear weapons scientists have examined very carefully the possibility that our weapons will degrade without testing. They have recommended steps that will enable us to retain confidence in the safety and reliability of our arsenal under CTBT, including a robust program of Stockpile Stewardship. These steps were incorporated in a package of understandings that accompanied the Treaty when it was submitted to the Senate.

We simply do not need to test nuclear weapons to protect our security. On the other hand, would-be proliferators and modernizers must test if they are to develop the kind of advanced nuclear designs that are most threatening. Thus, the CTBT would go far to lock in a technological status quo that is highly favorable to us.

There is, moreover, even another layer of protection for American security. If the day should come when our experts are not able to certify the safety or reliability of our nuclear arsenal--or if the Treaty is not working, and new threats are arising that require us to resume nuclear tests--we will have the right to withdraw from the Treaty.[11]

The "technological status quo" referred to by Albright refers to a U.S. nuclear arsenal which is not static, but rather is being constantly modernized and upgraded. The type of nuclear weapons research and development favored by Senator Helms is in fact continuing, even if not at the pace preferred by the most extreme nuclear weapons advocates. Today, the cycle of nuclear weapons design continues, despite the fact that the United States last exploded a nuclear weapon underground in 1992.

Despite the end of the Cold War and its obligation under the NPT to negotiate in good

faith to end the arms race and eliminate nuclear weapons, the U.S. has publicly stated that "[n]ational security policies in the post-Cold War era require that all historical capabilities of the weapons laboratories, industrial plants, and NTS [the Nevada Test Site] be maintained," and that "denuclearisation... is not feasible based on current national security policy."[12] To sustain this vast complex of nuclear weapons facilities, the U.S. is spending over $4.5 billion dollars a year on the "Stockpile Stewardship" program, more than was spent on average during the Cold War on directly comparable activities.[13]

And in fact, this money is buying far more than what is needed to maintain "all historical capabilities." In addition to keeping its nuclear test site ready for the resumption of full scale underground tests, the U.S. Department of Energy (DOE) is spending billions on new and more advanced nuclear weapons research and production facilities.

These include:

- The National Ignition Facility (NIF), now being built at the Livermore National Laboratory in California. The NIF is a laser driven fusion machine the size of a football stadium, designed to create very brief, contained thermonuclear explosions. It is slated to be used for a wide range of applications from training weapons designers in nuclear weapons science to nuclear weapons effects testing.

- The Dual Axis Radiographic Hydrotest Facility (DARHT). This facility, near completion at the Los Alamos National Laboratory in New Mexico, will join several already existing facilities where mockups of primaries, the first stage of a thermonuclear weapon, are imploded while very fast photographic or x-ray images are generated, thus allowing scientists to "see" inside. DOE already is developing technology for an even more sophisticated "hydrodynamic testing" facility, the Advanced Hydrotest Facility.

- Pulsed power technologies: Further experiments exploring the extreme conditions created in a nuclear weapon explosion are studied using various types of "pulsed power," in which a large amount of energy is stored up and then released very quickly in a small space. The energy source can be chemical high explosives or stored electrical energy. Pulsed power facilities at both DOE and Department of Defense laboratories are used to explore nuclear weapons function and effects and directed energy weapons concepts, and could lead over the long run to a wide range of high technology weapons, including new types of nuclear weapons.

The data streams from these and other experimental facilities, along with that from "subcritical" tests and the archived data from over 1000 past U.S. nuclear tests, will be integrated via the Accelerated Strategic Computing Initiative (ASCI), a multi-billion dollar supercomputing program which reaches beyond the weapons laboratories, seeking to incorporate the nation's leading universities into an effort to attract and train yet another generation of nuclear weapons designers. Smaller, modernized nuclear weapons production processes are being developed to allow flexible, small lot manufacturing, with contingency plans for resumption of large-scale production. DOE also plans to use improved computer-aided design and manufacturing echniques to shorten the nuclear warhead design and production cycle.

In addition, the Nevada Test Site remains both in readiness for resumption of underground testing and in use for a wide range of weapons experiments, including "subcritical" tests in which high explosives and plutonium are exploded underground without a self-sustaining nuclear reaction. Similar tests also can be conducted in steel tanks above ground at the Los Alamos National Laboratory, using an isotope of plutonium with a higher critical mass than that used in weapons. This procedure may allow weapons designers to use test devices which more closely resemble nuclear weapons primaries, the first stage of thermonuclear warheads. Although these are tests only of materials and components rather than full nuclear warheads, the Stockpile Stewardship program of which they are a part is intended to provide increasingly advanced capabilities to integrate data from a variety of testing techniques into simulations of nuclear weapons performance.

When conducted underground at the same site used for full-scale nuclear weapons tests, subcritical experiments make verification of a test ban more difficult, and manifest to the world both the existence of a vigorous nuclear weapons research program and the intention to retain the capability for full-scale underground tests. While no verification regime can provide absolute certainty, closing all nuclear test sites and terminating "subcritical" tests which can resemble nuclear explosive tests when monitored from a distance would help simplify verification, while increasing international confidence that the nuclear weapons states were scaling back their weapons development efforts.

This array of facilities can be used to do more than merely maintain existing nuclear warheads in working order. As Sandia National Laboratory director C. Paul Robinson noted in his testimony to the Senate Armed Services Committee on the CTBT, while the national laboratories "cannot create completely new concepts without testing, many previously tested designs could be weaponized to provide *new* military capabilities." Robinson observed that

For example, if nuclear weapons emerge as the right answer to deter the use of other weapons of mass destruction in a regional conflict, the nuclear weapons we currently deploy may carry too high a yield and be far too disproportionate a response to be a credible deterrent. Proven designs of lower yield exist that might be adaptable for new military requirements in the future. I believe that such weapons could be deployed this way without the need for nuclear tests.[14]

As noted earlier, one such modification, the B61-11 gravity bomb, already has been developed and deployed without underground testing. Under the rubric of exercising Stockpile Stewardship capabilities, the weapons laboratories also are developing replacement warhead designs for submarine launched ballistic missiles (SLBM) carried on Trident submarines. Upgrades of non-nuclear components currently underway for existing deployed warheads could result in increases in accuracy for a substantial portion of the SLBM warhead inventory.[15]

This ongoing program of intensive nuclear weapons research, design, and testing has fostered widespread doubts about U.S. commitment to "good faith" negotiations for nuclear disarmament required by the Non-Proliferation Treaty, and has provided arguments and political cover for those in other states who favor nuclear weapons development to question the purposes of both the CTBT and the nonproliferation treaty regime. Indian Prime Minister Atal Bihari

Vajpayee, for example, stated shortly after India's 1998 round of nuclear weapons tests that "taken as a whole, the CTBT is discriminatory because it allows nuclear weapons states with advanced technology capabilities to continue their nuclear weapons programme. And so also is Nuclear Non-Proliferation Treaty (NPT). There is no question of India accepting any treaty that is discriminatory in character."[16]

If there is any U.S. "leadership" on nuclear weapons issues, it must appear to the world to be heading in the wrong direction. Rather than seeking multilateral solutions to international conflict and lowering tensions by disassembling the enormous military machinery of the Cold War, the United States is setting the pace for a new century of high technology arms competition, with a constantly modernized nuclear arsenal still brandished as the ultimate threat.

BACKGROUND

In June 1997, the U.S. National Academy of Sciences (NAS) released a report entitled The Future of U.S. Nuclear Weapons Policy. The report recommended fundamental changes in United States nuclear weapons policy, suggesting negotiation of rapid U.S. and Russian forces reductions that would "begin with a quick cut to about 2,000 deployed strategic warheads each as envisioned in the Helsinki summit, then move to reductions to a total inventory of about 1,000 warheads each, and finally to a *total* inventory of a few hundred warheads on each side." (Emphasis in original.)[17] The report went on to explore "the conditions under which it might be possible to prohibit nuclear weapons altogether and possible paths to reach that goal," [18] stating that "[a]fter considering the[] risks and benefits, the committee has concluded that an essential long-term goal of U.S. policy should be the creation of international conditions in which the possession of nuclear weapons would no longer be perceived as necessary or legitimate for the preservation of national security and international stability."[19] In its analysis, the NAS also called into question other important aspects of current U.S. nuclear weapons policy which were receiving little public debate, including the use of nuclear weapons to deter the proliferation or use of chemical and biological weapons, the maintenance of a large arsenal of reserve nuclear warheads as reductions in deployed strategic arsenals go forward, and the indefinite retention of a nuclear weapons complex sufficient to rapidly reconstitute a substantial nuclear arsenal.

The NAS report was one of several proposals for systematic approaches to nuclear disarmament being advanced by mainstream arms control groups, beginning with substantial steps to be taken immediately. These proposals, ranging from the report issued in August 1996 by the Canberra Commission on the Elimination of Nuclear Weapons,[20] to the Stimson Center's "Building a Nuclear-Weapon-Free World,"[21] and others, had certain general elements in common. All saw adherence to the CTBT as an historically important nonproliferation and disarmament measure. All suggested that rapid, deep cuts in nuclear arsenals were achievable. All saw strict accounting for weapons-useable nuclear materials as a central element of a workable verification regime. And all contemplated a verification system that would be likely to require intrusive on-site inspections of nuclear weapons facilities at some point before elimination of existing arsenals could be accomplished, thus requiring an unprecedented degree of transparency of highly secretive military research, testing, and arms production activities. Another common element was the recognition that a greater commitment must be shown by the world's leading nuclear power if the ultimate goal of nuclear disarmament is to be achieved.

These proposals, however, were being advanced in a context where U.S. government policy assumed that a substantial nuclear arsenal would be retained indefinitely, and in which the U.S. planned to build and operate a modernized nuclear weapons research, development, testing and manufacturing complex with greater research and experimental capabilities than were available during the Cold War. This upgraded nuclear weapons infrastructure, lavishly funded as the so-called *"Stockpile Stewardship and Management"* (SS&M) program, will maintain the capability to design and develop new weapons. It also will encompass both a test site capable of rapid resumption of full scale underground testing and a substantial nuclear warhead production capacity which is intended to allow rapid, flexible warhead prototyping and production, computer-integrated with a new suite of high-tech, state-of-the-art experimental facilities at the weapons laboratories.

The 1996 Department of Energy (DOE) Programmatic Environmental Impact Statement for SS&M laid out the premise of this program and explained how it would work:

> *"National security policies in the post-Cold War era require that all historical capabilities of the weapons laboratories, industrial plants, and NTS [Nevada Test Site] be maintained... Stockpile stewardship and management capabilities are independent of foreseeable stockpile sizes*." (Emphasis added.)[22]

> "Stockpile *stewardship* comprises the activities associated with research, design, development and testing of nuclear weapons, and the assessment and certification of their safety and reliability. These activities have been performed at the three DOE weapons laboratories and the Nevada Test Site (NTS). Stockpile *management* comprises operations associated with producing, maintaining, refurbishing, surveilling and dismantling the nuclear weapons stockpile. These activities have been performed at the DOE nuclear weapons industrial facilities." (Emphasis added.)[23]

> "Understanding nuclear weapon performance requires knowledge of the performance of the individual elements: the primary (pit and HE [High Explosive]), the secondary, and the functional interaction between the primary and the secondary inside the case... This requires two principal elements: *advanced computational models and facilities to provide experimental data that can be used to adjust (normalize) the computational models in conjunction with past nuclear test data."* (Emphasis added.)[24]

Further, the document made clear that SS&M is contemplated as a long-term plan:

> *"The stockpile stewardship program is expected to continuously evolve* as better information becomes available and technological advancements occur. DOE is in the *early planning stages* for a number of what can be described as '*next generation'* stewardship facilities." (Emphasis added.)[25]

The U.S. plans to keep the entire SS&M complex operational throughout the full course of any conceivable future disarmament negotiations, right down to zero -- the point where all existing nuclear warheads have been eliminated -- and perhaps beyond:

> *"Stockpile stewardship capabilities are currently viewed by the United States as a means to further U.S. nonproliferation objectives in seeking a 'zero-yield' CTBT.* Likewise, it would be reasonable to assume that U.S. confidence in its stewardship capabilities would remain as important, if not more important, in future arms control negotiations to reduce its stockpile further. The path to a very small (10s or 100s) or zero stockpile would require negotiation of complex international treaties, most likely with provisions that require intrusive international verification inspections of nuclear weapons related facilities. Therefore, DOE believes it reasonable to assume that complex treaty negotiations, when coupled with complex implementation provisions, would likely stretch over several decades. *On a gradual path to a very small or zero stockpile, stockpile size alone would not change the purpose and need, proposed actions, and alternatives... as they relate to stewardship capabilities. The issues of maintaining the core competencies of the United States in nuclear weapons, and the technical*

problems of a smaller, aging stockpile in the absence of nuclear testing, remain the same.... While [DOE] does not directly consider the closure of the weapons laboratories and NTS, *it is not at all clear what nuclear weapons capabilities the U.S. would retain even if it decided on a zero stockpile*." (Emphasis added.)[26]

Conclusion of CTBT negotiations by 1996 was the most solid commitment the United States and other nuclear weapon states made in exchange for the acquiescence of non-nuclear weapon states in 1995 to the indefinite extension of the Nuclear Non-Proliferation Treaty (NPT). For the CTBT regime to be fully established, the Treaty must "enter into force" based upon its ratification by the 44 states that have commercial or research nuclear reactors (a recognition that nuclear power is the foundation for a nuclear weapons program). It is generally agreed that observance of the ban on underground test explosions is a necessary (though not sufficient) condition for the long-term viability of the non-proliferation regime, as the 1995 negotiations concerning the extension of the NPT illustrated. In the U.S., the laboratories and DOE have presented expanded laboratory capabilities as a *sine qua non* for ratification of the CTBT.

The highly debatable proposition that rebuilding a huge nuclear weapons research, development, testing and production complex and planning to maintain it for decades to come is somehow *essential* if the U.S. is to ratify the CTBT and thus to meet its nonproliferation objectives has been asserted as an unquestionable axiom in every official American public discussion on the future of the nuclear weapons complex. While not intuitively obvious to those unfamiliar with the politics of U.S. arms control, what is behind this seemingly incongruous idea is a Faustian bargain which if allowed to stand unchallenged will create significant long-term problems in terms of both horizontal and vertical proliferation. The nuclear weapons laboratories and their allies in the military and Congress, it is hoped, will accept a ban on full-scale underground nuclear explosions (which on the surface *appears* to mark the beginning of the end for nuclear weapons) in exchange for a nuclear weapons research and testing program of Cold War proportions that will keep nuclear weapons in the arsenal, in the budget, and in the career paths of scientists well into the next century.[27]

The "necessity" of conditioning acceptance of the CTBT on the establishment of a robust SS&M program has been reiterated at every opportunity by officials from DOE and its Livermore, Los Alamos, and Sandia nuclear weapons laboratories. Distinguished panels of experts, consisting primarily of past, present, and potential future employees of DOE, the Pentagon, and their corporate contractors have been engaged to provide "outside" reviews, which have been unremarkably predictable in their endorsement of SS&M.[28]

In November 1994, the JASON group, a think tank of top physicists and other scientists who advise DOE and DoD on applying science and technology to military problems, gave their imprimatur to *"Science Based"* Stockpile Stewardship (SBSS), the term coined to describe the transition now underway from an engineering-based understanding of how nuclear weapons work to a scientifically-based understanding. In a report prepared at the request of DOE, they concluded:

> "A strong SBSS program, *such as we recommend* in this report, is an essential component for the U.S. to maintain confidence in the performance of a safe and reliable nuclear deterrent under a comprehensive test ban.

The technical skill base it will help maintain and renew in the defense program and weapons labs will also be important for assessing emerging threats from proliferant nations and developing possible technical responses thereto." (Emphasis added.)[29]

The endless repetition without deviation from "the message," in the time honored manner in which dogmatic orthodoxies (and successful public relations campaigns) are made, has had its desired effect in suppressing public debate. Many members of the arms control community still seem convinced that it is impossible, impractical, or unwise, to examine closely the contradictions between DOE's ambitious new weapons programs and the notion of the CTBT as a step on the path towards elimination of nuclear weapons. The unfortunate result has been a discourse in which fundamental questions about "Stockpile Stewardship" in relation to the *purpose* of the CTBT are never raised. Instead of analyzing the global relationship between the CTBT and the future of nuclear weapons, the debate in the U.S. has been diverted mainly to the narrow question of prospects for Senate ratification of the Treaty.

While many arms control groups continue to press hard for CTBT ratification, few are willing to oppose openly and vigorously the stockpile stewardship bargain that remains the central element of the Clinton Administration strategy for achieving it. And, there has been little systematic consideration of the relationship between the envisioned steps or phases of nuclear disarmament and the announced U.S. intention to retain "*all historical capabilities of the weapons laboratories, industrial plants, and NTS"* right down to zero.

It has become clear that, as now proposed, the SS&M program conflicts with virtually every meaningful disarmament agenda which has been put forward -- and at virtually every step along the way:

(1) The SS&M program violates the spirit, the intent, and possibly, in certain respects, the letter of the CTBT, and jeopardizes prospects for its entry-into-force;

(2) The SS&M program anticipates the design and deployment of nuclear weapons with new military capabilities, calling into question the sincerity of the U.S. commitment under the NPT to negotiate in good faith cessation of the nuclear arms race and the elimination of nuclear weapons;

(3) The SS&M program may complicate verification measures critical to achieving significant stockpile reductions;

(4) The SS&M program has the potential to ignite a new arms race as a result of the close interconnections between research, design, and testing of thermonuclear weapons and other forms of advanced weapons research;

(5) The SS&M program is premised on a strategy of "lead and hedge," which will make permanent arms reductions more difficult to achieve;

(6) The SS&M program will increase the political power of the nuclear weapons labs and their control over weapons-related information, and may thus help to preserve nuclear weapons programs even where they impede arms control efforts;

(7) The SS&M program may lead to the diffusion of nuclear weapons-relevant information from U.S. programs to the rest of the world, thus heightening proliferation concerns.

(1) The SS&M program violates the spirit, the intent, and possibly, in certain respects, the letter of the CTBT, and jeopardizes prospects for its entry-into-force.

Entry-into-force of the CTBT is seen by most commentators as a key marker of progress towards a stable nonproliferation regime, and thus towards further disarmament. However, U.S. refusal to make timebound commitments towards the elimination of nuclear weapons, combined with an ambitious program to rebuild its nuclear weapons complex -- intended to systematize and accelerate the accumulation of nuclear weapons-relevant knowledge, and capable of designing, producing, and deploying nuclear weapons with improved military capabilities -- has provided arguments for nations reluctant to join the CTBT. Indeed, they assert that the Treaty is intended to perpetuate a two-tier international system in which the technological advantages of the declared nuclear weapon states are permanently institutionalized. Ironically, this reality was acknowledged early on by U.S. Ambassador to the CTBT negotiations, Stephen Ledogar. In remarks to Non-Governmental Organizations (NGOs) gathered at the United Nations in New York in October 1995, he stated:

> *"It is important to recognize that the motivation of the 38 countries that joined together in this negotiation is not the same.* The majority believes, as I understand it, that the banning forever of all nuclear tests in all environments will bring about, and bring about rapidly, the deterioration and the decay of all existing nuclear weapon stockpiles. As I understand it, all five nuclear weapon states believe that *without testing* we can nevertheless maintain for the foreseeable future the viability, the safety and the reliability of our nuclear stockpiles. So many participants are working on this endeavor from somewhat different premises.
>
> All five, as I understand it, believe that this is not only a classic disarmament negotiation, but that it is also a nonproliferation exercise... [N]one of the five of us wishes any of the other five to be left with a privileged position with regard to the reliability of their nuclear weapon stockpiles." (Emphasis added.)[30]

This view of the CTBT as primarily a nonproliferation instrument, in combination with continued development of increasingly sophisticated nuclear weapons research and simulation capabilities by the United States, provided India with arguments against the fairness of the proposed CTBT regime:

> "We have always believed that the objective of a CTBT was to bring about an end to

> nuclear weapons development. We are all aware that nuclear explosion technology is only one of the technologies available to the nuclear-weapon States. Technologies relating to subcritical testing, advanced computer simulation using extensive data relating to previous explosive testing, and weapon-related applications of laser ignition will lead to fourth-generation nuclear weapons even with a ban on explosive testing. It is a fact that weapons-related research and development in these technologies is being promoted. Our objective therefore was a truly comprehensive test-ban treaty, rather than merely a nuclear-test-explosion-ban-treaty. For many years, we had been told that a CTBT was not possible because testing was required for the safety and reliability of existing nuclear weapons. We questioned it then and now we know that we were right. *Today, underground explosion technology has the same relevance to halting development of new nuclear weapons by the nuclear-weapon States as banning atmospheric tests did in 1963.* A truly comprehensive treaty should have fossilized the technology of nuclear weapons." (Emphasis added.)[31]

And less than three years later, following India's nuclear test explosions, Prime Minister Atal Bihari Vajpayee was able to make the same arguments against joining the CTBT in its current form:

> We have made our stand on the CTBT very clear. We have indicated our readiness to discuss certain provisions of the treaty on a reciprocal basis. But, taken as a whole, the CTBT is discriminatory because it allows nuclear weapons states with advanced technology capabilities to continue their nuclear weapons programme. And so also is the Nuclear Non-Proliferation Treaty (NPT). There is no question of India accepting any treaty that is discriminatory in character. No one should have any illusions on this score.[32]

