In the Eyes of the Experts

Analysis and Comments on America's Strategic Posture

Selected Contributions by the Experts of the Congressional Commission on the Strategic Posture of the United States

Taylor Bolz, editor

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Note from the Executive Director

Dear Reader:

As the world begins to reinvigorate its concerns about nuclear weapons, the United States has adopted a policy that pledges the nation to work for the global elimination of nuclear weapons but also recognizes that until such conditions exist, we must maintain a safe, reliable, secure, and credible deterrent force. Integral to this policy is the emerging concept of "strategic posture," a concept that remains under-developed but, even in its infancy, useful to this policy.

This book of fifty-three expert papers has been compiled to expand upon the Final Report on the Congressional Commission on the Strategic Posture of the United States and to provide the public with some perspectives on the input provided to the commissioners. The Commission experts—approximately fifty national security and nuclear weapons professionals—were selected by the chairman, Dr. William Perry, and the vice-chairman, Dr. James Schlesinger, on the basis of their proven and extensive backgrounds in national security, defense policy, nuclear physics, and intelligence. Throughout the life of the Commission, these experts convened meetings and corresponded, brainstormed, developed, and critiqued their ideas before drafting papers that were sent on to the commissioners. As one expert put it, these papers, and the analysis and deliberations that they represent, are a "rich lode" of material from which the commissioners drew to form their recommendations. In an effort to illuminate the debate surrounding these issues, I am pleased to offer these papers to the public.

I would like to express my gratitude toward all the experts involved in both the group proceedings and writing of these papers; it demanded significant amounts of their time and attention, all of which they volunteered for benefit of the nation. Their insightful recommendations and considerable experience on these issues proved invaluable to the Commission and will undoubtedly prove invaluable to the country now and in the future.

I also want to recognize the tremendous support provided to the Commission and experts by Taylor Bolz, the editor of this volume, and Brian Rose, our specialist in just about any task I laid on him. They are the best!

Paul Hughes
Executive Director

Introduction

In mid-May 2008, the newly formed Congressional Commission on the Strategic Posture of the United States met for the first time at the U.S. Institute of Peace. Commission chairman William Perry and vice-chairman James Schlesinger convened this preliminary meeting to discuss the Commission's mandate and the selection of experts to aid commissioners in their work. The chair and vice-chair decided to create five expert working groups, each composed of expert advisers and charged with examining a separate component of strategic posture. Experts with experience in academia, government, and the private and non-profit sectors were selected and placed in groups that fit their respective talents and experience. A chair was chosen for each working group, and the mandate of each group was defined. Over the next eleven months, these groups worked semi-autonomously and produced an abundance of research and analysis for the Commission on a range of strategic posture topics.

The result of all this expert effort was a series of papers addressing a variety of strategic issues that helped the Commission in its deliberations. Both Drs. Perry and Schlesinger thought it important to publish these papers to make them available to a wider audience and further inform the public on these important issues of U.S. strategic posture. The groups were named to convey their respective subject areas: National Security Strategy and Policy; Deterrent Force Posture; Nuclear Infrastructure; Countering WMD Proliferation; and External Trends and Conditions. The function of each group was to address a particular area of concern by convening meetings, exchanging ideas via email and phone, circulating drafts among themselves, and ultimately sending these papers on to the commissioners. Later in the process, experts volunteered to form two additional working groups in order to tackle two specific topics of concern: force structure and arms control.

Groups were essentially fora in which experts could circulate ideas internally, receive feedback, and advance suggestions to the Commission for further discussion. Through this structured yet flexible working group system, experts were able to float ideas and opinions to commissioners, sometimes present their ideas in plenary sessions, and receive taskings for additional research from the Commission. Several government agencies provided briefings to the Commission as well as the working groups, including the Department of Defense, the Department of Energy, the National Nuclear Security Administration, and the Office of the Director of National Intelligence, among others, to provide experts with the most accurate information available from which they could form their arguments.

This reader is a collection of those expert working group papers and ideas that were presented to the Commission, in one form or another, between the summer of 2008 and the spring of 2009. Papers from the External Trends and Conditions working group could not be included in this compilation because they refer to classified information. All other papers included in this book are organized thematically—not based on group origin or on chronological progression—and focus on three central dimensions of strategic posture identified in the executive summary of the final report: deterrence, nonproliferation, and arms control. A fourth chapter on infrastructure was deemed necessary given the extraordinary wealth of material and the timeliness of the subject.

This compilation represents a portion of the experts' work and only begins to describe the extent to which they contributed their time and expertise. In his statement to Congress, Dr. Perry recognized and praised "the members of [the] five Expert Working Groups and their leaders, who have volunteered countless hours of their time in supporting the Commission and its work and provided us with strong intellectual assistance of the highest caliber." Though this book is an incomplete reflection of the total expert work effort as described by Chairman Perry, it is the most complete account of the experts' contributions to the Commission and is indicative of the nuanced and comprehensive input that factored into the Commission's final conclusions.

To set the stage for the analysis and commentary ahead, both Dr. Perry's and Dr. Schlesinger's statements to Congress are included in this introduction. Taken together, these statements offer a complementary and useful overview of the Commission's mandate and work.

Statement of Dr. William Perry

Last year, Congress appointed our twelve-person bipartisan group to conduct this review of U.S. strategic posture, and asked me to serve as chairman with Jim Schlesinger as vice-chairman. This Commission has deliberated for the last eleven months and is now prepared to report to the administration, to the Congress, and to the American people, and we are here today to do so. We all applaud the wisdom of Congress in setting up this Commission. For too long, there have been unanswered, even unasked, questions about the strategic posture of the United States, especially the nuclear dimensions of that posture. This "strategic silence" has not served America well. Continuing questions about our broader strategic posture have gone unaddressed, while the military, geopolitical, and technical needs that underlie these questions have grown ever more insistent. We understood from the outset that the lack of consensus about the future of the U.S. nuclear deterrent was a key motivator in Congress's charge to the Commission.

So your tasking last year to the Commission was timely. We hope that our report will be a useful input to the new administration as it prepares to undertake a new nuclear posture review.

The Commission has greatly benefited from the input of a number of members of Congress, outside groups, and individuals of every stripe who care deeply about these issues and their country. Likewise we have been enriched in our understanding of these issues by the thoughtful perspectives and advice of nations that are U.S. allies, friends, or fellow nuclear powers. We received unstinting assistance from the Executive Branch, which has been individually and collectively supportive of the Commission. The United States Institute of Peace, its employees and contractors have provided outstanding support to the Commission, and I thank them. I also want to make special mention of and praise the members of our five Expert Working Groups and their leaders, who have volunteered countless hours of their time in supporting the Commission and its work and provided us with strong intellectual assistance of the highest caliber.

While each commissioner would have written a report that would be worded somewhat differently than our final report, it is most significant that with the exception of parts of the chapter on the Comprehensive Test Ban Treaty (CTBT), this is a consensus document. And even with CTBT, while we could not agree on common language overall, we did agree on recommendations that would prepare the way for Senate reconsideration of the Treaty. We strove to ensure that the essence of our disagreement was presented as clearly and succinctly as possible so that interested individuals and groups can review the arguments, weigh them carefully, and reach their own conclusions.

At the beginning of the Commission's work, I did not imagine that such an ideologically disparate group of senior experts would find so much common ground. And the trail we followed to arrive at this document was not always easy for us, logistically, intellectually, or emotionally. But the seriousness of the issues, and the stakes involved for America and the world, called forth the "better angels" in all of us commissioners, producing the largely consensus document you have before you today. We hope that the Executive Branch and Congress will also face these critical security policy issues in a similar nonpartisan spirit.

In conducting its work, the Commission has adopted a broad definition of strategic posture. We defined the scope of our work to include all dimensions of nuclear weapons, including the key infrastructures that support them, and all the major tools to counter the nuclear threat to the United States and its allies, including arms control, missile defense, and countering nuclear proliferation.

But we also defined some limits to our inquiry. For example, we chose not to expand our scope of work to address issues associated with all weapons of mass destruction, though we did address the question of whether and how nuclear weapons have a role in deterring attacks with biological weapons. Neither did we examine threats such as cyber attacks and space conflict, though this does not mean we consider them unimportant, and believe they merit serious examination in the near future. Also, our pre-eminent conventional military capabilities are themselves a major strategic force, but we understood Congress was not seeking our advice on these matters.

When one considers the destructive power of the nuclear weapons within our strategic posture, which generated important disagreements throughout the Cold War and after, it is not surprising the American nuclear posture has been, and will continue to be, highly controversial on key issues. What was surprising is the extent to which our Commission did reach agreement on numerous issues related to our deterrent capabilities, nonproliferation initiatives, and arms control strategies—what I believe are the three key components of U.S. strategic posture in the years ahead. The Commission agreed that the nation must continue to safeguard itself by maintaining a nuclear deterrent appropriate to existing threats until such time as verifiable international agreements are in place that could set the conditions for the final abolition of nuclear weapons. That is, we seek to safeguard our security by supporting military and intelligence programs that maintain our deterrence force. At the same time, we also seek to safeguard our security by supporting largely non-military programs that prevent the proliferation of nuclear weapons to other states, that reduce the number of nuclear weapons worldwide, and that provide better protection for the residual nuclear forces and fissile material. Both approaches are necessary for America's future; each can and should reinforce the other; and neither by itself is sufficient as long as nuclear weapons still exist in the world.

Nuclear weapons safeguarded our security for decades during the Cold War by deterring an attack on the U.S. and its allies. We will need them to continue to perform this deterrence role as long as others possess them as well. On the other hand, if nuclear weapons were to fall into the hands of a terror organization, they could pose an extremely serious threat to our security, and one for which traditional forms of deterrence would not be applicable, given the terrorist mind-set. We must be mindful that Al Qaeda, for example, has declared that obtaining a nuclear weapon is a "holy duty" for its members.

Preventing nuclear terrorism is closely tied to stopping the proliferation of nuclear weapons, and recent developments in North Korea and Iran suggest that we may be at or near a tipping point in nuclear proliferation. (The urgency of stopping proliferation is articulated compellingly in the recent WMD Commission report: "World at Risk.")

While the programs that maintain our deterrence force are national, the programs that prevent proliferation and safeguard nuclear weapons and fissile material are both national and international. Indeed, it is clear that we cannot meet our goal of reducing the proliferation threat without substantial international cooperation. We cannot "go it alone" on this crucial security issue, nor need we, given that other nations are at risk from nuclear proliferation as much as we. But the international programs that are most effective in containing and rolling back proliferation can sometimes be in conflict with the national programs designed to maintain deterrence. Thus a strategic posture for the U.S. that meets both of these security requirements will necessarily have to make some trade-offs between these two important security goals when they are in conflict. Some commissioners give a priority to dealing with one threat while others give a priority to dealing with the other threat. But throughout the deliberations of the Commission, there was unswerving member loyalty to the importance of ensuring U.S. security in the years ahead, and all of our members sought to strike a balance that supports, to reasonable levels, both of these security needs. To a large extent, I am pleased to say, we were able to meet that objective.