It is impossible to judge with precision the extent to which the continued pursuit of advantage in nuclear weapons technology by the U.S. influences the debate within the national security elites of other states. What is clear is that U.S. behavior as the most powerful nuclear weapons state continues to legitimize nuclear weapons as instruments of sovereign national power, and reinforces the position of factions who favor acquisition of nuclear weapons within threshold states. The Canberra Commission on the Elimination of Nuclear Weapons recognized this basic reality:

> "Nuclear weapons are held by a handful of states which insist that these weapons provide unique security benefits, and yet reserve uniquely to themselves the right to own them. This situation is highly discriminatory and thus unstable; it cannot be sustained. *The possession of nuclear weapons by any state is a constant stimulus to other states to acquire them.*" (Emphasis added.)[33]

Even the U.S. National Academy of Sciences report on nuclear weapons policy frankly acknowledged:

> "The absence of change in U.S. nuclear posture and practice to reflect the dramatically

altered post-Cold War conditions weakens the credibility of U.S. leadership in nonproliferation efforts."[34]

The preamble to the CTBT states its historical aspirations:

> "...[T]he cessation of all nuclear weapon test explosions and all other nuclear explosions, *by constraining the development and qualitative improvement of nuclear weapons and ending the development of advanced new types of nuclear weapons*, constitutes an *effective* measure of *nuclear disarmament and non-proliferation* in all its aspects..." (Emphasis added.)
>
> Yet, the treaty itself conspicuously fails to define a nuclear test:
>
> "Each State party undertakes not to carry out *any nuclear weapon test explosion or any other nuclear explosion*..."[35]
>
> As U.S. negotiator Stephen Ledogar explained at an October 1996 briefing:
>
> "*There are no definitions in the Comprehensive Nuclear Test Ban Treaty*. That was a decision that was taken very carefully. For the United States and Russia it was based on the bitter experience of decades attempting, in our bilateral nuclear agreements, to put down an agreed definition of a nuclear explosion. It was found not possible to do so." (Emphasis added.)[36]

Many of the experiments included in SS&M programs involve explosive technologies and radioactive materials. What exactly did the nuclear weapon states have in mind when they agreed among themselves to accept a "zero-yield" CTBT? Genuine questions can be raised about whether the CTBT prohibits "laboratory-scale" explosions, and if so, which ones? Some critics, including former Los Alamos nuclear weapons designer Theodore Taylor, take the position that fusion explosions to be generated in the huge inertial confinement fusion facilities now being built as part of SS&M programs in the U.S. (National Ignition Facility or NIF) and France (Projet Megajoule) are banned. This is because sizeable explosions will be generated, which could contribute to the capability to design new types of weapons:

> "My first concern is about the evident proposed, and possible other future violations of the CTBT. Article I provides: 'Each State Party undertakes not to carry out <u>any nuclear weapon test explosion or any other nuclear explosion</u> and to prohibit any such nuclear explosion at any place under its jurisdiction or control' (emphasis added). Current publicly announced plans and appropriations by the U.S. government for the National Ignition Facility (NIF) and for 'subcritical' nuclear tests require explicit exceptions to this prohibition. If the NIF program meets its goal of producing more energy by small thermonuclear explosions than required to create the conditions for the explosions to take place, their energy release will be equivalent to at least several kilograms of chemical high explosive. Since the thermonuclear energy would be released in less than a billionth of a second, there is no question about the events being called 'nuclear explosions.' This raises

questions about the nature of the proposed exception to the CTBT. In particular, what limits if any, on energy release by thermonuclear explosions, however they are produced, are to be understood by all parties to the treaty?... Furthermore, are contained explosions in the NIF or other facilities, of thermonuclear pellets that are in contact with subcritical amounts of fissionable materials, such as plutonium or highly enriched uranium, to be allowed, even though they are also 'nuclear explosions?' Such explosions can appropriately be called 'boosted fission explosions,' whether or not the associated plutonium or uranium ever becomes critical -- i.e. able to sustain a fission chain reaction by itself. High energy neutrons emitted by a thermonuclear explosion, of any size, can cause fission of plutonium or any isotope of uranium, including U-238, the principal component of natural uranium."[37]

Other critics, including some who do not believe that laser-driven inertial confinement fusion experiments would be prohibited under a CTBT regime, take the position that a different category of explosive experiments already underway under the SS&M umbrella -- one that could lead to the development of compact pure fusion weapons -- should be prohibited. Frank Von Hippel and Suzanne Jones point to the particular dangers posed by high explosive driven pulsed power experiments:

"These involve the use of very intense currents and very high magnetic fields generated by pulsed power sources. In some cases the power pulses are generated by the implosion of magnetic fields with chemical high explosives, a technique pioneered by Sakharov and currently the focus of joint unclassified work by Arzamas-16 (the laboratory where Sakharov did his work) and Los Alamos. *Such complex systems could not achieve yield-to-weight ratios as high as modern thermonuclear bombs but some could potentially become compact enough to be used as weapons* . Indeed, this same concept was pursued urgently by the U.S. weapons labs in the late 1950' s and early 1960' s as a potential mini-neutron bomb for use on the battlefield." (Emphasis added.)[38]

Another "stockpile stewardship" program which limits the effectiveness of a CTBT as a disamarmament measure are "subcritical" tests, explosive test using fissile material in which no self-sustaining chain reaction occurs.

Subcritical Experiments are scientific experiments to obtain technical information in support of the DOE program to maintain the safety and reliability of the U.S. nuclear weapons stockpile without nuclear testing. The experiments use chemical high explosives to generate high pressures that are applied to nuclear weapon materials. High speed measurement instruments are used to obtain scientific data on the behavior of the materials. The configuration and quantities of explosives and nuclear materials have been designed so that no nuclear explosion will take place. Thus, the experiments are consistent with the Comprehensive Test Ban Treaty. They are called subcritical because there is no critical mass formed, i.e., no self-sustaining nuclear fission chain reaction occurs. (Emphasis in original.)[39]

Instead of preparing to close the Nevada Test Site (NTS) upon conclusion of the CTBT,

in October 1995 DOE awarded a 5-year, $1.5 billion contract to Bechtel Corporation to manage the test site, to maintain the capability to perform full scale underground tests there, and to conduct subcritical tests to assess the effects of new manufacturing techniques on weapon performance.[40] Subcritical tests yield information useful for further nuclear weapons modification, design, and prototyping, and exercise a range of skills and techniques which could be used to resume full scale underground testing. In addition to the subcritical testing program at the Nevada Test Site, subcritical tests using an isotope of plutonium having a higher critical mass than weapons grade material are slated to be conducted in containment vessels at the Los Alamos National Laboratory in New Mexico.[41]

In 1997, the U.S. conducted two subcritical tests in a horizontal tunnel complex 960 feet underground at the NTS. Consistent with the weapons laboratories' historical practice of "competing" with each other, one test, "Rebound," was sponsored by Los Alamos, while the other, "Holog," was sponsored by Livermore. In its public relations campaign, DOE drummed home "the message":

> "Scientific data obtained from the [Holog] experiment will allow scientists to answer basic questions about the way plutonium reacts when it's shocked -- which cannot be determined with the required precision by experimenting with substitute materials. *The data will help to bench-mark complex computer simulations of nuclear weapons performance that will be used to certify the safety and reliability of the Nation' s nuclear weapons stockpile, without nuclear testing.*
>
> The JASONs, an independent group of scientists, reviewed the design of this subcritical experiment. They concluded it *'will add valuable scientific information to our database relevant to the performance of our nuclear weapons,* and that there is no conceivable scenario in which it will lead to criticality.'
>
> *Subcritical experiments are essential to the United States'commitment to a reliable nuclear deterrent in a world free of nuclear testing..."* (Emphasis added.)[42]

The United States has conducted nine additional subcritical tests since 1997, in a program which appears to be intensifying.[43] This vigorous program of subcritical tests sends a signal that the CTBT is viewed by the U.S. as an agreement intended primarily to prevent horizontal proliferation, which the U.S. plans to interpret in a narrow, technical way, minimizing wherever possible limitations on the weapons programs of the existing nuclear weapons states. The subcritical tests also demonstrate U.S. resolve to keep its nuclear weapons test site in a state of readiness:

> The subcritical experiments provide an excellent opportunity to exercise most of the functions needed to conduct underground tests, and they replicate much of the test integration functions."[44]

As acknowledged by the U.S. Ambassador to the CTBT negotiations, stockpile

stewardship activities are underway among all five of the declared nuclear weapon states -- the U.S., Russia, France, Britain, and China. Russia reportedly also conducted a number of subcritical tests since the CTBT was signed,[45] and France also apparently has a subcritical testing program.[46]

The developing race in nuclear weapons laboratory testing and simulation technologies makes a Comprehensive Test Ban simultaneously less "comprehensive" and more necessary. It is these qualities which have led to the often murky and contradictory character of the debate, both within and among nations, about the CTBT. In essence, advances in nuclear weapons science, the consequence of competition in nuclear weapons science and technology which continues a decade after the Cold War, have rendered the CTBT, *without more*, an arms control and horizontal nonproliferation device rather than a disarmament measure. It can slow, but not stop, the pace of advanced nuclear weapons development. It has little effect on existing arsenals, which can be maintained at high levels of readiness without explosive testing using technology now decades old.[47] Advanced nuclear weapons states can upgrade their existing forces while remaining within the parameters of well-understood concepts and designs. And they can most likely make significant progress in prototyping more significant design innovations, which potentially could be tested and manufactured under crisis conditions. Despite (and in some ways because) of these developments, the CTBT remains an important goal. A legally binding global norm banning nuclear explosive testing could provide something of a "firebreak" if tensions among the NWS rise still further, making the decision to resume testing in order to deploy new weapons systems–which could occur quite quickly with weapons extensively tested and prototyped with sophisticated simulation techniques-- more consequential.

Despite its reduced value as a disarmament measure, particularly given the restrictive interpretations placed on the CTBT by the U.S. and other nuclear weapons states, continued pressure for universal ratification of and adherence to a CTBT regime is essential to prevent further loss of ground on nuclear disarmament. A resumption of a full-blown arms race among the most advanced NWS threatens us all, and would likely lead as well to the irreversible disintegration of the nonproliferation regime.

The CTBT interpreted literally may not ban expansive laboratory testing programs. But the commitment made by the NWS at the 1995 NPT review and Extension Conference to achieve a CTBT as part of a program for the "effective implementation of article VI," embodied in a provision which further stated that "[p]ending the entry into force of a Comprehensive Test-Ban Treaty, the nuclear-weapon States should exercise utmost restraint;" must be viewed in a different light. It clearly is bound to a broader interpretive context in which a CTBT is envisioned as a meaningful step along the road to nuclear disarmament, rather than an instrument for the temporary preservation of the status quo (and an instrument which could be rendered moot by foreseeable breakthroughs in nuclear weapons laboratory testing technology, at that).

In the realm of nuclear weapons testing, real progress towards disarmament would entail a commitment, manifested by concrete actions, by the NWS to first control and then eliminate nuclear weapons research, development, and testing in all its forms. Because of their role not only in providing information useful for nuclear weapons design but in exercising capabilities

needed to rapidly resume a full-scale nuclear explosive testing program, the logical starting place would be a termination of subcritical tests. And because the activities involved in this latter variety of sub-critical testing can so closely resemble underground explosive tests which would be prohibited by the CTBT, subcritical tests complicate verification of both the continuing informal testing moratorium among the original NWS and of a future test ban regime.[48] Cessation of subcritical tests would both be a visible, concrete step towards controlling a laboratory testing race and would facilitate complete closure of the remaining underground nuclear test sites. Closure of the test sites and subjecting them to extensive, intrusive verification is a key early arms control measure under current conditions, where tensions among the NWS appear to be increasing. In addition to simplifying verification issues (including the possibility that a nuclearist faction in a nuclear weapons state could exploit the uncertainties inherent in distinguishing "subcritical" tests from other activities to raise tensions still further),[49] this could help to broaden the "firebreak" between simulation testing-based prototyping of some types of radically new nuclear weapons concepts and their deployment.

This "firebreak" can be broadened still further by cessation of other programs intended to improve nuclear weapons simulated testing capabilities, to train new generations of weapons designers, to prototype new weapons designs, and to shorten the time cycle from prototyping to production through the integration of high performance computing-enhanced prototyping with new, flexible production facilities.

Inertial Confinement fusion and other pulsed power experiments aimed at creating thermonuclear fusion conditions are a class of experiments which should be sharply limited. A first step would be to cease construction of the next generation of pulsed power facilities. Best known of these are the laser-driven inertial confinement fusion facilities, including the National Ignition Facility (NIF), currently under construction at the Livermore Laboratory in California and the French Megajoule laser. Inertial confinement fusion (ICF) experiments have little to do with maintaining existing nuclear warheads, but are useful to exercise weapons-design relevant skills, to train new weapons designers, and to further refine understanding of the basic phenomena underlying nuclear weapons function.[50] The knowledge gained from a sophisticated ICF program can be of great benefit to a state which wishes to acquire advanced nuclear weapons.[51] ICF and other types of pulsed power facilities also can be used in to increase knowledge relevant to new types of nuclear weapons, including, for example, "pure fusion" weapons which would achieve a nuclear explosion without the use of plutonium or uranium.[52]

It has become clear that if the Comprehensive Test Ban is to be a true stepping stone on the path to disarmament, rather than doing little more than providing a decade or two of breathing space between the arms races of the past century and those of the next, it must be accompanied by far broader limitations on forms of research and physical experiments relevant to nuclear weapons development. The path to the elimination of nuclear weapons also would be simplified considerably by the cessation of both nuclear weapons research and production activities. This would make evasion of verification regimes and the production of weapons components or manufacturing equipment particularly suited to a hidden long-term nuclear weapons capability more difficult. The continued pursuit of increased nuclear weapons knowledge by any one state, from better understanding of fissile materials to more rapid, easily scaled production techniques

will be matched to a greater or lesser degree by others. The longer this virtual arms race is allowed to continue, the more difficult the task of disarmament will become.

(2) The SS&M program anticipates the design and deployment of nuclear weapons with new military capabilities, calling into question the sincerity of the U.S. commitment under the NPT to negotiate in good faith cessation of the nuclear arms race and the elimination of nuclear weapons.

Existing and proposed nuclear weapons research, testing, and production capabilities allow the United States to continue to develop its nuclear arsenal, adding new military capabilities to nuclear forces already far in excess of what is conceivably needed to deter nuclear attack. Further, to the extent that new refinements in weapons and associated delivery systems appear to have roles beyond deterrence of nuclear attack, e.g. deterrence of chemical and biological weapons use, they further legitimize the role of nuclear weapons in the post-Cold War world.

> *"Since the end of the Cold War, the Defense Department's nuclear forces and programs have been refocused and reconfigured to respond to new requirements.* The proliferation of nuclear and *other weapons of mass destruction* is not a hypothetical threat. A number of nation states already have such weapons; a larger number are capable of producing such weapons, potentially on short notice. In future confrontations, the United States may not be the sole decider of nuclear use.
>
> In the National Security Strategy of the United States, the President has defined the key tasks that must be accomplished:
>
> □ Maintain robust strategic nuclear forces.
>
> □ Retain the capability to respond forcefully and effectively and, where appropriate, overwhelmingly, against those who might contemplate the use of *weapons of mass destruction* so that the costs of such use will be seen as outweighing the gains.
>
> □ Develop improved defensive and offensive capabilities. To minimize the impact of proliferation of *weapons of mass destruction* on our interests, we will need the capability not only to deter their use against either ourselves or our allies and friends but also to successfully operate through WMD use and also, where necessary and feasible, to prevent it." (Emphasis added.)[53]

However, the NAS report warned that

> "A policy of nuclear deterrence of CBW [Chemical and Biological Weapons] would provide incentives and an easy justification for nuclear proliferation, which is inimical to U.S. security. Many other countries face far more plausible and immediate CBW threats than the United States. If U.S. policy points to nuclear weapons as the ultimate answer to CBW, other states could have an increased motivation to acquire nuclear arsenals. Highlighting new or continuing missions for nuclear forces could damage the nuclear

nonproliferation consensus throughout the world."[54]

To accomplish the expanded nuclear weapons mission, DOE's existing "stockpile stewardship" facilities already have been used to produce and deploy the first U.S. nuclear weapon with improved military capabilities since 1989 -- before the end of the Cold War. The B61-11 is an earth penetrating gravity bomb with a variable yield ranging from 300 *tons* to over 300 *kilotons* TNT.[55] DOE has denied that the B61-11 is a "new weapon," arbitrarily choosing to define "new" as requiring a redesigned physics package, rather than as a weapon having new or improved military capabilities. When its existence was discovered by public interest groups, buried in the footnote of a DOE document,[56] the Department tried to portray the B61-11 as a "safety improvement" because it is replacing, as the weapon of choice for destroying certain types of deeply buried targets, the B53, a huge, heavy, 1960' s-era gravity bomb with a mind-numbing nine-megaton yield and fewer modern safety features.[57]

However, in subsequent testimony to the U.S. Senate, Assistant Secretary of Defense Dr. Harold Smith made clear that the B61-11 offers advantages beyond safety improvements:

> "[O]ther factors make the B61-11 a better weapon than the B53. Operational considerations clearly favor the B61-11 over the B53. Due to its size and weight, the B53 could only be delivered by the B52 bomber. The B61-11 is compatible with both the F-16 and B-2. The B61-11 produces far less collateral damage and has the same effectiveness against deeply buried targets as the B53 with less than one twentieth the yield. Implementation of the program was performed in a remarkably short time -- only 16 months from initial verbal authorization to delivery of the first retrofit kits. Four complete B61-11 retrofit kits were delivered to the Air Force in November 1996, two weeks ahead of schedule. The military personnel and laboratory representatives who comprise the B61-11 Project Officers Group should be justifiably proud of their accomplishments. They have not only made the stockpile safer, they have also skillfully and effectively met a difficult military requirement. *The B61-11 is an outstanding example of using an existing weapon in a new way to hold at risk robustly defended, deeply buried targets."* (Emphasis added.)[58]

The B61-11 is precisely the kind of weapon which is likely to appear to be aimed at "new" threats, and at states portrayed as potential possessors of chemical and biological weapons in particular. Such an inference is unavoidable, given U.S. refusal to renounce first use of nuclear weapons, its extensive counterproliferation program aimed broadly at weapons of mass destruction, and its hints in recent years of possible nuclear weapons use against both Iraq and Libya if either employed chemical or biological weapons. In April 1996, the U.S. made an ambiguous threat suggesting the possible use of a new earth penetrating nuclear weapon -- a B61 modification -- against an unconfirmed underground chemical weapons plant in Libya.[59] At a January 27, 1998 Pentagon news briefing, a DoD spokesman refused to rule out the possible U.S. use of nuclear weapons, including earth penetrating weapons, against Iraq in response to Iraqi weapons of mass destruction.[60]

When the Nuclear Non-Proliferation Treaty (NPT) was negotiated in the late 1960's, the

underlying bargain struck to induce the non-nuclear weapon states to forswear the acquisition of nuclear weapons was two-fold. First, in an unfortunate commitment that promoted the very proliferation the Treaty was designed to prevent, the nuclear weapon states promised to assist the non-nuclear weapon states with the development of nuclear power (Article IV). Second, the nuclear weapon states promised to negotiate the cessation of the nuclear arms race and the elimination of their nuclear arsenals (Article VI).[61] This bargain was reaffirmed in the 1995 decision to extend indefinitely the duration of the Treaty. With regard to Article VI, the nuclear weapon states agreed to conclude a CTBT by 1996, to commence negotiations on a ban on the production of fissile material for nuclear weapons, and to pursue the reduction of their arsenals, with the ultimate goal of their elimination.[62]

These commitments, modest in scope when measured against the enormity of the nuclear threat which had in fact grown since the NPT was negotiated, were in 1996 strongly reinforced and expanded by the historic advisory opinion of the International Court of Justice (ICJ), the judicial branch of the United Nations, on the legality of the threat or use of nuclear weapons. In what is now *the* authoritative interpretation of Article VI, the Court held unanimously that "[t]here exists an obligation to pursue in good faith and *bring to a conclusion* negotiations leading to nuclear disarmament *in all its aspects* under strict and effective international control." (Emphasis added.) The Court also held that "[t]he threat or use of nuclear weapons would generally be contrary to the rules of international law applicable in armed conflict, and in particular the principles and rules of humanitarian law." (Humanitarian law protects civilians and combatants against unnecessary, indiscriminate, and disproportionate effects of warfare.)[63] The Court's latter holding regarding the general illegality of threat or use of nuclear weapons added powerful momentum to the trend in numerous spheres of discourse (medical, religious, environmental, to some degree strategic) towards recognition of the essential illegitimacy of the weapons, a recognition in fact embodied in Article VI as well as in the preamble of the NPT.

Despite these apparent advances on normative and political fronts, in terms of the reality of technological development and military strategy, the end of the Cold War also saw a dynamic, encapsulated by the term "counterproliferation," antithetical to renewed NPT commitments and the ICJ advisory opinion. During the Cold War, the NPT was largely ignored by the nuclear weapon states. Now, in the logic of counterproliferation, military establishments have turned the treaty's original logic on its head: while not ignoring potential conflicts among nuclear weapon states, *the possibility of proliferation of nuclear weapons and other weapons of mass destruction has become a principal rationale for the nuclear weapon states to maintain and upgrade their own nuclear arsenals*.