The need to strike such a balance has been with us at least since the ending of the Cold War. President Clinton's policy on nuclear posture spoke of the need to "lead but hedge." That policy called for the U.S. to lead the world in mutual nuclear arms reductions and to lead in programs to prevent the proliferation of nuclear weapons, while at the same time maintaining a nuclear deterrent force that hedged against adverse geopolitical developments. The leadership aspect of this policy was demonstrated most vividly by a cooperative program with Russia, established under the Nunn-Lugar Program, that dismantled more than 4,000 Russian nuclear weapons and assisted Ukraine, Belarus, and Kazakhstan in removing all of their nuclear weapons, a signal contribution to a safer world. U.S. leadership was also demonstrated by signing the Comprehensive Test Ban Treaty (CTBT), which seeks a permanent end to all nuclear testing, and negotiating with Russia a new arms control treaty for further reductions in nuclear weapons.

However, neither treaty was ratified by the Senate. The Bush administration initially took a different view on U.S. strategic posture, but last year Defense Secretary Gates explicitly reaffirmed that the American nuclear posture would be based on the time-tested "lead but hedge" strategy.

President Obama has moved this strategy forward, stating that the U.S. should work towards the goal of eventually eliminating all nuclear weapons. But he has also said that until that goal is reached, he is committed to maintain a U.S. nuclear deterrent that is safe, secure, and reliable. This is, in a sense, the most recent formulation of the "lead but hedge" policy. The Commission believes that reaching the ultimate goal of global nuclear elimination would require a fundamental change in the world geopolitical situation, something that none of us believe is imminent. Senator Sam Nunn, former chairman of this Committee, who has espoused the vision of nuclear elimination, has described this vision as the "top of the mountain," which cannot be seen at this time, and the exact path to which is not yet visible. But he argues that we should be heading up the mountain to a "base camp" that would be safer than where we are today, and from which the path to the mountaintop becomes clearer. In Nunn's view, getting the international political support to move to this "base camp" requires the United States to affirm the vision of global elimination of nuclear weapons. When we reach the base camp, it would

- provide for U.S. nuclear forces that are safe, secure, and can reliably deter attacks against the U.S. and our allies;
- be headed in the direction of the global elimination of nuclear weapons; and
- be stable—that is, it should be sustainable even under typical fluctuations in geopolitical conditions.

This base camp concept serves as an organizing principle for my own thinking about our strategic posture, since it allows the United States to both lead in the struggle to reduce and ultimately eliminate the nuclear danger; and hedge against a reversal in this struggle, providing an important safety net for U.S. security. While some of the commissioners do not accept this view of the base camp as an organizing principle, all commissioners accept the view that the U.S. must support programs that both lead and hedge; that is, programs that move in two parallel paths—one path which protects our security by maintaining deterrence, and the other which protects our security by reducing the danger of nuclear weapons.

The first path, "Deterrence," would include the following components:

- Clarify our policy on use of nuclear weapons to include a statement that our nuclear forces are intended to deter an attack against the U.S. or its allies (extending this security guarantee to our allies is often referred to as "extended deterrence") and would be used only as a defensive last resort; at the same time, our policy would reaffirm the security assurances we have made to non-nuclear states that signed the Non-Proliferation Treaty (NPT).
- Back up our deterrent and extended deterrent policy by assuring that our nuclear forces—including the weapons themselves, their delivery platforms, and the surveillance, detection, and command/control/communications/intelligence infrastructures that support them and the National Command Authority—are safe, secure, and reliable, and in sufficient quantities to perform their deterrent task.

- Maintain the safety, security, reliability, and effectiveness of our nuclear weapons stockpile by an enhanced nuclear weapons life extension program as long as it is feasible; but ensure the nuclear weapons laboratories maintain their capability to design a new weapon should that ever become necessary.
- Provide robust support for the Stockpile Stewardship Program, DOE's highly successful program to ensure the safety, security, and reliability of the nation's nuclear stockpile without testing. This program seeks a comprehensive, science-based understanding of nuclear weapon systems, and entails pushing the frontiers of computing and simulation along with ensuring robust laboratory experimental capabilities. The weapons labs have achieved remarkable success with stockpile stewardship, but continued success is endangered by recent personnel and funding cuts.
- Maintain all three weapon laboratories with programs that fully support the nuclear weapons programs and maintain their scientific and design vitality. Besides weapons programs, their program mix should include fundamental research and energy technologies as well as an expanded national security role, which will benefit other dimensions of the security challenges we face.
- Transform our weapons production capability by reducing and modernizing it, giving first priority to the Los Alamos plutonium facility, followed by the Y-12 site Uranium Processing Facility site after the plutonium facilities are under construction. The goal would be to have a capability to produce small numbers of nuclear weapons as needed to maintain nuclear stockpile reliability.
- Provide proven strategic missile defenses sufficient to limit damage from and defend against a limited nuclear threat such as posed by North Korea or Iran, as long as the defenses are effective enough to at least sow doubts in the minds of such countries that an attack would succeed. These defenses should not be so sizable or capable as to sow such doubts in the minds of Russia or China, which could well lead them to take countering actions, increasing the nuclear threat to the U.S. and its allies and friends and undermining efforts to reduce nuclear numbers, and nuclear dangers.
- Reprogram funding to initiate F-35 fighter aircraft contractor participation with NNSA to ensure that the U.S. would maintain current capabilities available to support U.S. allies.

The Commission recognizes the tension between modernization and nonproliferation. But so long as modernization proceeds within the framework of existing U.S. policy, it should minimize political difficulties. As a matter of policy, the United States does not produce fissile materials and does not conduct nuclear explosive tests, and does not currently seek new weapons with new military characteristics. Within this framework, the United States should seek all of the possible benefits of improved safety, security, and reliability.

The second path, "Reducing the Danger," includes the following components:

- Re-energize efforts to reverse the nuclear proliferation of North Korea and prevent the nuclear proliferation of Iran. Seek global cooperation to deal with other potential proliferation concerns arising from the anticipated global expansion of civilian nuclear power.
- Negotiate arms reduction treaties with Russia that make significant reductions in the nuclear stockpiles of Russia and the United States. The treaties should include verification procedures and should entail real reductions, not just a transfer from deployed to reserve forces. The first treaty could decrease deployed strategic warheads to numbers lower than the lower SORT limit (Moscow Treaty of 2002), but the actual numbers are probably less important than the "counting and attribution rules" of preceding agreements. I am quite encouraged by President Obama's announcement that he will seek a replacement strategic arms agreement before START I expires this December, and the positive Russian response. Follow-on treaties should seek deeper reductions, which would require finding ways to deal with difficult problems such as addressing "tactical" nuclear forces, reserve weapons and engaging other nuclear powers.
- Seek a deeper strategic dialogue with Russia that is broader than nuclear treaties, to include civilian nuclear energy, ballistic missile defenses, space systems, nuclear nonproliferation steps, and ways of improving warning systems and increasing decision time.
- Renew and strengthen strategic dialogue with a broad set of states interested in strategic stability, including not just Russia and our NATO allies but also China and U.S. allies and friends in Asia.
- Augment funding for threat reduction activities that strengthen controls at vulnerable nuclear sites. The surest way to prevent nuclear terrorism is to deny terrorist acquisitions of nuclear weapons or fissile materials. An accelerated campaign to close or secure the world's most vulnerable nuclear sites as quickly as possible should be a top national priority. This would build on and expand the important foundation of work begun under the Nunn-Lugar Cooperative Threat Reduction Program. Commit to the investment necessary to remove or secure all fissile material at vulnerable sites worldwide in four years. This relatively small investment could dramatically decrease the prospects of terrorist nuclear acquisition.

- Seek Senate ratification of the Comprehensive Test Ban Treaty and encourage other holdouts to do likewise. I strongly support Senate ratification of the CTBT, but I want to be clear that my view is not shared by all commissioners. I believe that the Stockpile Stewardship Program, established as a safeguard when the U.S. signed the CTBT, has been an outstanding success, and, with sufficient funding support, can continue to be. The United States has refrained from testing nuclear weapons for 17 years already and has no plans to resume such testing in the future. Prior to seeking ratification, the administration should obtain an explicit understanding with the P-5 states as to what tests are permitted by the treaty, and conduct a careful analysis of the issues that prevented ratification a decade ago. (All commissioners agree that these preceding steps should be taken, but not all commissioners support ratifying the CTBT.)
- While the Senate has the responsibility for considering the CTBT for ratification, both the Senate and the House should support funding for any Treaty safeguards the Obama administration may propose, which will be essential to the ratification process.
- Prepare carefully for the NPT review conference in 2010. If we are able to make progress in a new arms reduction treaty and CTBT ratification, this would reassert U.S. leadership and create favorable conditions for a successful conference.
- Seek an international Fissile Material Cutoff Treaty, as President Obama has called for, that includes verification procedures, and redouble domestic and international efforts to secure all stocks of fissile material, steps that would discourage both nuclear proliferation and nuclear terrorism.
- Seek to strengthen the International Atomic Energy Agency (IAEA) in its task to prevent the proliferation of nuclear weapons to other nations and control access to fissile material. In particular, work with the IAEA to promote universal adoption of the Additional Protocol to the NPT, which would allow extra inspections of suspected nuclear facilities as well as declared facilities.
- Develop and pursue options for advancing U.S. interests in stability in outer space and in increasing warning and decision-time. The options could include the possibility of negotiated measures.
- Renew the practice and spirit of executive-legislative dialogue on nuclear strategy that helped pave the way for bipartisanship and continuity in policy in past years. To this end, we urge the Senate to consider reviving the Arms Control Observer Group, which served the country well in the past.

In surveying six-plus decades of nuclear history, the Commission notes that nuclear weapons have not been used since 1945. It is clear that a tradition against the use of nuclear weapons has taken hold, which we must strive to maintain, and urge all nuclear-armed nations to adhere to it.

In sum, this is a moment of opportunity but also of urgency. The opportunity arises from the arrival of the new administration in Washington and the top-down reassessment that must now begin of national security strategy and of the purposes of U.S. nuclear weapons. The opportunity also arises because the Russian government has indicated a readiness to undertake a serious dialogue with the U.S. on strategic issues. The urgency arises because of the imminent danger of nuclear terrorism if we pass a tipping point in nuclear proliferation. The urgency also arises because of an accumulation of difficult decisions affecting our nuclear posture.

The commissioners know and agree on what direction they want to see the world take. We reject the vision of a future world defined by a collapse of the nonproliferation regime, a cascade of nuclear proliferation to new states, a resulting dramatic rise in the risks of nuclear terrorism, and renewed fruitless competition for nuclear advantage among major powers.