A 2000 Defense Threat Reduction Agency document describes one counterproliferation initiative:

> Project AC - Weapons Systems Lethality - This project addresses the lethality of the full spectrum of weapons, including advanced conventional and nuclear weapons, against the target base of today and tomorrow -- ranging from ultra-hard underground facilities to above ground, unhardened surface facilities and other special facilities that may be associated with the production, storage or deployment of weapons of mass destruction.

> Helping to maintain the continued effectiveness of the nuclear deterrent, this project also seeks to provide decision makers and warfighters expanded conventional weapon options against well-protected, high-priority targets. The program relies extensively on advanced numerical methods, as well as laboratory scale experiments, intermediate and full-scale field tests and operational test data to quantify functional and physical damage criteria and collateral effects. Project results will be provided to operational planners through PC-Based analytic prediction and visualization tools, multimedia hypertext databases, and technical manuals....
>
> On a broader scale, improvements in weapon effects and target response codes will be used to upgrade and expand physics-based modeling and simulation. These improved codes include: coupled finite difference-finite element codes, structure-medium interaction codes, groundshock propagation codes suitable for jointed and/or layered media and high resolution dynamic codes capable of predicting the transport of hazardous aerosol clouds over complex terrain. The understanding of weapon-target interaction resulting from this project will support the generation of weapon system requirements for the changing worldwide target base and provide a quantitative basis for planning contingency operations against high value targets. It will also improve the understanding of target/weapon interactions and their consequences for battle damage prediction and assessment. The project also allows the assessment of collateral effects from counterforce attacks, military strikes, terrorist action, incident or accident from nuclear facilities.[64]

Plans call for the National Ignition Facility (NIF), a key stockpile stewardship component, to be used also for nuclear weapons effects tests, including tests which would study the effectiveness of nuclear weapons against chemical and biological agents:

> "The U.S. and its allies face a growing threat of ballistic missiles capable of carrying biological/chemical agents or contact/salvage-fuzed nuclear warheads. The limited effectiveness of the interceptors being developed by the U.S. against this threat, using fragments or hit-to-kill vehicles, can be expected to generate increased interest in evaluating the lethality of a low-yield nuclear interceptor option against this threat.
>
> NIF provides large fluences of both fusion and fission neutrons with the very short pulse widths characteristic of low-yield nuclear intercepts, that can be used to establish lethal criteria for chemical/biological agents and nuclear warhead targets."[65]

When President Clinton submitted the CTBT to the Senate for its "advice and consent" on ratification on September 22 1997, his transmittal letter made clear that his endorsement of the Treaty was conditioned on Senate support for the SS&M program as a central requirement of *"our national security strategy."* Clinton repeated the conditions he first announced on August 11, 1995 in connection with U.S. support for a "zero yield" CTBT:

> "...As part of our *national security strategy*, the United States must and will retain strategic nuclear forces sufficient to *deter* any future hostile foreign leadership with access to strategic nuclear forces from acting against our vital interest and to convince it that

> seeking a nuclear advantage would be futile. In this regard, *I consider the maintenance of a safe and reliable nuclear stockpile to be a supreme national interest of the United States.*
>
> I am assured by the Secretary of Energy and the Directors of our nuclear weapons labs that we can meet the challenge of maintaining our *nuclear deterrent* under a CTBT through a Science Based Stockpile Stewardship program without nuclear testing... This program will now be tied to a new certification procedure... I am committed to working with the Congress to ensure this support." (Emphasis added.)[66]

A more detailed definition of "nuclear deterrence" and its role in defending U.S. "national security" is found in the December 1995 "Doctrine for Joint Nuclear Operations":

> *"[T]he fundamental purpose of US nuclear forces is to deter the use of weapons of mass destruction (WMD), particularly nuclear weapons, and to serve as a hedge against the emergence of an overwhelming conventional threat.* Credible and capable nuclear forces are essential for national security. *Deterrence of the employment of enemy WMD, whether it be nuclear, biological, or chemical*, requires that the enemy leadership believes the United States has both the ability and will to respond promptly and with selective responses that are credible (commensurate with the scale or scope of enemy attacks and the nature of US interests at stake) and militarily effective." (Emphasis added.)[67]

Subsequent doctrine statements have suggested that nuclear weapons might not be limited to a strictly retaliatory role:

> While there will certainly be long-term effects from the use of a nuclear device against any target, counterforce strategy focuses on the more immediate operational effect. Nuclear weapons might be used to destroy enemy WMD before they can be used, or they may be used against enemy conventional forces if other means to stop them have proven ineffective. This can reduce the threat to the United States and its forces and could, through the destruction of enemy forces, bring an end to the conflict.[68]

Linking nuclear weapons strategies to counterproliferation scenarios represents an expansion, rather than a reduction, of the role of nuclear weapons. And, adding to the possible list of nuclear targets contradicts the U.S. commitment to fulfill its NPT Article VI obligation. Further, planning for the use of nuclear weapons in regional conflicts could increase North-South tensions and undermine any security assurances pledged by the nuclear weapons states.

In the broad context of counterproliferation policy, the development of new military capabilities for nuclear weapons at the DOE laboratories, whether denominated "improvements" or "new weapons," sometimes seems to take on a momentum of its own:

> *"Building on the success of the B61-11, we are examining changes to other B61 designs*

> *to add additional value to these systems for our military customers.* One such effort is the Bomb Impact Optimization System (BIOS) program, in which Sandia is investigating the feasibility of modifying a B61 payload for use in a guided glide bomb for low-altitude release from a B-2 bomber against defended target complexes. This effort includes analysis, design, model fabrication and testing, and ground and flight testing of a functional prototype." (Emphasis added.)[69]

This effort apparently was pursued without any formal request from the armed services, a new military capability in search of a mission -- which happens to fit nicely with the "national security" policies described above.[70] The new array of weapons design and testing facilities, combined with large budgets, an inattentive Congress, and the formidable political power of the laboratories, presents the possibility of endless rounds of such "improvements," with no apparent consideration of their possible impact on the international arms control regime.

In addition to the BIOS program, which was apparently terminated without a decision to produce a modified warhead, the weapons laboratories are engaged in "concept studies" exploring the use of nuclear weapons to meet several counterproliferation needs:

> Two studies currently under way are the Air Force Agent Defeat Study and the Hard and Deeply Buried Target Defeat Study.
>
> The Agent Defeat Study is to identify weapon concepts that could interdict chemical and biological threats. The DOE is providing generic nuclear and advanced conventional concepts for use in effectiveness analysis and are investigating lethality and collateral damage issues. No design work on new nuclear weapon concepts is being conducted under this study.
>
> The Hard and Deeply Buried Target Defeat Study is examining concepts to neutralize certain targets of this class. The DOE is assisting the DOD with systems analysis, lethality calculations, and by providing nuclear warhead information. Technologies for using the capabilities of existing weapons are being investigated.[71]

In light of the improvements in military capabilities which apparently are possible through modification of existing warheads (as was demonstrated with the development and deployment of the B61-11 earth penetrator gravity bomb without underground testing), it is important not to underestimate the potential impact of these programs.[72] These activities are taking place, furthermore, as part of broader initiatives aimed at making nuclear weapons more effective, and more politically useable, against possessors of weapons of mass destruction.[73] Throughout the Department of Energy and Department of Defense laboratories, these continuing efforts range from software development to facilitate "adaptive planning," a new mode of nuclear weapons targeting allowing weapons systems to be shifted rapidly to target new threats as they emerge,[74] to efforts aimed at exploring use of nuclear weapons to destroy hardened WMD facilities with less politically unacceptable "collateral damage" to weapons effects studies exploring nuclear weapons use in contexts ranging from ballistic missile defense to incinerating chemical and biological weapons stored in underground facilities and bunkers.[75]

DOE's 1996 "Green Book," the master plan for the SS&M program, updated annually,

describes in detail the broader program strategy, including how SS&M will facilitate new weapons designs and modifications:[76]

> "The end of underground testing will necessitate fundamental changes in the stockpile assessment and certification process. Aboveground experimental facilities that once supplemented underground nuclear testing must be expanded to provide more comprehensive data across a broader range of nuclear processes. Computational modeling, once a tool to facilitate design and evaluation, must now serve as the integrating factor to link aboveground experiments, historical nuclear test data, and design experience into a nuclear predictive simulation capability." [77]

> "This plan provides for the continued development of such weapon components as pits, secondaries, high explosives, detonators, radiation cases, warhead electrical systems, gas reservoirs, and test and handling equipment. *Specific efforts in each of these product areas will include advanced development, design, production and assembly activities."* (Emphasis added.)[78]

Continued refinement of the nuclear arsenal also apparently will include improvements in ballistic missile warheads. The May 1997 DoD Nuclear Weapon Systems Sustainment Programs report discloses the existence of a "collaborative Navy/DOE effort to maintain the capability to jointly develop replacement nuclear warheads for the W76/Mk4 and W88/Mk5 should new warheads be needed in the future."[79] These are Sea-Launched Ballistic Missile (SLBM) warheads carried on Trident submarines. The Green Book describes two approaches to this warhead replacement program:

> "Weapons replacement design options that could be fielded with high confidence without additional nuclear testing will also be developed when necessary. Two candidate designs have been identified for the [Navy] Mk5 delivery system, one reusing an existing pit and one requiring new pit manufacture. These replacement designs would offer alternatives for possible replacement of existing warheads and would be prototyped, which is critical to maintaining our capability to design and fabricate new weapons as required by the Nuclear Posture Review. New experimental and computational capabilities are required to certify these designs *without further nuclear testing*." (Emphasis added.)[80]

> "Both of the replacement design options will be prototyped and flight tested, but no final development activities will be initiated until a decision is made to proceed. *The nuclear design activities of this program will be broadly based and will provide present and future weapons scientists and engineers with the opportunity to exercise the complete set of skills required to design and develop a stockpile warhead."* (Emphasis added.)[81]

A May 1997 Sandia National Laboratories document confirms that the Labs believe they can design and certify a new Trident warhead without underground testing.

> "The Replacement Warhead Project is a joint LANL [Los Alamos National

Laboratory]/Sandia design of a warhead to replace the W88/Mk5.... *Replacement Warhead is a new design that will not have UGTs [Under Ground Tests] for certification*." (Emphasis added.)[82]

The DoD Nuclear Weapon Systems Sustainment Programs report also describes plans to upgrade the missiles carried aboard the Trident fleet:

> "The Navy's backfit program will *update* four of the C-4 [Trident I] platforms to the *more modern and longer range* D-5 [Trident II] missile. These upgrades will begin in FY [Fiscal Year] 2000 and will finish in FY 2006." (Emphasis added.)[83]

In its discussion of candidate replacement systems for the Mk5 delivery system, the Green Book explains that the "refurbishment" of the nuclear stockpile in response to the discovery of defects due to aging or "*updated military requirements"* may "*require the design of modified or new components."* (Emphasis added.)[84]

Independent analyst William Arkin has warned that these programs are "actually part of a larger plan" to upgrade the entire SLBM force. According to Arkin:

> "Many of the navy's latest missiles, the Trident IIs, are equipped with W76 warheads rather than with the more advanced W88s. The W76s are fitted into the Mk4 reentry vehicles rather than the newer and more accurate Mk5s. In effect, the navy wants to replace the W76s with newly minted warheads similar to the W88, and it wants to upgrade the Mk4s, which were designed to burst above urban-industrial targets. *With the right kind of replacement for the Trident II's [W76] and/or a modified Mk4, Trident II's yield and accuracy to attack hard targets could extend across the entire force."* (Emphasis added)[85]

Similarly, Rear Admiral Nanos, director of Strategic Systems Programs, U.S. Navy, wrote:

> "We can chart the capability of our weapon system against targets and see what accuracy has done for us. The demonstrated capability of the D5 [missile] is excellent. Our capability for Mk 4 [reentry vehicle], however, is not very impressive by today's standards, largely because the Mk 4 was never given a fuse that made it capable of placing the burst at the right height to hold other than urban industrial targets at risk. *With the accuracy of the D5 and Mk 4, just by changing the fuze in the Mk 4 reentry body, you get a significant improvement. Why is this important? Because in the START II regime, of course, the ICBM hard target killers are going out of the inventory and that cuts back our ability to hold hard targets at risk. The Air Force has some plans for how to upgrade their ICBM force to restore that capability. We can do that with the Mk 4 reentry body* for 10 cents on the dollar in terms of investment because of the accuracy of our system, *and we have made this option available to the strategic CINC [Commander in Chief]*." (Emphasis added.)[86]

It was precisely this kind of "upgrading" of nuclear forces that raised fears of a disarming

"first strike" during the Cold War and was a driving force in the arms race as both major nuclear powers sought to gain a technological advantage and to protect their nuclear forces through ever more diverse delivery systems and elaborately hardened missile silos and command centers. And it appears that the U.S. military has sufficient confidence in its near-term "stockpile stewardship" capabilities to consider seriously developing and deploying these improved nuclear weapons designs *without underground testing*, while simultaneously proclaiming that the Comprehensive Test Ban will severely constrain the further development of nuclear weapons by the nuclear weapons states.

There are more new or modified nuclear weapons in the pipeline. According to the Green Book, beyond the B61-11 replacement for the B53 gravity bomb, "The laboratories are currently working on programs to provide new or modified designs that will address current stockpile issues and will exercise a broad range of design skills. These programs include the following:

> *W87 Life Extension Program.* The W87 life extension program will require a program of design and evaluation for the physics package, including the assessment required for certification
>
> .
>
> *B61 Mod 3, 4 and 10 surety upgrades*. Proposed modifications to improve the safety of the weapon will require an active nuclear design and laboratory test program to support final evaluation and nuclear certification.
>
> In addition to the above programs, which are expected to lead directly to stockpile modifications, the nuclear weapons laboratories will conduct prototype programs to provide possible future replacement warhead designs for Navy and Air Force systems..." (Emphasis in original.)[87]

The 1999 update of the Green Book documents other nuclear weapons upgrades currently in progress, including improvements for the B83 gravity bomb, with retrofitted models to be "equipped with a new dual channel radar, with alt 752 designating those configured with a different power cable to provide new MC required heights of burst."[88]

It may be difficult to tell what our real markers are for progress towards nuclear disarmament if warhead numbers remain in the thousands for decades, during which the nuclear weapons states both expand their above-ground component testing and simulation capabilities and deploy refined and modernized warheads and delivery systems. Even after considerable stockpile reductions have taken place, at the one thousand warhead level, for example, (actual, not "START countable," warheads), an arsenal consisting of a variety of modernized warheads, including many of low to moderate yield, fitted to an array of faster, stealthier, longer range delivery platforms with sophisticated electronics, fully integrated into the U.S. military's vision of a 21st century battlefield dominated by satellite surveillance, remotely deployed sensor arrays, and precision weaponry, looks very different from the generally held public image of our nuclear weapons during the course of arms reduction: a residual strategic nuclear force, maintained with little change to allow adequate *minimal* deterrence as we fulfill our international legal obligations to end the nuclear arms race and pursue the elimination of nuclear weapons.

3) The SS&M program may complicate verification measures critical to achieving significant stockpile reductions.

The determination to retain and operate extensive nuclear weapons research, design, testing, and production facilities throughout the process of nuclear arms reductions may create problems in the area of "transparency," and thus conflict with disarmament efforts. The likely difficulties of operating numerous complex, limited-access industrial facilities, while adhering to arms control measures which require international verification of arms reduction agreements, may well be substantial.

As the NAS report (and one of its authors in another context) pointed out, accounting for the number of warheads and warhead components (particularly plutonium pits) will become increasingly critical as reductions in stockpile sizes are negotiated.[89] This will probably require verification measures far more intrusive than those that have been used in arms control agreements to this point (hence the counting of delivery systems rather than warheads in existing nuclear arms control agreements). Attempting to verify numbers of warheads and pits may be complicated considerably by the simultaneous operation of extensive weapons testing and production activities. Intrusive remanufacturing of plutonium pits, for example, particularly recasting, may make it more difficult to account for pits and for total quantities of plutonium.[90] Lab testing activities which provide rationales for weapons to be "destroyed," and their components removed from the arsenal or dispersed will add to the confusion. As mentioned earlier:

> "Two candidate replacement nuclear weapons designs have been identified in this [SLBM] program. *One design would require new pit fabrication*, thereby maintaining expertise in new pit technologies. *The other would incorporate a reused pit from a retired warhead*, providing design and development expertise in pit reuse technologies." (Emphasis added.)[91]

> "*None of the manufacturing and surveillance capabilities of the current industrial base can be eliminated on the basis of the post-Cold War changes in national security policy...* [This] applies to new pit fabrication as well as both intrusive and nonintrusive modification pit reuse manufacturing capability and capacity." (Emphasis added.)[92]

Difficulties of this kind may be soluble to some degree through technical verification schemes, but such mechanisms would require a level of intrusiveness that it is difficult to imagine the weapons establishments in the nuclear weapons states accepting in the near term. At present, such issues do not even rate a mention in official descriptions or discussions of the SS&M program and its purported aim of "*furthering U.S. nonproliferation objectives in seeking a 'zero-yield' CTBT."* And given the likelihood that accounting for warhead numbers and fissile materials quantities would be more accurate and would achieve a greater level of international confidence the sooner it started, a vigorous program of warhead testing, replacement, and remanufacturing may from its inception complicate long-term arms control verification.

4) The SS&M program has the potential to ignite a new arms race as a result of the close interconnections between research, design, and testing of thermonuclear weapons and other forms of advanced weapons research.

Even more difficult problems may be posed by the close interconnection between research, design, and testing of fission-fusion thermonuclear weapons and other forms of weapons research. There is already controversy over the possible long-term application of laboratory nuclear weapons testing capabilities, and in particular inertial confinement fusion and related pulsed power technologies, to the development of "pure fusion" weapons.

> "Were it possible to create compact pure fusion nuclear explosives, as the nuclear-weapon labs have attempted for decades, they would obviously be prohibited by the [CTB]Treaty. Such explosives would have as much potential as weapons as fission explosives or the fission-fusion explosives in the U.S. strategic arsenal. Furthermore, if pure fusion explosives were developed, the method by which the nuclear weapons proliferation is controlled, the monitoring by the IAEA of the use of fissile materials in non-weapons states, would be bypassed."[93]

Hans Bethe, although a strong supporter of SBSS, thought the problem of sufficient import to merit a letter to President Clinton. On April 25, 1997 he wrote:

> "It seems that the time has come for our Nation to declare that it is not working, in any way, to develop further weapons of mass destruction of any kind. In particular, this means not financing work looking toward the possibility of new designs for nuclear weapons. And it certainly means not working on new types of nuclear weapons, such as pure-fusion weapons."

Although Bethe thinks success on pure fusion weapons unlikely, he added:

> "The United States already possesses a very wide range of different designs of nuclear weapons and needs no more. *Further, it is our own splendid weapons laboratories that are, by far and without any question, the most likely to succeed in such nuclear inventions.* Since any new types of weapons would, in time, spread to others and present a threat to us, it is logical for us not to pioneer further in this field." (Emphasis added.) [94]

Any program pursuing new types of nuclear weapons has the potential to ignite a new arms race. This is particularly likely of the new weapons types that hold promise for new military applications -- in the case of pure fusion weapons, for example, small nuclear explosives and neutron bombs.[95] Such research programs, moreover, may make it difficult to achieve an adequately transparent verification regime, as they are likely to involve continuing secret experiments employing a wide range of "stockpile stewardship" facilities: inertial confinement fusion, high-explosive-driven pulsed power, hydrodynamic testing, and high performance computing. And in the context of nuclear weapons policies which contemplate first use of nuclear weapons within a broad spectrum WMD counterproliferation program, and which explicitly aim

to maintain the capacity to design new nuclear weapons, a constantly-expanding *capability* to conduct such research may, in and of itself, be provocative to other states.

In addition, certain types of stockpile stewardship facilities and associated technologies have potential weapons applications beyond nuclear warhead testing. Pulsed power experiments are being conducted both at the DOE laboratories and at several DoD laboratories to study possible microwave and other directed energy weapons applications. In this area and others, the computing necessary to convert the data streams from sophisticated testing technologies into usable forms, and to employ such data in simulation and modeling, has a broad range of military applications.[96]

The immense, multi-faceted U.S. nuclear weapons laboratories are closely interconnected with a variety of military programs increasingly dependent on high technology and high performance computing. Thus the use of particular facilities whose core mission purportedly is to maintain the "safety and reliability" of the nuclear arsenal for a broad range of weapons research, is likely to complicate the path to nuclear disarmament in several ways. The perceived value for other military initiatives of facilities with extensive nuclear weapons research capabilities will add a further element to transparency problems, as there will be incentives to maintain a high level of secrecy at particular facilities and for larger numbers of particular programs and experiments. And even where a facility or program has potentially provocative nuclear weapons research capabilities or presents verification problems sufficient to compel its closure if nuclear arms control were the sole policy concern, its potential for other military applications may tip the balance, providing a rationale -- and a constituency -- for its continuation.

"Stockpile stewardship" actually represents one manifestation -- albeit possibly the leading edge -- of a broader initiative aimed at reinvigorating research with military applications in both universities and private industry. Although the U.S. military has for decades maintained its preeminence through planned technology development, it is now attempting a qualitative leap in the role high technology weapons will play, and in the approach to weapons research and development. This effort seeks to focus research more systematically on weapons-relevant knowledge, to speed the transition from experimental results to applicable weapons concepts, and to further subsidize and encourage private industry and university research which is considered likely to yield militarily useful technologies.