As pragmatic experts, we embrace a different vision. We see a world where the occasional nonproliferation failure is counterbalanced by the occasional rollback of some and continued restraint by the many. We see a world in which nuclear terrorism risks are steadily reduced through stronger cooperative measures to control terrorist access to materials, technology, and expertise. And we see a world of cooperation among the major powers that ensures strategic stability and order, and steadily diminishes reliance on nuclear weapons to preserve world peace, not as a favor to others, but because it is in the best interests of the United States, and the world. We commissioners believe that implementing the strategy our report recommends will help the United States lead the global effort to give fruitful birth to this new world.

Statement of Dr. James Schlesinger

The Congress established the Commission on Strategic Posture in order to provide recommendations regarding the appropriate posture for the United States under the changed conditions of the early twenty-first century. The appointed Commissioners represent a wide range of the political spectrum and have had quite diverse judgments on these matters. Nonetheless, urged by members of Congress, the Commission has sought to develop a consensus view. To a large—and, to some, a surprising—extent, the Commission has succeeded in this effort. Secretary Perry and I are here to present that consensus to this Committee. We are, of course, indebted to the Committee for this opportunity to present these recommendations.

For over half a century, the U.S. strategic policy has been driven by two critical elements: to maintain a deterrent that prevents attacks on the United States, its interests, and, notably, its allies—and to prevent the proliferation of nuclear weapons. The end of the Cold War, and particularly the collapse of the Soviet Union/Warsaw Pact, along with the substantial edge that the United States has developed in conventional military capabilities, has permitted this country sharply to reduce our reliance on nuclear weapons, radically to reduce our nuclear forces, and to move away from a doctrine of nuclear initiation to a stance of nuclear response only under extreme circumstances of major attack on the United States or its allies.

On the other hand, the growing availability of nuclear technology, along with the relaxation of the constraints of the Cold War, have obliged us to turn increasing attention to the problem of nonproliferation and, in particular, to the possibility of a terrorist nuclear attack on the United States.

Secretary Perry has just spoken on the diplomatic issues and the problems of preventing proliferation, and the risks of nuclear terrorism. I, for my part, will focus on the need, despite its substantially shrunken role in the post–Cold War world, to maintain a deterrent reduced in size, yet nonetheless reliable and secure—and sufficiently impressive and visible to provide assurance to the thirty-odd nations that are protected under the U.S. nuclear umbrella.

1. Since the early days of NATO, the United States has provided Extended Deterrence for its allies. That has proved a far more demanding task than protection of the United States itself. In the past that has required a deterrent sufficiently large and sophisticated to deter a conventional attack by the Soviet Union/Warsaw Pact. It also meant that the United States discouraged the development of national nuclear capabilities, particularly during the Kennedy administration, both to prevent proliferation and to avoid the diversion of resources away from the development of conventional allied capabilities. With the end of the Cold War and the achievement of U.S. preponderance in conventional capabilities, the need for so substantial a deterrent largely disappeared. Nonetheless, the requirements for Extended Deterrence still remain at the heart of the design of the U.S. nuclear posture. Extended Deterrence still remains a major barrier to proliferation. Both the size and the specific elements of our forces are driven more by the need to reassure those that we protect under the nuclear umbrella than by U.S. requirements alone. Even though the overall requirements of our nuclear forces have shrunk some eighty percent since the height of the Cold War, nonetheless the expansion of NATO and the rise of Chinese nuclear forces, significant if modest, have altered somewhat the requirements for our own nuclear forces.

2. Even though the most probable source of a weapon landing on American soil increasingly is that of a nuclear terrorist attack, nonetheless the sizing of our own nuclear forces (in addition to other elements of our deterrent posture) remains driven in large degree by Russia. Our NATO allies—and most notably the new members of NATO—remain wary of Russia and would eye nervously any sharp reduction of our nuclear forces relative to those of Russia—especially in light of the now-greater emphasis by Russia on tactical nuclear weapons. Consequently, the Commission did conclude that we should not engage in unilateral reductions in our nuclear forces and that such reductions should occur only as a result of bilateral negotiations with Russia under a follow-on START Agreement. Any such reductions must, of course, be thoroughly discussed with our allies
3. Our East Asian allies also view with great interest our capabilities relative to the slowly burgeoning Chinese force. Clearly that adds complexities, for example, to the protection of Japan, though that remains a lesser driver with respect to overall numbers. Still, the time has come to engage Japan in more comprehensive discussions—akin to those with NATO in the Nuclear Planning Group. It will also augment the credibility of the Extended Deterrent.
4. The Commission has been urged to specify the number of nuclear weapons the United States should have. That is an understandable question—particularly in light of the demands of the appropriations process in the Congress. Nonetheless, it is a mistake to focus unduly on numbers, without reference to the overall strategic context. Clearly, it would be illogical to provide a number outside of the process of negotiation with Russia—given the need to avoid giving away bargaining leverage. In preparation for the Treaty of Moscow, as with all of its predecessors, the composition for our prospective forces was subjected to the most rigorous analyses. Thus, it would seem to be unacceptable to go below the numbers specified in that Treaty without a similarly rigorous analysis of the strategic context—which has not yet taken place. Moreover, as our Russian friends have repeatedly told us: strategic balance is more important than the numbers.
5. Given the existence of other nations' nuclear capabilities and the international role that the United States necessarily plays, the Commission quickly reached the judgment that the United States must maintain a nuclear deterrent for "the indefinite future." It must convey, not only the capacity, but the will to respond—in necessity. Some members of the Commission have expressed a hope that at some future date we might see the worldwide abolition of nuclear weapons. The judgment of the Commission, however, has been that attainment of such a goal would

require a "transformation of world politics." President Obama also has expressed that goal, but has added that as long as nuclear weapons exist in the world, the United States must maintain "a strong deterrent." We should all bear in mind that abolition of nuclear weapons will not occur outside that "transformation of world politics."