A leading example of the military's current effort to channel university and corporate research in a militarily useful direction is the Accelerated Strategic Computing Initiative (ASCI), a key component of DOE's Stockpile Stewardship plan. DOE's September 1996 Accelerated Computing Initiative Program Plan stated that:

> "[t]he shift to high-performance computing and science as the basis for confidence in the stockpile poses complex theoretical and practical problems in computer science and physical sciences that are worthy of study by the best and most creative minds of the Nation."

The ASCI Program Plan described the magnitude of the challenge of nuclear weapons virtual testing and prototyping as *"on par with many aspects of the original Manhattan Project,"* requiring "the technical skills of the best scientists and engineers working in academia, industry, and other government agencies in addition to those working in the national laboratories." (Emphasis added.)[97]

Indeed, DOE has established the "Academic Strategic Alliance Program" as a "key component" of ASCI. In July 1997, DOE awarded $250 million to five major American universities to work collaboratively with the Lawrence Livermore, Los Alamos, and Sandia National Laboratories *"to help advance high-performance computer simulation capabilities needed to make an historic leap in large-scale computer modeling and simulation."* Assistant Secretary of Energy for Defense Programs, Dr. Victor Reis reemphasized that:

> *"ASCI is an enormous challenge and is such a demanding consumer of intellectual resources that the significant capabilities of our national laboratories need to be augmented with expertise in the academic community.* Together with our university and private-sector partners, we are confident we can achieve the kind of dramatic advances in computing and simulation capabilities that will make science-based stockpile stewardship a reality." (Emphasis added.)[98]

In 1997, DOE announced plans to provide $10 million to Washington State University to establish a "Shock Physics" institute "as part of DOE's strategic investment in selected scientific disciplines important to science based stockpile stewardship."[99] And, DOE's Office of Defense Programs began soliciting proposals from "all segments" of the U.S. private sector -- including universities -- through the "Inertial Fusion Science in Support of Stockpile Stewardship Financial Assistance Program." This program offered grants for up to $1 million a year to:

> "(1) increase U.S. efforts in high-energy-density science relevant to ICF through funding of small research projects at universities and other private sector institutions; (2) promote interactions between such investigators and scientists at the Department of Energy weapons laboratories, and; (3) assist in training scientists in areas relevant to stockpile stewardship."[100]

With regard to its SS&M program, DOE has attempted to downplay the destabilizing long-range potential of intensive, constant, broad-spectrum weapons modernization, grounded in an enormous military-specific science-industrial complex which sustains and modernizes itself with an increasing degree of self-consciousness and independence from meaningful civilian political control. DOE has responded to criticism on these issues by focusing on individual facilities and straw man issues, constantly reiterating, for example, that the NIF alone cannot be used to proof-test a new nuclear weapon.[101] Such rhetorical strategies are simply disingenuous; those who employ them know well (and further, fully intend) that any number of significant weapons concepts may result from recombining elements of rapidly developing new technologies.

> "The word 'revolutionary' is in common use, and overuse, today.... The word has been used to mean many things, and it is useful to put the term into a context within which we

can discuss new technologies and their use. The word is frequently used to identify a 'silver bullet' -- a single concept or device that will immediately produce the ascendancy of the user's forces over those of the user's adversaries. The world is not like that. Science, technology, and military inventions are not like that. Nearly always, it is the evolutionary follow-on of a new concept that produces a revolution in capability. For example, the nuclear weapon was the most revolutionary weapon ever invented. It not only changed the nature of warfare but also it changed the nature of all interactions among nations, and it changed the way all science was viewed by the public. The first two nuclear weapons, however useful as a demonstration of the principle, would not, had they been duplicated many times, have had that effect. It was the evolutionary development of the thermonuclear weapon from the fission weapon coupled with the evolution of the ICBM from the V-2 that produced the profound effects on society. Frequently, too, it is the association of well-known principles in an innovative way that produces the revolutionary result....

Thus, we can seldom expect to produce truly revolutionary effects with the first manifestation of a new technology. In recognition of this fact, demonstrations should not include all aspects of a new technology. Smaller steps should be taken to minimize the total cost and to permit more flexibility. The first attempt to apply new concepts is a necessary, but not sufficient step. In military systems, the second step in the development of a radically new concept must be determined after operational deployment. The warfighters will use the system in innovative ways not described in the manuals, and it is this experience that will define the path to revolution."[102]

In all likelihood, few people in the 1880' s could foresee the modern warfare only a few decades away, its capacity for previously unimaginable devastation made possible by predictable combinations of technologies already in development: the internal combustion engine, advances in metallurgy, explosives, communication, and mass-production. And yet the U.S. government suggests that the rest of the world will view with equanimity a "peacetime" program by the most powerful industrial nation on earth to devote tens of billions of dollars to an ambitious effort to explore both the basic sciences and the production engineering needed to release and control as weapons the most powerful energies known to humankind. At the same time, many in the arms control community seem to believe that such programs, even if sustained for decades, will have no significant effect on the international security context in which disarmament will or will not go forward.

5) The SS&M program is premised on a strategy of "lead and hedge," which will make permanent arms reductions more difficult to achieve.

The strategy of "lead and hedge," in which the United States retains large warhead and plutonium pit reserves throughout the earlier stages of disarmament, and retains a nuclear weapons complex sufficient to rapidly reconstitute large nuclear forces right down to zero, may make permanent arms reductions more difficult to achieve. This is a fundamental planning assumption of the SS&M program:

"Beginning in 1991, several Presidential policy declarations... resulted in DOD conducting the comprehensive NPR [Nuclear Posture Review], which was approved by the President in 1994. The NPR defines and integrates past and present U.S. policies for nuclear deterrence, arms control, and nonproliferation objectives....

The NPR assumes that the START I Treaty and START II protocol will be fully implemented. However, since the START I Treaty is not yet fully implemented and the START II protocol is not scheduled to be fully implemented until 2003, the NPR strategy protects the U.S. option to reconstitute the stockpile to START I levels should unfavorable events occur in the former Soviet Union. The treaties only control the number of strategic nuclear weapons that can be loaded on treaty-specified and -verified strategic missiles and bombers. These nuclear weapons are limited to 6,000 by the START I Treaty and 3,500 by the START II protocol. The treaties do not control the total stockpile size or the composition of strategic and nonstrategic weapons of either side. The U.S. stockpile will be larger than 6,000 under START I and 3,500 under START II since the stockpile also includes retaining weapons for nonstrategic forces, DOD operational spares, and spares to replace weapons attrited by DOE surveillance testing. *In the START II case, the stockpile may also include retaining weapons to reconstitute to the START I level."* (Emphasis added.)[103]

As the Green Book plainly states: *"DOE is maintaining a surge capability to rebuild a larger stockpile."*[104]

Concerning reserve warheads, the NAS study pointed out that

"Deploying yet more firepower in the event of renewed political antagonism with Russia would not improve the practical deterrent effect of U.S. nuclear forces. Moreover, the ability to overtly increase strategic readiness -- by dispersing bombers and by moving a larger fraction of the ballistic missile submarine forces to patrol areas -- would provide a hedge against surprise. Increases in U.S. nuclear force levels would be necessary only if massive growth in the Russian force imperiled the survivability of the U.S. arsenal. For the foreseeable future, Russia has no realistic capability to make such reconstitution possible.

The hedge strategy could become a self-fulfilling prophecy: the substantial stock of reserve warheads that the United States considers prudent could look to Russia very much like an institutionalized capability to break out of the START agreements. Russian legislators, worried about the breakout potential of U.S. forces and the high monetary cost of compliance, already are resisting the ratification of START II, which requires Russia to eliminate all of its multiple-warhead land-based ICBM's. *To the extent that the United States regards a return to hostile relations as a concern, it should focus on decreasing the probability of such developments."* (Emphasis added.)[105]

The NAS study also expressed skepticism about maintaining a nuclear weapons complex capable of rapidly reconstituting substantial nuclear forces once very low or zero arsenals have been reached. Although noting that retention of such a capability by the existing nuclear weapons

states might in some instances deter cheating and breakout, since detection would result in rapid rearmament by the other nuclear powers, the authors noted that

> "There are two potential problems with this kind of arrangement, however. First, allowing states to maintain the capability to build nuclear weapons on short notice would make it easier for a state to cheat while at the same time making it more difficult to detect cheating. *Permitted weapons-related activities would be of great value for a clandestine program and would create a background of legal activity against which it would be more difficult to detect illegal activities*. Second, *having states poised to resume manufacture and deployment of nuclear weapons could create dangerous instabilities in which states might rush to rearm during a crisis, thereby worsening the crisis.* Drawing the demarcation line closer to the other end of the spectrum would simplify verification, allow more time to respond to signs of breakout, and build a larger firebreak to nuclear rearmament." (Emphasis added.)[106]

These difficulties are exacerbated by the previously discussed intertwining of nuclear weapons activities with other advanced weapons research. It will be difficult enough to achieve adequate transparency of the armaments industries of the nuclear weapons states without providing an additional rationale ("capability based deterrence") for the construction and retention of additional multiple use high technology weapons research and production facilities.

6) The SS&M program will increase the political power of the nuclear weapons labs and their control over weapons-related information, and may thus help to preserve nuclear weapons programs even where they impede arms control efforts.

The political power of the U.S. nuclear weapons laboratories, and their virtually exclusive control over nuclear weapons information, limits meaningful debate on nuclear weapons policy, and may preserve nuclear weapons programs even where they impede progress on arms control. Most immediately, the weapons laboratories themselves constitute a politically well connected, multi-billion dollar industry, which is promoting intensely -- and successfully -- the continuation of its lucrative government contracts.[107] Moreover, their power is amplified by the mystique surrounding nuclear weapons, by the secrecy of much of the relevant information, by the lack of recognized nuclear weapons expertise independent of the weapons establishment -- and by their virtual monopoly on access to the Congress and other decision-makers. The Lab directors are forceful spokesmen for their cause:

> "New designs for components and subsystems will be a continuing requirement which will require all of the original core competencies we needed to make new weapon designs, as well as contemporary capabilities in advancing technology... The engineers and scientists who will do that work are probably entering kindergarten this year... They need to work on real systems... They have to design whole systems with real deliverables to fully develop their capabilities... *It is my belief that nuclear weapons will remain important for a long time to come.*" (Emphasis added.)[108]

> "Our job is to help the U.S. Government ensure that no one in the world doubts that the United States has the capability to project overwhelming force in the defense of its vital interests... *Nuclear weapons are the 'big stick' that defends our homeland and are the ultimate deterrent force against any potential aggressor."* (Emphasis added.)[109]

The link between control over nuclear weapons-relevant information and influence over nuclear weapons policy has been formally institutionalized by the "certification" process which is one element of SS&M, in which the weapons laboratories "certify" the safety and reliability of the nuclear arsenal once a year.[110] There apparently is no external check on this process, and the determination is essentially a judgment call by the laboratories.[111] If it is determined "that a high level of confidence in the safety or reliability of a nuclear weapon type...critical to our nuclear deterrent could no longer be certified," the "safeguards" which are part of the Clinton Administration's CTBT package provide that "the President, in consultation with the Congress, would be prepared to withdraw from the CTBT under the standard 'supreme national interests' clause in order to conduct whatever testing might be required."[112] This provision -- and the requisites of the SS&M program itself -- reportedly were included in the "safeguards" at the behest of the weapons laboratories. These "safeguards" provide an opportunity for the weapons laboratories to threaten an administration with termination of the CTBT regime if they are not given what they consider adequate resources to "certify" the reliability of the stockpile -- a temptation which paradoxically, and counterproductively, may grow in appeal if arms reduction efforts are successful, and nuclear weapons begin to lose their central place in U.S. national security dogma.

> "The ultimate measure of SSMP [Program] success will be our continuing ability to assure the President on a yearly basis the safety and reliability of the stockpile without nuclear testing....Should the SSMP fail to achieve its objectives, vitally important safeguards specified by the President... allow the U.S. to resume nuclear testing if the deterrent is judged to be at risk....
>
> *My greatest concern regarding the success of the SSMP is the possibility of a lack of timely and sustained support*... Program support must be timely because we must get on with the task before existing experienced people retire or leave to pursue other endeavors. In addition, the support must be sustained at an adequately funded level because every element of the SSMP is needed for the success of the program as a whole. *The technical risks in SSMP will be significantly greater if we are forced to stretch out activities in time or reduce the scope of planned research activities to meet more constrained budgets."* (Emphasis added.)[113]
>
> "[L]et me stress that if I am advised by the nuclear weapons laboratory directors that there is a problem with the stockpile that is critical to our nuclear deterrent and that we are unable to correct without returning to underground nuclear testing, I will not hesitate to advise the President of such."[114]

The concentration of arms control and nonproliferation policy and technology work at the DOE and DoD laboratories has further consolidated their influence over nuclear weapons policy.

> "The nation must avoid being surprised by foreign WMD activities. For decades, Livermore has used its technical knowledge about the design and testing of nuclear explosive devices to assess foreign nuclear weapons programs and nuclear proliferation risks. We will continue to integrate this knowledge with specifics about each country's capabilities and with our understanding of the nontechnical issues that motivate nuclear programs. *Livermore's analyses will support the U.S. intelligence and policy communities*, providing valuable technical assistance to policy makers and diplomats as they develop strategies for the U.S. response to international activities." (Emphasis added.)[115]

One likely result is a strong tendency to focus on technological approaches to proliferation problems.

> "The nation must be able to detect weapons-related activities and evaluate options for stopping potential proliferants from successfully acquiring WMD. We will build on the Laboratory's broad base of relevant expertise -- including genomics, microfabrication, sensors and remote monitoring, lasers, atmospheric science, computational modeling, intelligence analysis, and emergency response -- to develop needed capabilities and technologies."[116]

The tendency of institutions which have as their central purpose the design of high technology weapons systems to seek to seek out technological solutions to political problems exemplifies a broader trend characteristic of institutions dominated by specialists:

> "A working definition of an expert is a person who can solve a problem faster or better than others, but who runs a higher risk than others of posing the wrong problem. *By virtue of his or her expert methods, the problem is redefined to suit the methods."* (Emphasis added.)[117]

With the decline of the Arms Control and Disarmament Agency,[118] there is little left in the way of a perspective within the government on proliferation issues independent of institutions which will benefit directly from policies stressing weapons development and sophisticated sensing technologies as the solution to all proliferation issues. In addition to stressing the development of "counterproliferation" weaponry, development of defenses against (often not yet existing) WMD threats which might be developed by still to be determined adversaries provides an additional rationale for an extensive technology development program which is equally useful for weapons development. One example of this is the continuing array of facilities and programs involved in nuclear and electromagnetic spectrum weapons effects studies:

> "This project develops, provides, and maintains unique DoD test and simulation facilities and enabling technologies that are used by defense agencies, the Services and other federal agencies to evaluate the impact of hostile environments from conventional, nuclear, and other special weapons on military and civilian systems and targets. These facilities provide blast, thermal, electromagnetic pulse, ionizing radiation and radio frequency propagation environments and testbeds to support DoD and test requirements. *This project leverages*

fifty years of testing expertise to investigate weapons effects and target response to a spectrum of hostile environments that could be created by proliferant nations or terrorist organizations with access to advanced conventional or weapons of mass destruction (nuclear, biological, and chemical).

The project includes the upgrade of existing simulators to extend their utility and life, the decommissioning of obsolete simulators, and the development of new simulators, when required, to compensate as much as possible for the lack of underground testing....

The project provides test-beds for full and sub-scale tests that focus on weapon-target interaction with fixed hardened facilities to include hardened above-ground bunkers, cut-and-cover facilities and deep underground tunnels. This effort supports the Services' requirements for hard target defeat testing and emphasizes teaming with the Services to assess weapon-target interaction of existing and developmental weapon systems." (Emphasis added.)[119]

Here again, the overlap between facilities useful for weapons effects testing and those useful for other nuclear weapons applications, including design, code development, and maintaining a cadre of skilled weapons designers, may both complicate transparency issues and provide additional constituencies and rationales for preserving a large nuclear weapons testing complex.[120] In addition, the DOE weapons laboratories collaborate with the DoD laboratories on many of these efforts.

Monitoring and verification technologies also employ a facilities and skills base which is centered largely at the weapons laboratories. The difficulties of sorting out what is truly needed for monitoring and verification of the nuclear disarmament process alone from attempts, whether impelled by intent to achieve military advantage or by bureaucratic and fiscal inertia, to continue weapons development, are substantial. Combined with an extensive counterproliferation program in which nuclear weapons play a central role and an ambitious nuclear weapons "stewardship" program which will entail new generations of multi-use high energy density, hydrodynamic testing, and computing capabilities, they may be insurmountable.

7) The SS&M program may lead to the diffusion of nuclear weapons-relevant information from U.S. programs to the rest of the world, thus heightening proliferation concerns.

Although the level of secrecy and control of information maintained by the American weapons establishment may be adequate to assure dominance in the political debate at home, it may not be sufficient to prevent diffusion of nuclear weapons-relevant information from U.S. weapons programs to the rest of the world. In its proliferation impact study for the National Ignition Facility (NIF), DOE enumerated the advantages which sophisticated Inertial Confinement Fusion (ICF) programs and information may confer on potential proliferants, and then merely declared that the Department is "developing a proliferation management plan to address some of these issues...."[121] That was in 1995; no further details have been offered to the public concerning DOE's plans for "managing" the potential proliferation problems presented by the NIF.

Concerns that ICF research might facilitate nuclear weapons development in non-nuclear weapon states are not new. The "Fiscal Year 1981 Arms Control Impact Statements" prepared by the Arms Control and Disarmament Agency (ACDA) for Congress stated that

> "Concerns exist within the French, UK, US, and USSR governments that an ICF R&D [research and development] program could be a precursor to an advanced nuclear weapon program insofar as non-nuclear weapon states used ICF work to acquire the information, technology, trained people, and facilities applicable to nuclear weapon development." [122]

There are nations in the world which have ICF programs, extensive nuclear power systems, and large supplies of fissile material. Such countries might develop the capability to develop thermonuclear weapons relatively quickly, to the point where they would have to "break out" of a CTBT regime only for final proof-testing of designs which were fairly well understood.

> This concern also is not new. The "Fiscal Year 1981 Arms Control Statements" noted that "ICF research could stimulate development of nuclear weapons technology in non-nuclear weapon states... If an advanced non-nuclear weapon state with an ICF research program undertook a nuclear weapon program, it might subsequently be able to move more quickly to develop boosted fission and thermonuclear weapons than would otherwise be the case. This would almost certainly require full-scale and extensive nuclear testing, but ICF experience might serve to shorten the test program somewhat. Of course, a non-nuclear weapon state capable of executing an ICF program would be capable of developing a nuclear weapon at a fairly brisk pace in any case." [123]

ACDA concluded that *"ICF programs in non-nuclear weapon states, and perceptions by non-nuclear weapon states of the potential value of ICF research to nuclear weapon states could affect our arms control policy objectives."* [124]

This assessment was made in 1980, before many of the current generation of nuclear weapon simulated test facilities had been developed, and, perhaps most significantly, before the rapid increase in computing capacity which has occurred since that time. It is worth contemplating, for example, whether the amount of full-scale testing required for a technologically advanced proliferator to deploy thermonuclear weapons has changed (and, perhaps, will continue to change) due to the increase in sophistication of available simulation technologies. Consider the following 1997 Congressional testimony:

> "In January, 1986 the Department of Energy Office of Military Application commissioned a study by its three top national laboratories at Los Alamos, Lawrence Livermore and Sandia titled 'The Need for Supercomputers in Nuclear Weapons Design.' The study found that 'The use of high-speed computers and mathematical models to simulate complex physical process has been and continues to be the cornerstone of the nuclear weapons design program [of the United States]. This study still stands as the definitive word on the use of supercomputers in designing nuclear weapons systems.
>
> The Energy Department study considered the issue of 'efficiency.' Thanks to supercomputers, a new nuclear weapons design or concept involves exponentially fewer explosive tests. For example, in 1955 a new concept would require 180 tests; in 1986 the

number of tests required was reduced to 5. *As even more powerful supercomputers are available today, it is highly probably that the number of tests may be reduced even further, or testing altogether eliminated."* (Emphasis added.)[125]

In an unpublished dissent from the 1994 JASON report on Stockpile Stewardship, JASON member J.I. Katz argued for "curatorship," rather than "stewardship," of nuclear weapons:

> "In *stewardship* the human resources required to design and develop weapons are maintained, with skills honed on classified and unclassified experiments conducted at facilities such as NIF and in hydronuclear tests. In *curatorship* these facilities are not built, and design and development skills are allowed to atrophy; only those skills required to remanufacture weapons according to their original specifications are preserved... The chief nuclear danger in the present world is that of proliferation, and stewardship will exacerbate this danger, while curatorship will mitigate it while preserving our existing nuclear forces....
>
> ...The construction and operation of NIF and related facilities would not be cheap. More important are the consequences for the present and future danger of proliferation. NIF will bring together the weapons and unclassified communities. People will rub elbows, share facilities, collaborate on unclassified experiments and communicate their interests and concerns to each other. Information and understanding will diffuse from the classified to the unclassified world, without any technical violation of security. The desire to achieve renown and career success by publication in the open literature will diffuse from the unclassified to the classified world.
>
> Inertial (chiefly laser) fusion has similarly brought its classified and unclassified communities into intellectual and geographical contact over the last 25 years. The consequence has been the declassification of many nuclear weapons concepts and information. It is common knowledge that there is a great deal of physics in common between inertial fusion and nuclear weapons. The unclassified inertial fusion community has reinvented weapons technology, and the classified community has pressed successfully for declassification of formerly classified concepts, some applicable to inertial fusion and some not so applicable....This process would continue at NIF, which would provide a facility and funding for the unclassified world to rediscover nuclear weapons physics and (implicitly) to develop the understanding and computational tools required to design weapons. This reduction of the barriers to proliferation of both fission and thermonuclear weapons is not in the national interest."[126]