6. We sometimes hear or read the query, "Why are we investing in these capabilities which will never be used?" This is a fallacy. A deterrent, if it is effective, is in "use" every day. The purpose in sustaining these capabilities is to be sufficiently impressive to avoid their "use"—in the sense of the actual need to deliver the weapons to targets. That is the nature of any deterrent, but particularly a nuclear deterrent. It exists to deter major attacks against the United States, its allies, and its interests.

Years ago the role and the details of our nuclear deterrent commanded sustained and high-level national attention. Regrettably, today they do so far less than is necessary. Nonetheless, the role of the deterrent remains crucial. Therefore, I thank this Committee for its continued attention to these critical questions.

Part I: Deterrence

The central rationale behind U.S. nuclear weapons policy has been the need to be able to deter attacks against the United States and its vital national interests. The destructive capabilities inherent in nuclear weapons are so substantial that the international behavior of other nations cannot help but be influenced by their existence, as is U.S. behavior by the existence of others' nuclear weapons. This ability to influence the behavior of other countries, and deter attacks on those countries that possess them, is a primary incentive for some nations to seek nuclear weapons capability. Nuclear deterrence may be an elusive concept, but its impact is very real. Despite conflicts and tensions that have witnessed the use of virtually every other type of weapons, 64 years have elapsed since nuclear weapons have been detonated in anger. The blend of these nuclear deterrence needs and the technological capabilities of the United States, tempered by important geopolitical factors, shapes the size of U.S. nuclear forces. Commission experts examined a range of deterrence issues, including force structure considerations, extended deterrence, declaratory policy, and the looming threat of nuclear terrorism.

Throughout the Commission's work, its experts addressed a number of deterrence force posture issues. The end of the Cold War has resulted in a relative de-emphasis of the role of advanced strategic technology, though its reduced role nonetheless remains a prominent one. While often not widely appreciated, the substantial role of extended deterrence in assuring our allies and friends of their place under the U.S. nuclear umbrella has drawn recent renewed recognition—an issue that a number of Commission experts explore below. As many of the experts note, without such security assurances, it is quite possible that many states would attempt to develop their own nuclear weapons. The first several papers in this chapter examine extended deterrence issues and their implications and possible challenges in the future. Elbridge Colby begins the chapter with his paper on the nature and utility of the U.S. alliance structure. Colby illustrates the past, present, and possible future course of our alliances and how extended nuclear deterrence plays an important role in our international relations. Brad Roberts identifies key issues and concerns for the Commission on the role of extended deterrence in the development of the United States' strategic posture. With a more regional focus, Kathleen Bailey examines proliferation and extended deterrence issues in northeast Asia, where the issues have grown in prominence in recent years. As Bailey explains, this region of the world, home to two nuclear weapons states, deserves considerable attention given the high potential for conflict; Bailey suggests insights into each country's perspective on extended deterrence, which she notes is shaped by history and different modern-day geopolitical pressures.

Considering the changing requirements of the post–Cold War era and the central role that nuclear deterrence requirements play in decisions about force structure and arms control, the experts paid much attention to factors affecting the size and composition of the U.S. nuclear arsenal. In his paper on the role of nuclear weapons, Elbridge Colby recognizes the post–Cold War realities of today and contrasts the role of nuclear weapons in the past with the changing present and future threats and requirements; Colby further emphasizes the need to reconfirm the importance of nuclear weapons. Clark Murdock also addresses this point in his paper on the saliency of nuclear weapons in the views of different segments of the policy community, noting that this community is deeply divided over the relevance and importance of nuclear weapons within national security policy. He suggests that the new administration should focus on deeds, not words, to build support for a series of concrete actions on these topics.

In four subsequent papers, members of the Deterrent Force Posture working group address the difference between Cold War nuclear posture and the forces needed today to address the emerging threats of the 21st century. While not as militarily strong as in years past, Frank Miller states that Russia still remains a credible threat to U.S. security. Miller questions whether a resurgent Russia and an increasingly powerful China will become emboldened and seek to increase the size and capability of their arsenals as the United States draws down its own numbers. In the same vein, Brad Roberts and Barry Blechman examine the case of China: an increasingly powerful nuclear weapons state that could be tempted to "sprint to parity" with the U.S. and Russia in nuclear weapons. As China upgrades and diversifies its nuclear arsenal, Roberts examines the U.S. attitude of "benign neglect" toward China that he concludes is decidedly too ambivalent, and even dangerous, for the future; Roberts identifies key policy issues and questions concerning China for the Commission to ponder, including how the U.S. should respond to Chinese nuclear weapons modernization and maintenance, U.S. missile defense posture toward China, and how to pursue a relationship with China while engaging other nuclear weapons states. In his paper, Blechman raises the questions of what is the most appropriate mix of U.S. offensive nuclear forces and missile defenses—a mix that he argues should neither force China's hand nor render the United States more vulnerable. Dennis Blair continues this discussion of China and expands it to include our ability to deter more unpredictable and "rogue" states such as North Korea and Iran. Based on his experience and analysis, Blair sketches a series of hypothetical confrontations between the United States and China, North Korea, and Iran to better inform scenario-based strategic thinking about U.S. nuclear forces.