Swiss physicist André Gsponer has studied extensively the potential for new weapons development utilizing SBSS technologies. In a 1997 report he warned that

> "[T]he signing of the CTBT and the implementation of politically-correct programs, such as the Science-Based Stockpile Stewardship, might well correspond to the begining [sic] of a new age, the 'Golden Age' of thermonuclear weapons *proliferation*. If the construction of large ICF simulation facilities (such as NIF in the USA, LMJ [Laser Megajoule] in France and others in Japan, Germany, Russia, China, etc.) are not stopped, we will soon witness the emergence of a growing number of 'virtual' thermonuclear-weapon States, as well as a proliferation of *fourth generation nuclear weapons.*" (Emphasis in original.)[127]

Four decades ago, the U.S. "Atoms for Peace" program, by promising a source of "safe, clean" energy, "too cheap to meter," spread the deadly knowledge and materials necessary to build atomic weapons around the world. In the decades to come, the similarly misnamed "Stockpile Stewardship" program may facilitate the dissemination of new technologies that could spark an arms race of unprecedented complexity. Although the path of technology development cannot be predicted with any certainty, we might anticipate, for example, multilateral competition to develop and deploy compact, extremely powerful explosives more useable than existing thermonuclear weapons. We might also eventually see directed energy weapons employing engineering achievements and physics concepts developed through extensive experimentation with pulsed power technologies, and a range of weapons derived from the same knowledge and technology base which will employ various types of tailored energy releases to degrade or destroy the electronic sensing, communications, and computing devices on which modern weapons systems (and modern societies) increasingly rely. *We should have learned by now that it is not necessary for high technology weapons to be proven workable to spark a destabilizing and financially ruinous arms race*. An arms race encompassing technologies which threaten the remote sensing, communications, and information processing capabilities on which modern militaries depend also may generate an accelerated, intensified "fog of war," and a fear of losing globally dispersed electronic "assets" which would make future confrontations between technologically sophisticated states even more unstable than the late Cold War world of immense forces on alert, highly accurate, multiple warhead nuclear missiles, and short warning times.[128]

Conclusions

The end of the Cold War was widely hailed as an historic "window of opportunity." People the world over breathed a collective sigh of relief, believing that at long last the nuclear nightmare was over. The NPT was extended indefinitely, START I and II were ratified, and the CTBT -- perhaps the longest-sought "prize" of the nuclear age -- was signed. Yet fundamentally *little has changed* with respect to nuclear weapons policies and practices. It was his own growing realization of this frightening reality that led retired General Lee Butler, who from 1992 - 1994 served as commander in chief of the U.S. Strategic Air Command in control of all Navy and Air Force nuclear weapons, to come forward:

> "I am compelled to speak, by concerns I cannot still, with respect to the abiding influence of nuclear weapons long after the Cold War has ended....
>
> [N]o one could have been more relieved than I was by the dramatic end of the Cold War and the promise of reprieve from its acute tensions and threats....
>
> Most importantly, I could see for the first time the prospect of restoring a world free of the apocalyptic threat of nuclear weapons. Over time, that shimmering hope gave way to a judgment which has now become a deeply held conviction: that a world free of the THREAT of nuclear weapons is necessarily a world DEVOID of nuclear weapons. Permit me... to elaborate briefly on the concerns which compel this conviction.
>
> FIRST, a growing alarm that despite all of the evidence, *we have yet to fully grasp the monstrous effects of these weapons*, that the consequences of their use defy reason, transcending time and space, poisoning the earth and deforming its inhabitants. SECOND, *a deepening dismay at the prolongation of Cold War policies and practices in a world*

where our security interests have been utterly transformed. THIRD, that *foremost among these policies, deterrence reigns unchallenged*, with its embedded assumption of hostility and associated preference for forces in high states of alert. FOURTH, *an acute unease over renewed assertions of the utility of nuclear weapons, especially as regards response to chemical or biological attack*. FIFTH, *grave doubt that the present highly discriminatory regime of nuclear and non-nuclear states can long endure absent a credible commitment by the nuclear powers to eliminate their arsenals.* And FINALLY, *the horrific prospect of a world seething with enmities, armed to the teeth with nuclear weapons, and hostage to maniacal leaders strongly disposed toward their use."* (CAPS in original. Emphasis added.)[129]

It is high time to begin in earnest a debate over our nuclear weapons policy which repeatedly has been short-circuited -- a debate which either has been evaded by taking as given political deals which should be thoroughly justified rather than assumed, or paid lip service and then simply ignored in the rush to find ways to sustain the flow of defense dollars uninterrupted. The JASONs recommended that SBSS be managed with "restraint and openness" to avoid disruptions of the CTBT and nonproliferation regimes, but nowhere addressed substantively what forms such "restraint" might take.[130] DOE, under unprecedented political pressure during the brief House National Security Committee chairmanship of Congressman Ronald V. Dellums, an outspoken disarmament advocate, undertook a proliferation impact review of the NIF. But when electoral events removed the political pressure, DOE responded by producing another "ex post facto" justification of a decision already made, a shoddy, internally contradictory analysis, with no consideration of alternatives, and with the weapons laboratories' Stockpile Stewardship bargain treated as axiomatic, apparently as immutable as a law of physics. Requests by public interest groups for a thorough, public proliferation impact analysis of the Stockpile Stewardship and Management program in its entirety were refused. Despite the veneer of openness taken on by DOE to "spin-control" its continuing public relations difficulties concerning widespread radioactive contamination of American communities and human experimentation, DOE Defense Programs continue to manifest the characteristics of Cold War military institutions: secretive, arrogant, secure in their belief that they are above public accountability. These attitudes clearly are visible to the international community, and do not bode well for the future of an arms control regime based on trust and transparency.

"The CTBT should be seen as a step, albeit a very important one, towards the attainment of genuine nuclear disarmament ushering in a world that will be completely free of nuclear weapons. That ultimate goal ought to be predicated on, not just the proliferation of nuclear weapons horizontally, but also vertically. If the NPT is seen as an essential instrumentality to realize horizontal nuclear non-proliferation, then the CTBT is the process by which vertical proliferation will be curbed. Yet, when under tremendous pressure the non-nuclear-weapon States Members of the NPT went along most reluctantly, with the Treaty's indefinite extension there is no reciprocal spirit of accommodation on the part of the nuclear powers with respect to the CTBT. *It is not without reason, therefore, that many non-nuclear-weapon States view with cynicism the 'good faith' undertaking of the nuclear-weapon States to continue negotiations on nuclear disarmament, as enjoined by the NPT. With an indefinitely extended NPT already in hand and now a CTBT favourable to the nuclear-weapon States in the offing,*

> *there is a very clear impression that the club of nuclear countries are manipulating the entire nuclear disarmament processes to serve their own agendas.* The draft Text as currently presented renders the test-ban Treaty less than comprehensive as it keeps the door open for other forms of testing, including laboratory testing and simulations, which will not put a complete halt to the qualitative improvement of nuclear weapons but merely circumscribing it through testing by other technically more sophisticated means." (Emphasis added.)[131]

Conditioning adoption of the CTBT on the establishment of a massive "Stockpile Stewardship" program to "compensate" for the loss of underground testing demonstrates a profound U.S. disregard for global and historical expectations for the CTBT, and may eventually contribute to the unraveling of the nonproliferation regime. By attempting to limit the range of public debate to a narrow discussion of how to get the Senate to ratify the Treaty in the short term, many in the arms control community failed to recognize the centrally important long term issue -- *the future of nuclear weapons*.

The NAS study provided one opportunity to engage with these issues in a meaningful way. The NAS committee stated that as disarmament proceeds

> "[A]n infrastructure of nuclear weapons expertise sufficient to maintain the safety and reliability of the remaining nuclear weapons will be required. The infrastructure must be sufficiently transparent to provide accountability of the total number of nuclear weapons and to assure the international community that it is not being used for the development of additional types of weapons. Maintenance of such infrastructure, including availability of highly capable technical personnel, should not be interpreted as contrary to achieving reductions.[132]

Along with the NAS committee's opinion that retaining the full capability to produce nuclear weapons once existing warheads would be eliminated "could create dangerous instabilities in which states might rush to rearm during a crisis"[133], this passage frames the real tensions among the options facing nuclear weapons policy makers. What kind of "infrastructure of nuclear weapons expertise" is adequate to maintain acceptable minimal deterrence, while simultaneously being "sufficiently transparent to provide accountability of the total number of nuclear weapons and to assure the international community that it is not being used for the development of additional types of weapons?" The NAS panel judged these issues difficult and dependent on "the political and technical circumstances in which comprehensive nuclear disarmament would be pursued." And this was within a broader perspective which assumed that rapid cuts in nuclear arsenals, termination of new weapons design activities, and a willingness to remove the nuclear option from U.S. counterproliferation strategy are possible in the near term.

Disarmament groups the world over have attempted to address these difficult issues head on by articulating a vision for a world without nuclear weapons, and by promoting a means to get there. The Abolition 2000 Global Network to Eliminate Nuclear Weapons, a dynamic network of more than 2000 NGOs and municipalities from over 90 countries, is calling as its central demand for immediate commencement of negotiations on a treaty to eliminate nuclear weapons within a timebound framework. In contrast to many arms control groups, Abolition 2000 challenges stockpile stewardship directly. The 11-point Abolition 2000 Statement links calls for a "truly comprehensive test ban treaty" with a prohibition on "nuclear weapons research, design,

development, and testing through laboratory experiments including but not limited to non-nuclear hydrodynamic explosions and computer simulations," and insists that all nuclear weapons laboratories be subject to international monitoring, while all nuclear test sites are closed.[134] To further its principal goal of a treaty, an Abolition 2000 working group including prominent international lawyers and scientists, under the leadership of the Lawyers' Committee on Nuclear Policy and the International Network of Engineers and Scientists Against Proliferation, produced a Model Nuclear Weapons Convention, which was introduced as an official United Nations document by Costa Rica.[135] SS&M is clearly inconsistent with the Model Nuclear Weapons Convention, which requires closure of nuclear weapons research, development, testing and production facilities, broadly defined, and strict controls of fissile materials on a short time schedule.[136]

The SS&M program may, in fact, represent the biggest scientific-technical push related to weaponry since the Manhattan Project -- at a time when public awareness (in the U.S.) is almost nonexistent and global geopolitical alliances are in a dramatic state of flux. In 1997, Dr. Victor Reis, DOE Assistant Secretary of Defense Programs, told a Senate committee that the DOE will

> "ensure the safety, security and reliability of the enduring stockpile, without nuclear tests... through the vigorous implementation of the integrated Stockpile Stewardship and Management Program, *a scientific and technical challenge perhaps as formidable as the Manhattan Project."* [137]

SS&M manifests a fundamental decision by the United States to re-commit us to a world dominated by the threat of nuclear annihilation. Ironically, this crucial choice is at least partially visible this time around, but has been largely ignored by a public convinced by its political leaders that the nuclear danger is over. General Butler came out of private retirement to issue this dire warning:

> "By now time, and human nature, are wearing away the sense of wonder and closing the window of opportunity. Options are being lost as urgent questions are unasked, or unanswered; as outmoded routines perpetuate Cold War patterns and thinking; and as a new generation of nuclear actors and aspirants lurch backward toward a chilling world where the principal antagonists could find no better solution to their entangled security fears than Mutually Assured Destruction."[138]

But General Butler has also offered hope and a challenge:

> "Such a world was and is intolerable. We are not condemned to repeat the lessons of forty years at the nuclear brink. We can do better than condone a world in which nuclear weapons are accepted as commonplace. The price already paid is too dear, the risks run too great. The task is daunting be we cannot shrink from it. The opportunity may not come again."[139]

The decision to go forward with "Stockpile Stewardship" is too important to be "left to the generals." It is also too important to be left entirely to a coterie of scientists who have spoken only to the generals for the last half-century. If the CTBT/SS&M "deal" does not generate serious and searching public debate -- and soon, discussion of "nuclear arms control" may well be reduced to a sterile academic exercise, an empty prefiguration of a history that may never be written.

ENDNOTES

1. "When President Clinton put his signature on Presidential Decision Directive-60 in November 1997, he not only ordered the nuclear planners to reduce targeting in Russia and broaden the scope of targeting in China, he also identified specific regional contingencies (such as the Persian Gulf and the Korean Peninsula) where U.S. nuclear forces could be directed against opponents armed with WMD." Hans M. Kristensen "U.S. Strategic Nuclear Reform in the 1990s," Nautilus Institute, March 2000 http://www.nautilus.org/nukepolicy/USA/StratRef.html Kristensen's work, extensively supported by documents obtained under the U.S. Freedom of Information Act from the U.S. Strategic Command and other agencies, traces the debates within the government over nuclear weapons policies throughout the 1990' s. See also Kristensen, "Nuclear Futures: Proliferation of Weapons of Mass Destruction and U.S. Nuclear Strategy," British American Security Information Council (BASIC), March 1998; and "Targets of Opportunity," Bulletin of the Atomic Scientists, September/October 1997.

2. Harold Feiveson and his co-authors provide an account of the 1993-94 Nuclear Posture Review (NPR), a watershed moment for nuclear weapons policy in the United States in which "the NPR was transformed from a review of national policy to a force posture exercise which, with modest exceptions, reinforced existing doctrine, targeting plans, and requirements." Their account is based in part on interviews with NPR participants. "The Next Nuclear Posture Review?" in Feiveson et al, *The Nuclear Turning Point: A Blueprint for Deep Cuts and De-Alerting of Nuclear Weapons* (Washington, D.C. 1999), p.276. Hans Kristensen provides further detail of the triumph of nuclear weapons advocates in the 1990' s, and of their adaptation of the Cold War arsenal to a changed world in which nuclear weapons would in some ways have a broader role:

> Bogged down in bureaucratic and personal quagmires, the Nuclear Posture Review failed to redefine the role of nuclear weapons after the Cold War. In the end, according to an internal STRATCOM report, the NPR "reaffirmed the benefits of ambiguity in existing nuclear weapon declaratory policy." In other words, any presidential de-targeting initiatives or other confidence-building measures could be accommodated, because U.S. policy could say one thing and do another, and new systems increasingly allowed nearly instant shifts back to the core targeting that Washington had agreed was beyond change.
>
> The NPR also blessed another of the "Cold Warrior' s" schemes -- keeping the "hedge," an extra supply of non-deployed warheads that provided a non-survivable upload capability. U.S. nuclear forces were not only improved over pre-1990 capabilities, but the United States would retain the capability to fight a protracted nuclear war, at least on paper. President Clinton' s approval of the NPR in September 1994 confirmed the war planners' views. They had avoided any significant post-Cold War change and even prevailed in the most recent Pentagon force structure review from 1997 -- the Quadrennial Defense Review -- which concluded that "nuclear weapons remain important as a hedge against NBC proliferation and the uncertain futures of existing nuclear powers." Therefore, the review concluded, the United States will "continue to need a reliable and flexible nuclear deterrent - survivable against the most aggressive attack, under highly confident, constitutional command and control."[10] The Cold War-like assumptions and conclusions of the Nuclear Posture Review remain the basis for U.S. nuclear strategy today as we enter the twenty-first century. Kristensen, "U.S. Strategic Nuclear Reform in the 1990s," *supra*.

3. William S. Cohen, U.S. Secretary of Defense, Annual Report to the President and Congress 2000, Chapter 2, "The Military Requirements of the Defense Strategy." http://www.dtic.mil/execsec/adr2000/chap2**.html**

4. Cohen, U.S. Secretary of Defense, Annual Report to the President and Congress 2000, Chapter 6, "Nuclear Forces and Missile Defenses."

5. Cohen, U.S. Secretary of Defense Annual Report to the President and Congress 2000, Chapter 1.

6. General Lee Butler, retired Commander of U.S. Strategic Command, remembered his first comprehensive look at the U.S. nuclear war plans, at a time "when the Cold War had already been declared over with the signing of the Conventional Forces in Europe treaty in Paris in December of 1990:"

> Even having some sense of what it encompassed, I was shocked to see that in fact it was defined by 12,500 targets in the former Warsaw Pact to be attacked by some 10,000 nuclear weapons, virtually simultaneously in the worst of circumstances, which is what we always assumed. I made it my business to examine in some detail every single one of those targets. I doubt that that had ever been done by anyone, because the war plan was divided up into sections and each section was the responsibility of some different group of people....
>
> At the conclusion of that exercise I finally came to understand the true meaning of MAD, Mutually Assured Destruction. With the possible exception of the Soviet nuclear war plan, this was the single most absurd and irresponsible document I had ever reviewed in my life. General Lee Butler (retired), address to the Canadian Network Against Nuclear Weapons, March 11, 1999.

And even a portion of the START III-allowed strategic arsenal could devastate either Russia or the U.S. if used:

> "A total of 500 deliverable U.S. retaliatory warheads, for instance, could destroy 'most [Russian] petrochemical, metallurgical, and heavy-machinery industry; all major [CIS] storage sites for ammunition, fuel, and other military supplies; all major tactical airfields; some troop concentrations; and all major [Russian] transportation nodes and choke points en route to the European and Far Eastern theaters,' all garrisons for mobile strategic missiles; all primary strategic bomber bases and submarine pens; most strategic bomber dispersal bases; and most major fixed and mobile command posts. A comparable number of survivable Russian strategic warheads could wreck no less comprehensive devastation on the United States." Bruce Blair, The Logic of Accidental Nuclear War (The Brookings Institution, Washington, D.C., 1993, quoting U.S. Congressional Budget Office, The START Treaty and Beyond (1991) pp.14-15, 21

7. "Proposal on ABM: 'Ready to Work with Russia,'" *The New York Times*, April 28, 2000, p. A10 (emphasis added). The document quoted from was a document "that American negotiators have presented to the Russians with proposals for amending the 1972 ABM treaty, in order to allow the United States to build a limited national missile defense system."

It is worthy of note that the current U.S. administration has publicly committed itself to pursuit of anti-ballistic missile defenses, and views such systems as an integral part of its program to deter use of weapons of mass destruction:

> Nuclear forces and missile defense are critical elements of U.S. national security and will remain so into the future. Strategic forces continue to provide a credible and a highly valuable deterrent. The United States remains committed to appropriate and jointly agreed upon reductions in strategic nuclear forces, but will protect options to maintain its strategic capabilities at START I levels until the START II Treaty has entered into force. The Administration also believes it is necessary to protect the United States, its forces abroad, and its friends and allies from the effects of chemical and biological weapons and the missiles that can deliver them. The United States has a comprehensive strategy for countering such threats. The structure of the theater and National Missile Defense (NMD) programs meets present and projected future missile threats, provides the best technology to meet these threats, and is fiscally prudent. Cohen, U.S. Secretary of Defense, Annual Report to the President and Congress 2000 Chapter 6, "Nuclear Forces and Missile Defenses," p.69.

8. That deployed U.S. strategic weapons can be reduced substantially and still fulfill the same nuclear warfare "missions" should not surprise us, given the excessive levels of Cold War superpower arsenals. As Herbert York, a former U.S. arms control negotiator and nuclear weapons laboratory director, noted,

> Throughout this period, most of our Presidents have taken the attitude when they' ve become President and really seen what the situation is, that my God, this is awful, these forces are simply beyond belief, beyond what is necessary..." Herbert York, Interview, April 1982, In Appendix, Robert Scheer, With Enough Shovels: Reagan, Bush, and Nuclear War (New York: 1982) at 266.

9. Senator Jesse Helms, Congressional Record: October 6, 1999 (Senate), p. S 12311--12312.

10. Senator John Warner, Chairman of the Senate Armed Services Committee, bolstered his similar position with a letter from a former Chairman of the Joint Chiefs of staff, which stated in part:

> If the United States is to remain the preeminent nuclear power, and maintain a modern safe secure, reliable, and usable nuclear deterrent force, I believe we need to continue to develop new nuclear weapons designed to incorporate the latest in technology and to meet the changing security situation in the world. Changes in the threat, changes in intelligence and targeting, and great improvements in delivery precision and accuracy make the weapons we designed thirty years ago less and less applicable to our current and projected security situation. The United States, the one nation most of the world looks to for securing peace in the world, should not deny itself the opportunity to test the bedrock building block of its security, its nuclear deterrent force, if conditions require testing. John W. Vessey, General, USA (Ret.), Former Chairman, Joint Chiefs of Staff, letter to Hon. John W. Warner, Chairman, Armed Services Committee, United States Senate, October 5, 1999, entered into the record of the debate on the ratification of the Comprehensive Test Ban Treaty by Senator Warner, Congressional Record: October 6, 1999 (Senate), p. S.12091.

The Director of one of the three U.S. nuclear weapons design laboratories also recently emphasized that new nuclear weapons designs were likely to be necessary in the future, expressed doubt about the ability of the U.S. nuclear weapons laboratories to maintain existing weapons and design new ones adequately without testing, and implied that even under a CTBT regime, the U.S. should test a new nuclear weapons design when one is 'needed:'

> Although I believe all of us would wish that the US will never need new nuclear weapon designs; based on the past, this is quite unlikely. The US will undoubtedly require a new nuclear weapon, either for a different delivery mode or vehicle or, quite likely, because it is realized that the yields of the weapons left over from the Cold War are too high for addressing the deterrence requirements of a multipolar, widely proliferated world. Without rectifying that situation, we would end up being self-deterred. Will the US then consider the need for a new nuclear weapon to equate with our Supreme National Interest, as President Clinton has said he would do for a problem in reliability or safety of a critical weapon in the current stockpile?" Maintaining a Viable Nuclear Weapons Program in a Test Ban Environment: A Strong Technical Foundation in the Laboratories, C. Paul Robinson, President and Laboratories Director, Sandia National Laboratories (Presented at the Nuclear Security Decisionmakers Forum, March 28, 2000, Albuquerque, NM).

11. Secretary of State Madeleine K. Albright Remarks at Chicago Council on Foreign Relations November 10, 1999, Chicago, Illinois, as released by the Office of the Spokesman U.S. Department of State.

12. Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management, United States Department of Energy, September 1996, p. S-3, S-48.

13. "Historical and Proposed Spending on U.S. Nuclear Weapons Research, Development, Testing, and Production -- 1948-2003," The U.S. Nuclear Weapons Cost Study Project, the Brookings Institution, available on the World Wide Web at http://www.brook.edu/fp/projects/nucwcost/rdt&e.HTM.

14. Statement of C. Paul Robinson to the U.S. Senate Armed Services Committee, October 7, 1999.

15. See Greg Mello, "That Old Designing Fever," *Bulletin of Atomic Scientists*, January/February 2000, p.51. See also section 2 on design and deployment of weapons with new military capabilities *infra*.

16. Interview with Indian Prime Minister Atal Bihari Vajpayee, *India Today*, May 25, 1998.

17. The Future of U.S. Nuclear Weapons Policy, Committee on International Security and Arms Control, National Academy of Sciences, National Academy Press, Washington, D.C. 1997, p. 30. ("NAS") Available on the World Wide Web at http://www.nap.edu/readingroom/books/fun/

18. Id.

19. NAS, p. 88.

20. Report of the Canberra Commission on the Elimination of Nuclear Weapons, Canberra Australia, Commonwealth of Australia, 1996. ("Canberra Commission") Available on the World Wide Web at http://www.dfat.gov.au/cc/cchome.html

21. "An American Legacy: Building a Nuclear-Weapon-Free World," The Final Report of the Steering Committee Project on Eliminating Weapons of Mass Destruction, The Henry L. Stimson Center, Report No. 22, March 1997.

22. Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management, United States Department of Energy, September 1996, p. S-3. ("FPEIS").

23. FPEIS, p. S-1.

24. FPEIS, p. S-21-- S-22.

25. FPEIS, p. S-5. For a brief overview of existing, approved, and planned SS&M facilities, see "Description of ICF Program and Selected Other Major SBSS Facilities," from the Review of the Department of Energy's Inertial Confinement Fusion Program: The National Ignition Facility, National Research Council, March 20, 1997, attached as Appendix I.

26. FPEIS, p. 3-10 -- 3-11.

27. A May 1997 Department of Defense (DoD) report describes the "Pathway to Nuclear Sustainment."

> "Sustainment is most likely to be successfully accomplished for nuclear systems or other military capabilities when and if a set of interrelated conditions are achieved:
>
> The capability is clearly and consistently given priority...
>
> All of the physical components that make up the capability are regarded as life-limited parts that require constant surveillance and are refurbished, modernized or replaced as needed.
>
> Career paths exist for both military and civilian personnel that attract and retain sufficient numbers of personnel with appropriate qualifications.
>
> The program involves a complete, end-to-end capability (development-deployment-operations) capability...
>
> The potential for modifying existing weapons/weapon systems (without nuclear weapons testing) to meet plausible future contingencies is maintained....
>
> *[S]o long as one weapon and delivery system remain in our force structure, action will have to be taken to ensure that DoD nuclear weapons systems are effective, safe, secure, reliable, and survivable."* (Emphasis added.) Nuclear Weapons Systems Sustainment Programs, Office of the Secretary of Defense, May 1997.

28. The deceptively-named Department of "Energy" (DOE) operates the nuclear weapons research, development and testing complex for its "customer" the Department of Defense (DoD). DoD (also called the Pentagon), is responsible for U.S. military forces and operations, including deployed nuclear weapons.

29. "Science Based Stockpile Stewardship," S. Drell, Chairman, JASON, The MITRE Corporation, November 1994, p. 3. ("JASON")

30. Transcript, "Nuclear Test Ban Negotiations: Progress Report," panel discussion held at the United Nations, October 26, 1995, sponsored by the UN Centre for Disarmament Affairs, the UN Department of Public Information and the NGO Committee on Disarmament. Available from the NGO Disarmament Committee in New York.

31. Arundhati Ghose, Ambassador of India to the Conference on Disarmament, Final Record of the Seven

Hundred and Forty-Sixth Plenary Meeting, Geneva, 20 August 1996, CD/PV.746, p. 6.

32. Interview with Indian Prime Minister Atal Bihari Vajpayee, India Today, May 25, 1998.

33. Canberra Commission.

34. NAS, p. 47.

35. Comprehensive Nuclear Test Ban Treaty, Article I, Basic Obligations, 1.

36. Edited transcript, "The Nuclear Test Ban Treaty: Implementation," panel discussion, October 24, 1996, sponsored by the NGO Disarmament Committee in cooperation with the UN Centre for Disarmament Affairs and the UN Department of Public Information. Available on the World Wide Web at http://www.igc.apc.org/disarm/forum.html

37. Affidavit of Theodore B. Taylor in Support of Plaintiffs' Reply to Defendants' Opposition to Plaintiffs' Motion for Preliminary Injunction, June 15, 1997. Natural Resources Defense Council, et. al., v. Federico Peña, et. al., United States District Court for the District of Columbia, Civil Action No. CV-97-0936.

38. "The Question of Pure Fusion Explosions Under the CTBT," Frank von Hippel and Suzanne Jones, May 14, 1997, available from the Federation of American Scientists. This potential for developing pure fusion bombs and other advanced weapons types is discussed further in section (4) *infra.*

39. "Second Subcritical Experiment Conducted Successfully at the Department of Energy's Nevada Test Site," DOE press release, September 18, 1997.

40. "New Contractor Announced for Nevada Test Site: Secretary Outlines Plans for Site," DOE news release, October 27, 1995.

41. These tests, code-named "Appaloosa," are conducted above ground at Los Alamos in special steel tanks. Because they can use Pu-242, an isotope of plutonium with a higher critical mass than that used in nuclear weapons (and which as a consequence will not result in a self-sustaining chain reaction), the device tested can more closely simulate certain aspects of the functioning of actual thermonuclear bomb triggers than other "hydrodynamic" explosive tests in which other substitute materials are used:

> Experts say use of the plutonium-242 isotope in explosives tests would allow a full-scale nuclear weapon mockup to be detonated without resulting in any nuclear yield, an experiment that would allow detailed hydrodynamical study of the early stages of the implosion of a nuclear weapon. But while there have been hints in the public record about the possibility of such tests being planned for DARHT [the Dual Axis Radiographic Hydrotest facility at Los Alamos], details have been tightly classified....
>
> Basic physics provides a rationale. When weapons-grade plutonium-239 reaches a critical mass, a nuclear chain reaction begins, a phenomenon that severely limits the type of nuclear weapons testing that can be done in a test ban environment. But plutonium-242 is much less fissionable. That means an identical mass of plutonium to that used in a weapon could be imploded with a full charge of high explosives with no nuclear yield resulting. While that won' t help weapons scientists understand the physics of the nuclear blast itself, it could allow them to analyze in great detail the behavior of the plutonium as it liquifies and is squeezed inward by the high explosive blast used to set off a nuclear weapon.
>
> As plutonium ages and develops imperfections, the behavior of the material in that crucial instant becomes one of the key questions facing the weaponeers as they cope with an aging arsenal that they are not permitted to test directly with underground blasts.
>
> There was a feud within the Energy Department in 1996 over the classification of the use of

plutoniuin-242 in the DARHT tests, with classification and weapons program officials favoring declassifying it, while nonproliferation officials opposed any such move. Thus, the potential use of plutonium-242 at DARHT remains officially classified, but officials speaking with NW&M Monitor confirmed the general outlines of a program in which plutonium-242 will be detonated in containment vessels at DARHT. Whether that plutonium-242 would actually be assembled into a warhead configuration remained unclear. "Los Alamos To Use PU-242 in Explosives Tests at DARHT," Nuclear Weapons & Materials Monitor, February 1, 1999.

Interestingly, some of the technology development for these classified above ground subcritical experiments apparently is being done in cooperation with Russia:

> "We also placed a contract with Russia's Arzamas-16 nuclear weapons laboratory to continue development of the metal/composite (x-ray transparent) explosion containment vessel required for advanced hydrodynamic radiography, which also appears to offer new market opportunities such as accident response and transitioning subcritical experiments aboveground." Sandia National Laboratory Institutional Plan FY2000 – 2005, § 5.6.5, "Pulsed Power Sciences."

For further information, relevant documents, and the current status of the above ground subcritical testing program at Los Alamos, see the web site maintained by the Los Alamos Study Group at http://www.lasg.org/appaloos/intro.htm

42. "Second Subcritical Experiment Scheduled for September 18," DOE press release, September 16, 1997.

43. The United States conducted 2 subcritical tests in FY1998 and 3 in FY1999. See U.S. Department of Energy *FY2000 Congressional Budget Request, Weapons Activities/Stockpile Stewardship*, p.5 (electronic pdf version) and U.S. Department of Energy *FY2001 Congressional Budget Request, Weapons Activities/Executive Budget Summary* p.24 (electronic pdf version). DOE has announced conduct of 4 additional subcritical tests since the end of FY 1999.

44. U.S. Department of Energy Office of Defense Programs, "Stockpile Stewardship and Management Plan: Second Annual Update (FY 1999), April 1998, Appendix B, "Nevada Test Site Readiness," p. B-5.

45. In early 1999, for example, the Washington Post reported that Russia had conducted three subcritical tests. See Walter Pincus, "Russian Tests Raise U.S. Speculation About New Nuclear Design," *Washington Post*, January 24, 1999; Page A24. Interestingly, unnamed U.S. intelligence officials were cited in the article speculating that the tests were being used "to design a new generation of tactical nuclear weapons," despite repeated denials during the same period by U.S. officials that U.S. nuclear weapons research and testing facilities could be used to design and deploy significant new designs without underground nuclear explosive testing.

46. "Détonations sous haute surveillance au polygone de Pontfaverger-Moronvilliers," L'union, 21 January 1997, p. 1.

47. In 1978, long before the sophisticated new weapons testing facilities now being built by the United States were contemplated, three prominent U.S. nuclear weapons scientists, Norris Bradbury, Carson Mark, and Richard Garwin, wrote to President Jimmy Carter informing him that it would be possible to assure the safety and reliability of nuclear warheads without underground nuclear testing, so long as warhead designs were not significantly changed. They noted that

> ...[T]he assurance of continued operability of stockpiled nuclear weapons has in the past been achieved almost exclusively by non-nuclear testing-- by meticulous inspection and disassembly of the components of the nuclear weapons, including their firing and fusing equipment. Problems encountered in this inspection are normally validated by additional sampling and solved by the remanufacture of the affected components. This program is, of course, supplemented by the instrumented firing of the entire nuclear weapon with inert material replacing the fissile materials, and the entire program thus far described would be unaffected by the requirements of a CTBT. It has been exceedingly rare for a weapon to be taken from the stockpile and fired 'for assurance.'

It has been rare to the point of non-existence for a problem revealed by the sampling and inspection program to require a nuclear test for its resolution. There are three acceptable approaches to the correction of deficiencies without requiring nuclear testing:

1) Remanufacture to precisely the original specifications

2) Remanufacture with minor modifications in surface treatment, protective coatings, and the like, after thorough review by experienced and knowledgeable individuals.

3) Replace the nuclear explosive by one which has previously been tested and accepted for the stockpile.

A fourth option, to replace the troubled nuclear system by one not already proof tested may result in improved performance, lesser use of special nuclear materials, or the like, *virtues which have more to do with improvement of the stockpile than with confirming its operability.... "* Letter, N. Bradbury, C. Mark, and R. Garwin, to President Jimmy Carter, August 15, 1978, Appendix J to R.E. Kidder, "Maintaining the U.S. Stockpile of Nuclear Weapons During a Low-Threshold or Comprehensive Test Ban," Lawrence Livermore National Laboratory 1987. (Emphasis added)

Richard Garwin today is an advocate of the Stockpile Stewardship Program, but he also has suggested that a remanufacturing approach alone would be workable. he would favor both close adherence to original production techniques where possible plus a further "stewardship" type experimental research.

Automatic replacement of components on a fixed schedule is a reasonable approach if it can be afforded and if strong management prevents changing the design or process of the untestable parts; indeed, scheduled remanufacture may be less costly than the alternative. Of course, the combination of remanufacture within initial specifications together with understanding and computation would provide still more assurance of reliability and safety. Richard Garwin, "The Future of Nuclear Weapons Without Nuclear Testing ," *Arms Control Today,* November/December 1997 Volume 27, Number 8.

48. Suzanne Jones and Frank von Hippel wrote that

Seen from space, activity at the test site associated with an underground subcritical test would be virtually indistinguishable from that for any other underground experiment, including a hydronuclear test. Seismic measurements can place an upper limit on the total explosive yield of a test, adequate to rule out the possibility that a full-scale nuclear test had been conducted. But seismic data would be of no use in determining what fraction of the energy from an explosion was nuclear. If other countries wished to know whether a subcritical or hydronuclear experiment had taken place, how could they tell the difference?

Evidence that this question is not purely academic is provided by alleged activities at the Russian nuclear test site Novaya Zemlya, near the arctic circle in January 1996. According to leaks to the *Washington Times,* intelligence information on these activities led some U.S. officials to suspect that a nuclear test had occurred. One government official was quoted as saying that 'many Pentagon officials have few doubts and believe Moscow set off a small nuclear weapon.' In the same article, however, State Department Spokesman David Leavy was quoted as saying, 'It is the view of the United States that the Russian moratorium on nuclear testing is continuing.'

The confusion may have arisen in part from the fact that a seismic array in Norway detected a magnitude 2.5 event in the Novaya Zemlya region on January 13, 1996. A seismic signal of this magnitude would correspond to a well coupled underground explosion of a few tons of TNT, or about a thousand-ton decoupled explosion. Later data analysis by the independent Incorporated Research Institutions for Seismology determined, however, that the event was an earthquake--not at the test site, but under the sea. Suzanne L. Jones and Frank N. Von Hippel, "Transparency Measures for Subcritical Experiments Under the CTBT," *Science and Global Security,* 1997, Vol.6, p.291, 292-3.

49. The exploitation of subcritical tests in this way is well within the realm of possibility. In August 1997, CIA information about preparations for Russian subcriticals at their arctic test site, coupled with a nearby earthquake, was seized upon by some in the U.S. establishment as an opportunity to drum up opposition to the CTBT. They charged that Russia had conducted a nuclear test and argued that the U.S. should resume full-scale underground testing in response. Impartial seismologists confirmed that no such test had occurred. See "Hints of a Nuclear Test in Russia Are Disputed," New York Times, October 21, 1997, p. A-12. See also the discussion of the same incident in Von Hippel and Jones, "Transparency Measures for Subcritical Experiments Under the CTBT," *supra.*

50. "...[O]nly a portion of the very expensive and controversial National Ignition Facility (NIF), for example, is coupled directly to the stockpile stewardship task, and much of that portion has more to do with maintaining expertise and developing capabilities that would be useful in case the CTB regime collapsed than with maintaining the enduring stockpile of the nine existing weapon designs safely and reliably for the indefinite future." Richard L. Garwin, "The Future of Nuclear Weapons Without Nuclear Testing Arms," Control Today November/December 1997 Volume 27, Number 8.

51. See generally C.E. Paine and M.G. McKinzie, "Does the U.S. Science-Based Stockpile Stewardship Program Pose a Proliferation Threat?" *Science and Global Security*, 1998, Vol. 7, p.151

52. Nuclear weapons laboratory officials generally deflect discussion of the long-term potential of ICF and other pulsed power technologies for research on fundamentally new weapons contexts by stating that inertial confinement fusion research cannot by itself lead, for example, to pure fusion weapons. This is a half-truth. New and more powerful ICF machines will allow unprecedented access to fusion-relevant conditions in laboratory conditions allowing a wide range and large number of experiments. Laser-driven ICF is only one part of a broad pulsed power research program, ongoing in at least the two leading nuclear weapons states, employing a variety of "drivers" ranging from electricity stored in immense capacitor banks to high explosives. All of these approaches reveal different kinds of information relevant to the problem of obtaining fusion using a variety of initiators. On the relation of fusion research to pure fusion weapons generally, see A. Makhijani and H. Zerriffi, "Dangerous Thermonuclear Quest: The Potential of Explosive Fusion Research for the Development of Pure Fusion Weapons," Institute for Energy and Environmental Research, Takoma Park, MD, 1998; on the relation between inertial confinement fusion and the development of a broader range of new weapons concepts see A. Gasponer and J.P. Hurni, "The Physical Principles of Thermonuclear Explosives, Inertial Confinement Fusion, and the Quest for Fourth Generation Nuclear Weapons," International Network of Engineers and Scientists Against Proliferation Technical Report No.1, 1997.

53. Preface by William S. Cohen, U.S. Secretary of Defense, in Nuclear Weapons Systems, supra.

54. NAS, p. 75.

55. "The Birth of a New Bomb: Shades of Dr. Strangelove! Will We Learn to Love the B61-11?," Greg Mello, The Washington Post, June 1, 1997, p. C-1. ("Mello") See also "New bomb, no Mission" by Greg Mello in The Bulletin of the Atomic Scientists, May/June 1997.

56. "Stockpile Surveillance: Past and Future," Lawrence Livermore, Los Alamos, and Sandia National Laboratories, September 1995. The footnote, on page 11, reads: *"A modification of the B61 is expected to replace the B53 by the year 2000. Since this modification of the B61 is not currently in the stockpile, there is no Stockpile Evaluation data for it."*

57. When one of the authors questioned the validity of the "safety" argument at a public symposium in late 1995, suggesting that the B53 could be simply retired if unsafe, she was ridiculed by a Livermore Lab weaponeer: "Only Western States Legal Foundation would suggest that there's something insidious about replacing an old, dangerous bomb with a smaller, cleaner, safer one." Comment by Kent Johnson at a University of San Diego symposium on the CTBT, September 1995. Recollection of author.

58. Testimony before the Senate Energy and Water Development Appropriations Subcommittee, March 20, 1997.

59. "Nuking Libya," The Nation, July 8, 1996, pp. 5-6. See also Mello, supra.

60. Kenneth H. Bacon at a DoD News Briefing, January 27, 1998.

61. Article VI of the Treaty on the Non-Proliferation of Nuclear Weapons reads: "Each 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, and on a treaty on general and complete disarmament under strict and effective international control."

62. 1995 Review and Extension Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Principles and Objectives for Nuclear Non-Proliferation and Disarmament, NPT/CONF,1995/L.5, 9 May 1995.

63. International Court of Justice, The Hague, Communiqué No. 96/23, 8 July 1996. For a comprehensive explanation and analysis of the ICJ opinion see The Legality of Threat or Use of Nuclear Weapons, A Guide to the Historic Opinion of the International Court of Justice, by John Burroughs, Lit Verlag, Muenster, 1997. (Available from Western States Legal Foundation.) The full ICJ opinion is available on the World Wide Web at http://www.ddh.nl/org/ialana

64. U.S. Defense Threat Reduction Agency, FY 2001 RDT&E Budget Item Justification Sheet (R-2 Exhibit) Appropriation/budget Activity RDT&E, Defense-Wide/Applied Research Nuclear Sustainment & Counterproliferation Technologies; 0602715BR Project AC - Weapons Systems Lethality, February 2000.

65. “Nuclear Weapon Effects Test Facilitization of the National Ignition Facility,” Lawrence Livermore National Laboratory (August 8, 1995), p.15. (deleted version declassified 11/12/97)

66. The complete text of Clinton’s letter is attached as Appendix II.

67. U.S. Joint Chiefs of Staff, Doctrine for Joint Nuclear Operations, Joint Pub 3-12 (December 1995), p. V. For a more comprehensive discussion of current U.S. nuclear weapons policy, see "Targets of Opportunity," by Hans Kristensen in The Bulletin of the Atomic Scientists, September/October 1997.

68. “Nuclear Operations,” Air Force Doctrine Document 2-1.5, 15 July 1998, pp. 8-9.

69. Written testimony of C. Paul Robinson, Director, Sandia National Laboratory, at Hearing of the Subcommittee on Strategic Forces Committee on Armed Services, U.S. Senate, March 19, 1997. This design project also exercised the new, computer-integrated prototyping process. According to Robinson:

> "This year, the BIOS program proved the effectiveness of concurrent engineering approaches when, for the first time at Sandia, the nose tip for the BIOS prototype was taken from concept to inspected, accepted flight component by means of a completely paperless process. The polycarbonate nose tip for the BIOS flight test program is a very complex shape requiring five-axis machining capability; yet, drawings were neither created nor needed. Solid models of the part were developed as computer files which were directly compatible with software for finite element analysis, numerically controlled machining, and even inspection. The process is proving to be so flexible and efficient that refinements to the part will be possible even as it is being machined, with no significant downtime."