In order to consider any numerical or compositional changes to the arsenal, the Commission needed to delve deeply into the structure of the U.S. nuclear forces. To fully inform commissioners of the implications of force structure changes, Commission experts produced a series of papers to analyze current force composition and provide a framework for alternative postures, force reduction options, and force management suggestions. As a starting point for the Commission, Thomas Scheber begins the discussion by offering a summary of current forces committed to the nuclear mission, including the number of ICBMs, SSBNs, SLBMs, nuclear-capable bombers, nuclear cruise missiles, non-strategic nuclear forces, and nuclear command and control forces. Scheber also addresses the funding issues behind these weapons systems to illustrate sustainability issues to commissioners. Building on this, Clark Murdock proposes a "judgment-centric" methodological framework to take into account modern-day variables that put pressure on force size and structure, including extended deterrence obligations, nonproliferation considerations, other nuclear weapons states' arsenals, treaty obligations, and domestic attitudes towards nuclear weapons. To further guide the decision-making process, James Miller proposes a set of alternative options for modifying the stockpile size. Each alternative offers the Commission a strategic backdrop to promote a healthy debate and provide scenarios for future wargaming and assessment.

In addition to nuclear arsenal size considerations, the Commission and experts examined compositional and managerial aspects of the arsenal, including the relevance of maintaining the traditional nuclear triad (land, sea, and air nuclear delivery systems) and nuclear and conventional force integration. In acknowledgment of the decades-old trend toward smaller nuclear forces, Thomas Scheber outlines the unique attributes of each leg of the triad while pointing out capabilities that would be lost in the possible elimination of any of these legs. Drawing upon previous American experiences with managing nuclear and conventional forces, Dennis Blair uses historical examples and hypothetical future scenarios to explain the organizational difficulties surrounding dedicated and dual-use nuclear force integration and separation.

The Commission also explored the topic of declaratory policy as it relates to deterrence. Experts provided their input on declaratory policy and more specifically, the possibility of adopting a "No First Use" policy, under which the United States would not use nuclear weapons against another country unless that country had first attacked the United States or its allies with nuclear weapons. This proposal is a contentious one. In his paper to the Commission on declaratory policy, Elbridge Colby considers the spread of new technologies as a key determinant in formulating appropriate declaratory policy. In his view, Colby maintains that the United States must retain its flexibility to respond "asymmetrically as we deem appropriate" against state and non-state aggressors alike.

On the subject of "No First Use," other experts encouraged the Commission to explore the nuances and effects of declaratory policy on deterrence, nonproliferation objectives, and other nuclear weapons states' postures. In his paper on the cost-benefit analysis of a "No First Use" declaratory policy, author Scott Sagan recommends that the Commission carefully weigh the effect of any declaratory policy on our extended deterrence commitments as well as our non-proliferation goals before making a decision. Sagan points out the potential for mimicry of U.S. declaratory policy among other relatively new nuclear weapons states in their "doctrinal development"; Sagan suggests that considering this potential for mimcry, the U.S. adoption of an NFU policy could push other states to adopt it as well.

As powerful a concept as nuclear deterrence has proven to be, most experts worry that nuclear deterrence will be of doubtful effectiveness against the new and growing threat of nuclear terrorism. In the past, nuclear deterrence has been relied upon to influence the strategic posture of other nuclear weapons states. In his paper on nuclear terrorism and deterrence, Scott Sagan points out the new challenge that non-state actors and terrorists pose to the concept of declaratory policy and ponders whether traditional paradigms will be useful in formulating strategy and policy in the future. Sagan proposes to the Commission a range of policy options to deter terrorism: more direct threats toward would-be state sponsors of terrorism, including threats to hold complicit or negligent states accountable; seek cooperation with nuclear weapons states to prevent any security lapses; and initiatives to delegitimize the morality of nuclear weapons use to those that might logistically or otherwise support terrorist attacks or activities.

The Commission created a special group of experts, the Force Structure Tiger Team, to create a framework for examining future U.S. nuclear force structures under alternative arms control and other scenarios. One member of this Tiger Team, Clark Murdock, summarizes the team's extensive analysis in a short paper that addresses deterrence, including extended deterrence, force structure and disarmament implications, as well as other policy considerations.

To close the section, James Dobbins addresses several broad deterrence issues, including the present geopolitical environment and nuclear deterrence, the continuing importance of extended deterrence, the relationship between congressional funding and nuclear weapons policy, and the feasibility of prompt global strike. As a summary of critical deterrence issues, Dobbins concludes the section by offering his broad vision of future steps in U.S. nuclear weapons policy.

1

Alliance and U.S. Nuclear Forces

Elbridge Colby

Summary: The future of U.S. nuclear forces is intimately linked with the future of U.S. alliance relationships, extended deterrent commitments, and allocation of responsibilities among partners. Indeed, much of the real debate takes place at these levels, as Homeland deterrence requirements are comparatively straightforward. Yet discussion about the purposes, structure, and posture of U.S. nuclear forces, while subject to vigorous analysis at most levels, seems often to presume a static alliance structure for the United States in the future. Given sharply shifting global power relationships, however, this presumption may lead to suboptimal allocation of U.S. efforts, resources, and commitments. It is therefore worth thinking comprehensively and creatively about what the U.S. alliance structure should look like in light of national strategic requirements, how resources should be allocated and burdens shared among these commitments, and what this entails for our nuclear forces. It should be emphasized that such an analysis may conclude that our current alliance posture is suitable—but it may not. Either way, recommendations for our nuclear force structure should be based upon such an analysis rather than a presumption of continuity.