70. As reported by Jonathan Landay in the Christian Science Monitor:

> "No one in the government asked for it and the Air Force says it does not need it.
>
> Yet the Sandia National Laboratory in New Mexico, one of America's nuclear-weapons research facilities, is working on an atomic bomb that would have capabilities beyond those in the current United States arsenal.
>
> The bomb, carrying an ‘old’ nuclear explosive device and a new guidance system, would soar on wings like a glider after its release from a radar-dodging B-2 bomber. It would drill deep into earth or

concrete, its explosion crushing 'hardened' bunkers hundreds of feet below ground while causing little surface damage.

The project symbolizes US determination to maintain the most advanced arsenal possible absent global disarmament and amid rising concerns over a growth of deeply buried command-and-control and arms making complexes in Russia, Iran, Libya, Iraq, and North Korea. But it also comes as President Clinton is using American power and prestige to support global efforts to curb the proliferation of weapons of mass destruction and reduce the number of nuclear warheads....

The idea behind a gliding version of the B61-11 is to better protect the $2.2 billion B-2 and its crew by allowing them to release the weapon a safe distance from antiaircraft defenses around their target. The bomb would glide on its wings the rest of the way, guided by an on-board radar that would also activate the fuse of the nuclear payload.

'Standoff capability is something that people have wanted in weapons for years,' says Heinz Schmitt, Sandia's vice president for weapons systems, in defending BIOS. 'This is very much exploratory in nature.'

But Pentagon and DOE officials say they have not asked for a modified version of the B61-11. Adds Capt. Leo Devine, an Air Force spokesman: 'The Air Force has no requirement for it.'

Still, DOE and Pentagon officials support the objectives of BIOS program. They say such work is not barred by any arms-control accords and is justified under a new nuclear-weapons program designed to allow the US to adhere to the 1996 Comprehensive Test Ban Treaty (CTBT)." Jonathan Landay, "Why US Lab Is Designing A Bomb No One Asked For," Christian Science Monitor, July 24, 1997, p.1.

71. U.S. Department of Energy, Office of Defense Programs, FY 2000 Stockpile Stewardship and Management Plan, ("Green Book"), March 15, 1999, pp. 5-26–5-27.

72. In this regard, Sandia National Laboratory director C. Paul Robinson noted in testimony prior to the October 1999 Comprehensive Test Ban vote in the U.S. Senate that although the national laboratories

> "cannot create completely new concepts without testing, many previously tested designs could be weaponized to provide new military capabilities. For example, if nuclear weapons emerge as the right answer to deter the use of other weapons of mass destruction in a regional conflict, the nuclear weapons we currently deploy may carry too high a yield and be far too disproportionate a response to be a credible deterrent. Proven designs of lower yield exist that might be adaptable for new military requirements in the future. I believe that such weapons could be deployed this way without the need for nuclear tests." Statement of C. Paul Robinson to the U.S. Senate Armed Services Committee, October 7, 1999.

73. Kristensen, supra; Arkin, infra.

74. Kristensen Nuclear Futures 10 et seq.

75. See, for example, the following description of "accomplishments" Department of Defense Research Program Element Descriptive Summaries:

> FY 1998 Accomplishments
> Weapons Effects Phenomenology ($3,716K)
> Developed concepts for demonstrating nuclear weapons effects on underground storage facilities, and other very hard and very deep targets.
> Developed a weapons output report on nuclear weapons effects from potential proliferants' weapons.
> Completed energy coupling analysis and effective yield models for cratering and ground motion.
> Accomplished ground motion predictions and experiment for Degelen-98 100 ton underground high explosive event.
> Developed prototype Integrated Munitions Effects Assessment-(Nuclear) (IMEA-N) model to allow collateral consequence assessment of targeting weapons of mass destruction (WMD) materials. Model designated interim NATO standard.
> Completed nuclear targeting analysis for Air Force Milestone 0 study

RDT&E Budget Item Justification Sheet (R-2 Exhibit), RDT&E, Defense-Wide/Applied Research - BA2, WMD Related Technologies; 0602715BR February 1999

Similar activities also were documented in published studies from the Lawrence Livermore National Laboratory:

Hans Kruger, "Defense Against Biological or Chemical Bomblet Warheads with Nuclear Interceptors, Lawrence Livermore National Laboratory, UCRL-ID-123815 (1996);
Hans Kruger, "Delayed Fission Debris Radiation Effects on Chemical and Biological Agents Stored in a Bunker," Lawrence Livermore National Laboratory, UCRL-ID-130475 (1998);
Edgar Mendelsohn, "Energy Deposition in a Bioloigcal Submunition Warhead by Low-Yield Nuclear Interceptors," Lawrence Livermore National Laboratory, UCRL-ID-119330 (1994)

76. Stockpile Stewardship and Management Plan, U.S. Department of Energy Office of Defense Programs, February 29, 1996 (hereafter 1996 Greenbook). The 1996 Green Book was obtained through a lawsuit brought by the Natural Resources Defense Council (NRDC), Western States Legal Foundation and 37 other public interest groups, challenging the adequacy of DOE's Programmatic Environmental Impact Statement for SS&M. In August 1997, NRDC issued an interim report analyzing the Green Book, End Run: The U.S. Government's Plan for Designing Nuclear Weapons and Simulating Nuclear Explosions Under the Comprehensive Test Ban Treaty. ("End Run")

77. 1996 Greenbook, p. IV-2.

78. 1996 Green Book, p. II-6.

79. Nuclear Weapons Systems, supra.

80. 1996 Green Book, p. IV-11. The Nuclear Posture Review, a year-long evaluation of U.S. nuclear weapons policy completed by DoD in September 1994, required DOE to "Maintain capability to design, fabricate, and certify *new* warheads (without underground nuclear testing or fissile material production.)" (Emphasis added.)

81. 1996 Green Book, p.V-10.

82. Replacement Warhead Summary and Status Charts for SWPP Program Review Meeting (5/97), Sandia National Laboratories. This set of documents was obtained by the Los Alamos Study Group under the Freedom of Information Act. They are reproduced in End Run, supra.

83. Nuclear Weapons Systems, supra.

84. 1996 Green Book, p. IV-11.

85. "What's New?," William H. Arkin, The Bulletin of the Atomic Scientists, November/December 1997, p. 24. The original article text referred to the replacement of the W88 warhead. This was a typographical error in the original text, and should have read "replacement for the Trident II's W76..." Personal communication from William Arkin to John Burroughs, Western States Legal Foundation, December 5, 1997.

86. P. Nanos, "Strategic Systems Update," The Submarine Review (April 1997), p. 13.

87. 1996 Green Book, p. V-9 -- V-10.

88. U.S. Department of Energy Office of Defense Programs, FY 2000 Stockpile Stewardship Plan, March 1999, p. 9-6.

89. "How well and how effectively the nuclear powers -- especially Russia and the United States -- are willing to account precisely to each other for the warheads they produced during the Cold War will go a long way toward determining the perceived feasibility of, and a realistic timetable for, reductions below 1,000 warheads." NAS, p. 79.

90. "We could be highly confident that a declared number of nuclear warheads has been dismantled if dismantling facilities and fabricated weapon components were subject to verification during the reduction process. Unfortunately, the process of dismantling excess warheads is already well underway in the United States and Russia without the benefit of any verification or transparency measures. As long as the pits remain intact, it may be possible yet to gain a high degree of confidence that a certain number of nuclear warheads were dismantled. If, however, the nuclear components are recast or reused, it will be impossible to verify independently the number or type of weapons that have been dismantled. In that case, one would have to rely primarily on records or assurances provided by the inspected party, supplemented by an imperfect accounting of the fissile materials that had been placed under safeguards." Steve Fetter, "Verifying Nuclear Disarmament," The Henry L. Stimson Center, Occasional Paper No.29, October 1996, p.23.

91. 1996 Green Book, p. V-10.

92. FPEIS, p. S-20.

93. "The Question of Pure Fusion Explosions Under the CTBT," Von Hippel and Jones, supra. On the relation of fusion research to pure fusion weapons generally, see A. Makhijani and H. Zerriffi, "Dangerous Thermonuclear Quest: The Potential of Explosive Fusion Research for the Development of Pure Fusion Weapons," Institute for Energy and Environmental Research, Takoma Park, MD, 1998; on the relation between inertial confinement fusion and the development of a broader range of new weapons concepts see A. Gasponer and J.P. Hurni, "The Physical Principles of Thermonuclear Explosives, Inertial Confinement Fusion, and the Quest for Fourth Generation Nuclear Weapons," International Network of Engineers and Scientists Against Proliferation Technical Report No.1, 1997.

94. Bethe should know. A senior member of the Manhattan Project, he was the Director of the Theoretical Division at Los Alamos from 1943-45. In his letter to Clinton, Bethe went on to "*fully support the Science-based Stockpile Stewardship program, which ensures that the existing nuclear weapons remain fully operative."* This internally contradictory logic typifies the limited range of what little debate is taking place within the arms control and weapons communities. The letter from Hans A. Bethe to President William E. Clinton, April 25, 1997 is available on the World Wide Web at http://www.fas.org/betheltr.htm

95. Von Hippel and Jones note that

> Two potential weapons applications of fusion explosives would be: i) warheads with yield-to-weight ratios at least an order of magnitude higher than achievable with conventional high explosives; and ii) mini-neutron bombs of the type that were being pursued by the U.S. around 1960:
>
> Powerful Explosives. The fusion of about 0.1 grams of D-T (about one half a liter of gas at atmospheric pressure) would produce the equivalent of about ten tons of yield -- i.e. in the yield range of the smallest tactical nuclear weapons -- sometimes described as "micro-nukes." This much fusion could conceivably be produced with high-explosive-powered pulsed-power equipment weaponized in a package weighing as little as a ton. The fusion yield could be amplified by surrounding the device with natural uranium. Uranium-238, the non-chain-reacting isotope which makes up 99.3% of natural uranium, can be fissioned by the fast neutrons produced by D-T fusion. If one U-238 were fissioned by each fusion neutron, the explosive yield would be increased tenfold. If higher yields could be achieved, such a device could potentially be used as a alternative to a fission trigger for a high-yield thermonuclear "secondary."
>
> Neutron Bombs. The fusion of 0.1 grams of D-T would also produce about 1022 neutrons and a neutron fluence which would be lethal (450 rad dose) out to a radius of about 800 meters (half a mile). Lethal doses out to 50 meters could be achieved with yields of 1019 neutrons (10 kg TNT equivalent). "The Question of Pure Fusion Explosions Under the CTBT," unpublished background paper, Frank von Hippel and Suzanne Jones, May 14, 1997.

96. The Lawrence Livermore National Laboratory (LLNL) Institutional Plan FY 1997-2002 states that "[a]pplication of LLNL-developed nuclear weapons technology is synergistic with enhancement of the U.S. conventional defense in many critical technologies, such as energetic materials, warhead design, advanced materials, sensor and electro-optic technology, and assessments of lethality, vulnerability, and survivability." LLNL Institutional Plan FY 1997-2002 (1996), p.20. In regard to high powered microwave applications, the 1997 DoD Defense Technology Area Plan notes that "DoD organizations have primary responsibility for the development and applications of HPM technology. However, both DOE and private sector efforts complement military HPM programs. Lawrence Livermore, Los Alamos, and Sandia National Laboratories have HPM source development and effects programs that directly support service efforts." U.S. Department of Defense 1997 Defense Technology Area Plan, Chapter X, Section 3.9.2.3. In regard to the wide range of military applications of the computer simulation codes related to electromagnetic field phenomena, see "Computational Electromagnetics: Codes and Capabilities," in the LLNL publication Science and Technology Review, March 1997 (available on the World Wide Web at http://www.llnl.gov/str/Shang.html).

The Air Force FY97 Directed Energy Technology Area Plan (DETAP) outlines a broad array of directed energy weapons initiatives underway at the DOD and DOE laboratories. (Headquarters, Airforce Materiel Command, Directorate of Science and Technology, FY97 Directed Energy Technology Area Plan) It notes that "High Power Microwaves (HPM) represent a major potential advance in Electronic Warfare technology by extending conventional RF power output several orders of magnitude. This enables the damage and disruption of a much broader range of targets and simplifies the threat-specific nature of systems (at ii.) The DETAP describes advanced pulse power development as "a key technology for high power RF sources." (id.) Although the DETAP focuses on activities at the Air Force laboratories, the new pulsed power facilities planned for the DOE Stockpile Stewardship program also are likely to allow research with similar applications. The DETAP lists, for example, among the long term "enabling technologies" useful for the development of radio frequency weapons "Ultra High Pulse Power Drivers" and "Micro Fission/Micro Fusion Technology." (at 18). Military applications of radio frequency and other directed energy weapons envisioned by the Air Force range from Agent Defeat Warheads for use against chemical and biological weapons to "Suppression of Enemy Air Defenses" (at 18) to "Counterspace Negation" (e.g., development of "directed energy (laser and high-power microwave) component technologies that will deliver both temporary and permanent effects against space, ground, and user segments of a satellite network, or for command and control warfare...") (at 21).

97. Accelerated Strategic Computing Initiative Program Plan, U.S. DOE Defense Programs, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Sandia National Laboratory, September 1996, Executive Summary.

98. "DOE, National Labs Select Five Universities to Bolster Large-Scale Computer Simulation Effort," Lawrence Livermore National Laboratory press release, July 31, 1997, NR-07-07.

99. "Washington State University Selected to Establish Shock Physics Institute to Understand Aging Nuclear Stockpile," Washington State University press release, June 23, 1997.

100. Office of Defense Programs, Inertial Fusion Science in Support of Stockpile Stewardship Financial Assistance Program, Department of Energy, Sources Sought/Notice of Interest..., January 21, 1997. Available on the World Wide Web at http://www.pr.doe.gov/OAKNOTE.TXT

101. See e.g. The National Ignition Facility and the Issue of Nonproliferation, Final Study, Prepared by the U.S. Department of Energy Office of Arms Control and Nonproliferation (NN-40), December 19, 1995, pps. 4, 8, 19, etc.

102. U.S. Air Force Scientific Advisory Board, December 1995 "New World Vistas: Air and Space Power for the 21st Century," Summary Volume, Chapter I, "Technologies for Arming the Air Force of the 21st Century," p.13.

103. FPEIS, p. S-13.

104. 1996 Green Book, p. I-3. The FY 2000 edition of the Greenbook adds further detail on U.S. plans to maintain the capability to reconstitute a very large nuclear arsenal:

"Hedge technologies will enable the future NWC to rapidly expand production capacity when a requirement arises. There are two scenarios that may require NWC capacity expansion above the SSM PEIS preferred alternative "high" case. They are:

Timely response to a significant defect in multiple weapons systems within the stockpile, frequently referred to as common-mode failure, and

Response to a national emergency, requiring return to Cold War production levels."

U.S. Department of Energy, Office of Defense Programs, FY 2000 Stockpile Stewardship and Management Plan, March 15, 1999, p. 10-42.

105. NAS, p. 29.

106. NAS, p. 92.

107. For an in-depth discussion of the weapons labs' enormous political influence see "Who's minding the store?" by Jonathan Weisman in The Bulletin of the Atomic Scientists, July/August 1997. See also "The Role of National Legislatures and International Legal Instruments, The Comprehensive Test Ban Treaty: A Case Study," Jacqueline Cabasso (pp. 135-146). In Science, Ethics and Society, Proceedings of the International Symposium, World Federation of Scientific Workers, under the auspices of UNESCO, Paris, France, September 1996 (published July 1997).

108. Written Statement of C. Paul Robinson, Director, Sandia National Laboratories, United States House of Representatives Committee on National Security, Joint Hearing the Subcommittee on Military Procurement and Subcommittee on Research and Development, March 12, 1996.

109. Written Testimony of Sigfried S. Hecker, Director, Los Alamos National Laboratory, Hearing of the Subcommittee on Strategic Force, Committee on Armed Services, U.S. Senate, March 19, 1997.

110. The procedure for such annual certification, which is to be "embodied in domestic law," is described in detail in President Clinton's September 22 letter to Congress, supra.

111. The allies of the weapons labs in Congress are attempting to further buttress the Labs' power over information relevant to nuclear weapons policy by assuring their special protection in providing information to the President and Congress. In July 1997, Arizona Republican Senator Jon Kyl proposed language, subsequently modified and incorporated into Defense Authorization legislation, that enables the directors of the nuclear weapons laboratories to present their personal views directly to the President, the National Security Council, or Congress, "regarding the safety, security, effectiveness, and reliability of the nuclear weapon stockpile." It is worth noting that while framed in terminology typical of "whistle blower" protection, this is not a "societal verification" provision extending to all those involved in nuclear weapons work and promoting transparency of the nuclear weapons enterprise. Rather, it extends protection only to those in the inner circle of the nuclear elite. Congressional Record - House, October 23, 1997, H9166-H9167, Sec. 1305. Advice to the President and Congress Regarding the Safety, Security, and Reliability of United States Nuclear Weapons Stockpile.

112. Clinton letter to the Senate, supra.

113. Written testimony of C. Bruce Tartar, Director, Lawrence Livermore National Laboratory, submitted to the Senate Governmental Affairs Subcommittee on International Security, Proliferation and Federal Services, Hearing on the Condition of the U.S. Nuclear Stockpile, October 27, 1997.

114. Secretary of Energy Federico Peña, Testimony before the Senate Energy and Water Development Appropriations Subcommittee, October 29, 1997.

115. "Creating the Laboratory's Future: A Strategy for the Lawrence Livermore National Laboratory," UCRL-AR-128045, September 1997, p. 17.

116. Id., p. 15.

117. Charles Perrow, Normal Accidents: Living with High Risk Technologies, Basic Books, New York, NY, 1984, pp. 322-323.

118. The Arms Control and Disarmament Agency (ACDA) was created in 1961 under President John F. Kennedy. During the Reagan years the agency's ability to serve as an advocate for nuclear disarmament was greatly diminished. Under growing pressure from a Republican Congress, in April 1997 the Clinton Administration announced plans to terminate ACDA's independent status, and to consolidate the agency as a bureau of the State Department.

119. Project AB- Test & Simulation Technology -- Development of effective, survivable, and affordable weapons systems requires a robust testing and simulation capability to support acquisition managers and decision makers, Defense Special Weapons Agency FY1998/1999 Biennial Budget Estimates, Program Document, Research, Development, Test and Evaluation, Defense-Wide (February 1997).

120. Several of the major SS&M facilities, including the NIF, also are intended for nuclear weapons effects testing. "The goal of the National Ignition Facility (NIF) project is to provide an aboveground experimental capability for maintaining nuclear competence and *weapons effects simulations*, and to provide a facility that is capable of achieving fusion ignition using solid-state lasers as the energy driver." (Emphasis added.) National Ignition Facility Conceptual Design Report, May 1994, UCRL-PROP-117093 Vol 1, NIF-LLNL-94-113, L-16973-1, p. 1-1.

121. The National Ignition Facility and the Issue of Nonproliferation, supra, pp. 26-27, 57.

122. Fiscal Year 1981 Arms Control Impact Statements, Submitted to the Congress by the President Pursuant to Section 36 of the Arms Control and Disarmament Act, May 1980, p. 467.

123. Id., p. 471.

124. Id. p. 474.

125. Testimony of Dr. Stephen D. Bryen before the House National Security Committee, Military Procurement Subcommittee, on Supercomputers and Nuclear Weapons, April 15, 1997.

126. "The Case Against Stockpile Stewardship," J.I. Katz, Department of Physics, Washington University, St. Louis, Mo. 63130, undated circa late 1994, cited in Fourth Affidavit of Christopher E. Paine in Support of Plaintiffs' Motion for Preliminary Injunction, April 30, 1997, Natural Resources Defense Council, et. al., v. Federico Peña, et. al., United States District Court for the District of Columbia, Civil Action No. CV-97-0936. Mr. Paine's affidavit contains an extensive analysis of the potential for the spread of nuclear weapons information from "stockpile stewardship" activities, which the argument here draws upon in part.

127. "The Physical Principles of Thermonuclear Explosives, Inertial Confinement Fusion, and the Quest for Fourth Generation Nuclear Weapons," André Gsponer and Jean Pierre Hurni, Independent Scientific Research Institute (ISRI), Geneva, Switzerland, Technical Report NO. 1, International Network of Engineers and Scientists Against Proliferation, September 25, 1997.

128. These problems are likely to be exacerbated by the extension of electronic warfare into space, where satellite-based intelligence and warning systems provided a virtually invulnerable (although still fallible) means of assessing threats during the Cold War. Although beyond the scope of this paper, it is worthy of note that arms control efforts during the Cold War period focused not on disarmament, but on controlling technology development

paths which were perceived to threaten the stability of the strategic balance among the nuclear armed states -- e.g. ballistic missile defense and forward deployed, highly accurate nuclear missiles. Apparently, with the perceived "end" of the Cold War, U.S. policy makers feel comfortable pushing ahead with weapons technology development on many fronts, with little thought to the complexities and instabilities which these developmental paths may impart to foreseeable tensions among states in the decades to come.

129. National Press Club Remarks, General Lee Butler, USAF (Retired), December 4, 1996, Washington, DC. ("Butler") Available on the World Wide Web at http://www.stimson.org/zeronuke/generals/but1204.htm

130. "One worrisome aspect of the SBSS program is that it may be perceived by other nations as part of an attempt by the U.S. to continue the development of ever more sophisticated nuclear weapons. This perception is particularly likely to be held by countries that are not very advanced technologically since they are less able to appreciate the limits on advanced weapons design that a lack of testing enforces. Hence it is important that the SBSS program *be managed with restraint and openness*, including international collaboration and cooperation where possible, so as not to end up as an obstacle to the Non-Proliferation Treaty." (Emphasis in original.) JASON, p.19.

131. Statement by Ambassador Razali Ismail, Permanent Representative of Malaysia to the United Nations at the Resumed Plenary Meeting of the 50th Regular Session of the G.A. on the Request for the Resumption of Consideration of Agenda Item 65 Comprehensive Test Ban Treaty, September 9, 1996. The draft text referred to was subsequently adopted as the final text of the CTBT. Available on the World Wide Web at http://www.undp.org/missions/malaysia/960909.htm

132. NAS, p. 81.

133. NAS, p. 92.

134. The Abolition 2000 Statement is the basis of agreement among the participating groups. The Statement and additional information about Abolition 2000 is available on the World Wide Web at http://www.abolition2000.org

135. Model Nuclear Weapons Convention: Convention on the Prohibition of the Development, Testing, Production, Stockpiling, Transfer, Use and Threat of Use of Nuclear Weapons and on Their Elimination, UN Document A/C.1/52/7 An analysis of the Model Nuclear Weapons Convention, with commentary and responses by a variety of experts and activists, can be found in *Security and Survival: The Case for a Model Nuclear Weapons Convention* (1999), a joint publication of International Physicians for the Prevention of Nuclear War (IPPNW), International Association of Lawyers Against Nuclear Arms (IALANA), and the International Network of Engineers and Scientists Against Proliferation (INESAP). This publication is available from PPPNW at 727 Massachusetts Ave, Cambridge, MA 02139, website http:// www.ippnw.org

136. The Model Nuclear Weapons Convention (MNWC) suggests two years after entry into force for closure of research, development, testing and production facilities. See MNWC Art. IV.

137. Testimony of Dr. Victor Reis DOE Assistant Secretary of Defense Programs to the Armed Services Committee of the Senate, March 19, 1997.

138. Butler, supra.

139. Id.

Appendix I

Description of ICF Program and Selected Other Major SBSS Facilities✶

Table B.1 identifies existing and planned Inertial Confinement Fusion program facilities as well as selected other major stockpile stewardship facilities. The list includes those proposed by individual laboratories, many of which have not yet been approved by DOE. Finally, two major stockpile stewardship and management programs, the Accelerated Strategic Computing Initiative (ASCI) and the Advanced Design and Production Technology (ADaPT), are listed for completeness.

A brief description of each of the facilities follows:

- ADaPT is an initiative to develop the tools to integrate the development of weapons components with associated advanced manufacturing and materials processes.

- AHF is a proposed advanced hydrotest facility using new and developing accelerator technology that would provide time-resolved images of the implosion of a weapon primary from several different angles of view.

- APT is a proposed alternative for producing tritium using an accelerator instead of a nuclear reactor.

- ASCI is an initiative to create the leading-edge computational modeling and simulation capabilities that are essential for maintaining the safety, reliability, and performance of the nuclear tockpile.

- ATLAS is a new pulsed-power facility with a 36-MJ capacitor bank that will provide an order-of-magnitude increase in dynamical pressure over that provided by PEGASUS.

- CFF is located at LLNL Site 300 to provide a continuing capability for testing the high-explosive component of a nuclear weapon.

- DARHT, a hydrotesting facility under construction at LANL, provides two views of an imploded pit through the use of two electron accelerators placed at right angles to each other.

- HEAF is an experimental facility at LANL that assesses detonators and the initiation and burning of high explosives.

- HEPPF is a proposed next-generation large-explosive experimental facility at the Nevada Test Site for experimental physics studies related to weapons secondary at shock pressures and velocities approaching actual weapon conditions.
- LANSCE is a defense programs neutron science center. The LAMPF complex at LANL has been converted to LANSCE to support general defense program objectives, particularly radiographic and neutron studies.

- LPSS is a proposed 1-MW cold neutron source at LANL for the study advanced materials.

✶ From Review of the Department of Energy's Inertial Confinement Fusion Program: The National Ignition Facility, Appendix B, pp. 48 – 50. National Research Council, March 20, 1997.

- NIF is a 192-beam, 1.8-MJ glass laser facility for conducting high-energy-density experiments (temperatures up to 600 eV) and demonstrating inertial fusion ignition in the laboratory.

- NIKE is a 4-kJ krypton fluoride (FrF) gas laser at NRL for studying direct-drive inertial fusion issues and other related phenomena.

- NOVA is a 10-beam (~40-kJ) glass laser facility at LLNL for conducting indirect drive inertial fusion experiments and weapons-related high-energy-density science experiments.

- OMEGA is a 60-beam (45-kJ) glass laser facility at the University of Rochester for conducting direct-drive inertial fusion experiments.

- PBFA is a fast-pulsed accelerator (~50 ns) at Sandia National Laboratories; PBFA II, PBFA X, and PBFA Z are modifications to the accelerator to conduct light ion inertial fusion experiments, light ion extraction experiments, and z-pinch experiments, respectively.

- PEGASUS is a 4.3-MJ capacitor bank at LANL with a slow (microseconds) direct drive for hydrodynamic studies with an experimental volume of 1 cubic centimeter.

- PHERMEX is a dynamic radiography facility located at LANL.

- PROCYON is a 15-MJ, high-explosive, pulsed-power system at LANL providing 2- to 6-microsecond drive. It has been used for direct-drive plasma implosions to produce soft x-rays for weapon physics experiments.

- SABRE is a positive-polarity-induction linear accelerator located at SNL. SABRE uses an extraction ion diode and is used mainly for studies of light ion beam generation, transport, and focusing.

- SATURN is a fast-pulsed accelerator at SNL that can produce a 600-kJ radiation source from a 4-MJ Marx capacitor bank. The source is used for studies of nuclear weapons effects and hohlraums (up to 100 eV).

- SPSS is a capability at LANSCE to provide moderated (low-energy) neutrons with wavelengths comparable to atomic physics dimensions to address primary physics issues.

- TRIDENT is a multipurpose Nd:glass laser facility at LANL that supports inertial fusion, weapons physics, and other experiments and instrument development. Trident has two main beams with 100 J per beam in a 100-ps pulse with a third beam used for backlighting. The TRIDENT Upgrade is proposed to produce several kilojoules.

- WETF is a facility at LANL to investigate tritium technology for weapons applications.

- X-1 is a proposed advanced z-pinch radiation source producing 8 to 10 MJ of soft x-rays.

TABLE B.1 Existing and Planned [SBSS] Program Facilities

Existing Facilities	Approved Facilities[a]	Proposed Facilities[b]
<u>Lasers</u>		
NOVA		
OMEGA	National Ignition Facility (NIF)	TRIDENT Upgrade
NIKE		
TRIDENT		
<u>Pulsed Power</u>		
PBFA II (PBFA X, PBFA Z)	ATLAS	X-1
SATURN		ATLAS -- $34 million
PEGASUS		
PROCYON		
SABRE		
<u>Neutron Radiographic</u>		
Los Alamos Neutron Scattering Center (LANSCE)	Short-Pulse Spallation Source (SPSS)	Long-Pulse Spallation Source (LPSS)
<u>Hydrodynamics</u>		
Pulsed High-Energy Radiographic Machine Emitting X-Rays (PHERMEX) Flash X-Ray (FXR)--$81 million	Dual-Axis Radiographic Hydrodynamic Testing Facility (DARHT)	Advanced Hydrotest Facility (AHF)
<u>Materials</u>		
Weapon Engineering Tritium Facility (WETF)		Accelerator Production of Tritium (APT)
<u>Explosive</u>		
High Explosives Application Facility Facility (HEAF)		High Explosive Pulsed Power Facility at NTS (HEPPF)
<u>Test</u>		
Contained Firing Facility (CFF)		
<u>Computing</u>		
Accelerated Strategic Computing Initiative (ASCI)		
<u>Manufacturing</u>		
Advanced Design and Production Technology (ADaPT)		

[a] Includes partially funded facilities.
[b] Includes laboratory-proposed facilities not yet approved by DOE.

Appendix II

THE WHITE HOUSE
September 22, 1997

TO THE SENATE OF THE UNITED STATES:

I transmit herewith, for the advice and consent of the Senate to ratification, the Comprehensive Nuclear Test-Ban Treaty (the "Treaty" or "CTBT"), opened for signature and signed by the United States at New York on September 24, 1996. The Treaty includes two Annexes, a Protocol, and two Annexes to the Protocol, all of which form integral parts of the Treaty. I transmit also, for the information of the Senate, the report of the Department of State on the Treaty, including an Article-by-Article analysis of the Treaty.

Also included in the Department of State's report is a document relevant to but not part of the Treaty: the Text on the Establishment of a Preparatory Commission for the Comprehensive Nuclear Test-Ban Treaty Organization, adopted by the Signatory States to the Treaty on November 19, 1996. The Text provides the basis for the work of the Preparatory Commission for the Comprehensive Nuclear Test-Ban Treaty Organization in preparing detailed procedures for implementing the Treaty and making arrangements for the first session of the Conference of the States Parties to the Treaty. In particular, by the terms of the Treaty, the Preparatory Commission will be responsible for ensuring that the verification regime established by the Treaty will be effectively in operation at such time as the Treaty enters into force. My Administration has completed and will submit separately to the Senate an analysis of the verifiability of the Treaty, consistent with section 37 of the Arms Control and Disarmament Act, as amended. Such legislation as may be necessary to implement the Treaty also will be submitted separately to the Senate for appropriate action.

The conclusion of the Comprehensive Nuclear Test-Ban Treaty is a signal event in the history of arms control. The subject of the Treaty is one that has been under consideration by the international community for nearly 40 years, and the significance of the conclusion of negotiations and the signature to date of more than 140 states cannot be overestimated. The Treaty creates an absolute prohibition against the conduct of nuclear weapon test explosions or any other nuclear explosion anywhere. Specifically, each State Party undertakes not to carry out any nuclear weapon test explosion or any other nuclear explosion; to prohibit and prevent any nuclear explosions at any place under its jurisdiction or control; and to refrain from causing, encouraging, or in any way participating in the carrying out of any nuclear weapon test explosion or any other nuclear explosion.

The Treaty establishes a far reaching verification regime, based on the provision of seismic, hydroacoustic, radionuclide, and infrasound data by a global network (the "International Monitoring System") consisting of the facilities listed in Annex 1 to the Protocol. Data provided by the International Monitoring System will be stored, analyzed, and disseminated, in accordance with Treaty-mandated operational manuals, by an International Data Center that will be part of the Technical Secretariat of the Comprehensive Nuclear Test-Ban Treaty Organization. The verification regime includes rules for the conduct of on-site inspections, provisions for consultation and clarification, and voluntary confidence-building measures designed to contribute to the timely resolution of any compliance concerns arising from possible misinterpretation of monitoring data related to chemical explosions that a State Party intends to or has carried out.

Equally important to the U.S. ability to verify the Treaty, the text specifically provides for the right of States Parties to use information obtained by national technical means in a manner consistent with generally recognized principles of international law for purposes of verification generally, and in particular, as the basis for an on-site inspection request. The verification regime provides each State Party the right to protect sensitive installations, activities, or locations not related to the Treaty. Determinations of compliance with the Treaty rest with each individual State Party to the Treaty.

Negotiations for a nuclear test-ban treaty date back to the Eisenhower Administration. During the period 1978-1980, negotiations among the United States, the United Kingdom, and the USSR (the Depositary Governments of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)) made progress, but ended without agreement. Thereafter, as the nonnuclear weapon states called for test-ban negotiations, the United States urged the Conference on Disarmament (the "CD") to devote its attention to the difficult aspects of monitoring compliance with such a ban and developing elements of an international monitoring regime. After the United States, joined by other key states, declared its support for comprehensive test-ban negotiations with a view toward prompt conclusion of a treaty, negotiations on a comprehensive test-ban were initiated in the CD, in January 1994. Increased impetus for the conclusion of a comprehensive nuclear test-ban treaty by the end of 1996 resulted from the adoption, by the Parties to the NPT in conjunction with the indefinite and unconditional extension of that Treaty, of "Principles and Objectives for Nuclear Non-Proliferation and Disarmament" that listed the conclusion of a CTBT as the highest measure of its program of action.

On August 11, 1995, when I announced U.S. support for a "zero yield" CTBT, I stated that:

> ". . . As part of our national security strategy, the United States must and will retain strategic nuclear forces sufficient to deter any future hostile foreign leadership with access to strategic nuclear forces from acting against our vital interests and to convince it that seeking a nuclear advantage would be futile. In this regard, I consider the maintenance of a safe and reliable nuclear stockpile to be a supreme national interest of the United States.
>
> "I am assured by the Secretary of Energy and the Directors of our nuclear weapons labs that we can meet the challenge of maintaining our nuclear deterrent under a CTBT through a Science Based Stockpile Stewardship program without nuclear testing. I directed the implementation of such a program almost 2 years ago, and it is being developed with the support of the Secretary of Defense and the Chairman of the Joint Chiefs of Staff. This program will now be tied to a new certification procedure. In order for this program to succeed, both the Administration and the Congress must provide sustained bipartisan support for the stockpile stewardship program over the next decade and beyond. I am committed to working with the Congress to ensure this support.
>
> "While I am optimistic that the stockpile stewardship program will be successful, as President I cannot dismiss the possibility, however unlikely, that the program will fall short of its objectives. Therefore, in addition to the new annual certification procedure

> for our nuclear weapons stockpile, I am also establishing concrete, specific safeguards that define the conditions under which the United States can enter into a CTBT . . ."

The safeguards that were established are as follows:

> The conduct of a Science Based Stockpile Stewardship program to ensure a high level of confidence in the safety and reliability of nuclear weapons in the active stockpile, including the conduct of a broad range of effective and continuing experimental programs.
>
> The maintenance of modern nuclear laboratory facilities and programs in theoretical and exploratory nuclear technology that will attract, retain, and ensure the continued application of our human scientific resources to those programs on which continued progress in nuclear technology depends.
>
> The maintenance of the basic capability to resume nuclear test activities prohibited by the CTBT should the United States cease to be bound to adhere to this Treaty.
>
> The continuation of a comprehensive research and development program to improve our treaty monitoring capabilities and operations.
>
> The continuing development of a broad range of intelligence gathering and analytical capabilities and operations to ensure accurate and comprehensive information on worldwide nuclear arsenals, nuclear weapons development programs, and related nuclear programs.
>
> The understanding that if the President of the United States is informed by the Secretary of Defense and the Secretary of Energy (DOE) -- advised by the Nuclear Weapons Council, the Directors of DOE's nuclear weapons laboratories, and the Commander of the U.S. Strategic Command -- that a high level of confidence in the safety or reliability of a nuclear weapon type that the two Secretaries consider to be critical to our nuclear deterrent could no longer be certified, the President, in consultation with the Congress, would be prepared to withdraw from the CTBT under the standard "supreme national interests" clause in order to conduct whatever testing might be required.

With regard to the last safeguard:

> The U.S. regards continued high confidence in the safety and reliability of its nuclear weapons stockpile as a matter affecting the supreme interests of the country and will regard any events calling that confidence into question as "extraordinary events related to the subject matter of the treaty." It will exercise its rights under the "supreme national interests" clause if it judges that the safety or reliability of its nuclear weapons stockpile cannot be assured with the necessary high degree of confidence without nuclear testing.

To implement that commitment, the Secretaries of Defense and Energy -- advised by the Nuclear Weapons Council or "NWC" (comprising representatives of DOD, JCS, and DOE), the Directors of DOE's nuclear weapons laboratories and the Commander of the U.S. Strategic Command -- will report to the President annually, whether they can certify that the Nation's nuclear weapons stockpile and all critical elements thereof are, to a high degree of confidence, safe and reliable, and, if they cannot do so, whether, in their opinion and that of the NWC, testing is necessary to assure, with a high degree of confidence, the adequacy of corrective measures to assure the safety and reliability of the stockpile, or elements thereof. The Secretaries will state the reasons for their conclusions, and the views of the NWC, reporting any minority views.

After receiving the Secretaries' certification and accompanying report, including NWC and minority views, the President will provide them to the appropriate committees of the Congress, together with a report on the actions he has taken in light of them.

If the President is advised, by the above procedure, that a high level of confidence in the safety or reliability of a nuclear weapon type critical to the Nation's nuclear deterrent could no longer be certified without nuclear testing, or that nuclear testing is necessary to assure the adequacy of corrective measures, the President will be prepared to exercise our "supreme national interests" rights under the Treaty, in order to conduct such testing.

The procedure for such annual certification by the Secretaries, and for advice to them by the NWC, U.S. Strategic Command, and the DOE nuclear weapons laboratories will be embodied in domestic law.

As negotiations on a text drew to a close it became apparent that one member of the CD, India, would not join in a consensus decision to forward the text to the United Nations for its adoption. After consultations among countries supporting the text, Australia requested the President of the U.N. General Assembly to convene a resumed session of the 50th General Assembly to consider and take action on the text. The General Assembly was so convened, and by a vote of 158 to 3 the Treaty was adopted. On September 24, 1996, the Treaty was opened for signature and I had the privilege, on behalf of the United States, of being the first to sign the Treaty.

The Treaty assigns responsibility for overseeing its implementation to the Comprehensive Nuclear Test-Ban Treaty Organization (the "Organization"), to be established in Vienna. The Organization, of which each State Party will be a member, will have three organs: the Conference of the States Parties, a 51-member Executive Council, and the Technical Secretariat. The
Technical Secretariat will supervise the operation of and provide technical support for the International Monitoring System, operate the International Data Center, and prepare for and support the conduct of on-site inspections. The Treaty also requires each State Party to establish a National Authority that will serve as the focal point within the State Party for liaison with the Organization and with other States Parties.

The Treaty will enter into force 180 days after the deposit of instruments of ratification by all of the 44 states listed in Annex 2 to the Treaty, but in no case earlier than 2 years after its

being opened for signature. If, 3 years from the opening of the Treaty for signature, the Treaty has not entered into force, the Secretary-General of the United Nations, in his capacity as Depositary of the Treaty, will convene a conference of the states that have deposited their instruments of ratification if a majority of those states so requests. At this conference the participants will consider what measures consistent with international law might be undertaken to accelerate the ratification process in order to facilitate the early entry into force of the Treaty. Their decision on such measures must be taken by consensus.

Reservations to the Treaty Articles and the Annexes to the Treaty are not permitted. Reservations may be taken to the Protocol and its Annexes so long as they are not incompatible with the object and purpose of the Treaty. Amendment of the Treaty requires the positive vote of a majority of the States Parties to the Treaty, voting in a duly convened Amendment Conference at which no State Party casts a negative vote. Such amendments would enter into force 30 days after ratification by all States Parties that cast a positive vote at the Amendment Conference.

The Treaty is of unlimited duration, but contains a "supreme interests" clause entitling any State Party that determines that its supreme interests have been jeopardized by extraordinary events related to the subject matter of the Treaty to withdraw from the Treaty upon 6-month's notice.

Unless a majority of the Parties decides otherwise, a Review Conference will be held 10 years following the Treaty's entry into force and may be held at 10-year intervals thereafter if the Conference of the States Parties so decides by a majority vote (or more frequently if the Conference of the States Parties so decides by a two-thirds vote).

The Comprehensive Nuclear Test-Ban Treaty is of singular significance to the continuing efforts to stem nuclear proliferation and strengthen regional and global stability. Its conclusion marks the achievement of the highest priority item on the international arms control and nonproliferation agenda. Its effective implementation will provide a foundation on which further efforts to control and limit nuclear weapons can be soundly based. By responding to the call for a CTBT by the end of 1996, the Signatory States, and most importantly the nuclear weapon states, have demonstrated the bona fides of their commitment to meaningful arms control measures.

The monitoring challenges presented by the wide scope of the CTBT exceed those imposed by any previous nuclear test-related treaty. Our current capability to monitor nuclear explosions will undergo significant improvement over the next several years to meet these challenges. Even with these enhancements, though, several conceivable CTBT evasion scenarios have been identified. Nonetheless, our National Intelligence Means (NIM), together with the Treaty's verification regime and our diplomatic efforts, provide the United States with the means to make the CTBT effectively verifiable. By this, I mean that the United States:

> will have a wide range of resources (NIM, the totality of information available in public and private channels, and the mechanisms established by the Treaty) for addressing compliance concerns and imposing sanctions in cases of noncompliance; and

will thereby have the means to: (a) assess whether the Treaty is deterring the conduct of nuclear explosions (in terms of yields and number of tests) that could damage U.S. security interests and constraining the proliferation of nuclear weapons, and (b) take prompt and effective counteraction.

My judgment that the CTBT is effectively verifiable also reflects the belief that U.S. nuclear deterrence would not be undermined by possible nuclear testing that the United States might fail to detect under the Treaty, bearing in mind that the United States will derive substantial confidence from other factors -- the CTBT's "supreme national interests" clause, the annual certification procedure for the U.S. nuclear stockpile, and the U.S. Safeguards program.

I believe that the Comprehensive Nuclear Test-Ban Treaty is in the best interests of the United States. Its provisions will significantly further our nuclear nonproliferation and arms control objectives and strengthen international security. Therefore, I urge the Senate to give early and favorable consideration to the Treaty and its advice and consent to ratification as soon as possible.

WILLIAM J. CLINTON
THE WHITE HOUSE, September 22, 1997