Text: The United States currently serves as security steward for a wide variety of countries—including most of the advanced nations of the world.[1] These relationships range from the "roughly thirty" countries covered by the U.S. nuclear umbrella, including NATO allies and Japan, through those protected by conventional security commitments, as in the Gulf region and Asia, to those not aligned with the United States but "free riding" on the beneficial "runoff" of its alliances with others, as with Austria, Sweden, and Switzerland in Europe (or France between its withdrawal from NATO and 1989) or the nonaligned countries of Southeast Asia benefiting from

American maintenance of open sea lanes and monitoring of China.[2] Furthermore, the United States provides numerous security "collective goods" through its command of the "global commons" of sea, air, and space and does so in the service of the free flow of people, goods, and information.[3] In brief, enabled by its military supremacy the United States provides enormous benefits to its allies and other free riders through its security commitments abroad, allowing them to maintain much lower military budgets than would be the case in a more uncertain strategic environment, substantially reducing the dangers associated with mistrust among potential rivals (Japan and South Korea being a good example), and generally helping to sustain the liberal market politico-economic system. Though it would probably be impossible to price these services accurately, the comment of one Commission expert-advisor that even a slight change in the U.S. nuclear posture in Europe would be a "disaster" and the testimony of others about Japanese reactions to similar moves in East Asia are illuminating of the value associated with these guarantees. Clearly, decisionmakers in these countries—if not their populaces —understand this.

Of course the United States derives tremendous benefits from this arrangement as well. Like any dominant actor providing collective goods, it too has profited and profits from these goods, even if smaller actors may not contribute to the provision of these collective goods proportionately compared to the benefits they enjoy.[4] As leader the U.S. enjoys perquisites and privileges attendant to that role, including an outsized influence in the world.[5] Through these alliances, the United States has successfully helped structure and sustain a "free world" system of generally increasing prosperity, security, and representative liberal government, leading to a more secure environment for itself.

Indeed, this situation has emerged partly through American design. Historically the U.S. seems to have been well aware of—and often even encouraged—"unequal" relationships, preeminently by agreeing to assume security commitments to formerly militarized Europe and Japan and by encouraging them to concentrate on economic and social development.[6] In large part because of its pronounced supremacy both in the post–World War II years and beginning again with the economic revival and Revolution in Military Affairs of the last quarter of the 20th century, the United States accepted and even encouraged these "unequal" relationships as satisfactory arrangements given the Soviet threat, the comfortable margin of U.S. advantage, the benefits the U.S. derived, and the concern over relapse to pre-1945 habits in Europe and East Asia.

Now running into their seventh decade, these alliances today exhibit both the advantages and disadvantages of lock-in and path dependency. On the plus side of the ledger, Europe and Northeast Asia are calm. Alliance relationships in these regions are remarkably stable and have helped in addressing significant challenges beyond the Soviet threat, including facilitating cooperation in response to economic crises. Despite post-Cold War concerns about dissolution, NATO, the U.S.-Japan, and the U.S.-ROK alliances are still active. Together, these nations constitute an enormously powerful bloc of states broadly dedicated to the preservation and development of the existing liberal market world order.

But there are disadvantages as well. Over sixty years of the U.S. leading and allies following has entrenched modes of behavior and expectations that may not gel well with a global power structure that is changing—and changing more rapidly, potentially, than had been anticipated even a few years ago. The intensely frustrating difficulties that the United States has faced in spurring European and Asian allies to contribute troops and even resources to the war in Afghanistan is perhaps the most salient example of the disconnect between need and performance. But this represents only one facet of a general aversion to developing, let alone deploying, significant forces for out-of-area operations among both Europeans and Japanese—an aversion midwifed and sustained by expectations that the United States would invariably address such problems. Even the war in the former Yugoslavia—near the heart of Europe—had ultimately to be addressed by the United States.

These arrangements might have been satisfactory in the past, but it is increasingly questionable that they will continue to be so. First, the global power structure has changed and will continue to change markedly. The United States is no longer *the* dominant nation that it was in the 1990s, let alone the 1940s and 1950s; though the U.S. will likely remain the greatest world power in absolute terms for much, if not hopefully all, of the coming century, its relative power edge will continue to shrink as China, India, and other powers develop. The economic crisis of this year will likely finally lead to the rectification of massive structural imbalances in the U.S. economic position; this adjustment will likely lead to a more conservative approach to overseas commitments in light of a society-wide belt-tightening. Thus the U.S. may not be in a position to be quite as magnanimous in its burden-sharing with allies.

Second, the areas of strategic focus have shifted to East and South Asia and the Middle East while existing alliance structures were created and developed to meet the threats of the Cold War, principally in Europe. Yet existing alliances are not showing much promise in projecting power to these new areas of concern. Though effectively immovable conscript reserve armies postured for territorial defense may have answered the call for Europe during the Cold War, such forces are of vanishingly little utility in a world in which the strategic challenges are far afield. While strenuous and earnest efforts have been made to reorient our alliances to meet the likely threats we will face in the future (including the rise of great power rivals, proliferation of massively destructive technology to states of concern, and the dangers posed by non-state actors), the jury is very much out as to whether this effort has been successful. Ultimately alliances probably need to serve a purpose beyond their perpetuation as stabilizing and "locking in" institutions if they are to survive. In this respect, the principle of marginal utility would seem to be superior to path dependency.[7]

These issues raise a host of questions about our alliances, including:

Are our alliances relationships optimally postured for our strategic needs in the coming decades?

Are the allocations of responsibilities among our allies and us optimal for these needs? Can the U.S. responsibly "get more in return" for the services it provides, both to its allies and to free riders? In a more competitive world and with an economy under intense strain, can the U.S. afford to "undercharge" for these services?

Even if our current relationships are not ideal, is it too dangerous or risky to try to alter them? If that is the case, how best can we elicit greater allied cooperation in endeavors such as Afghanistan or a possible security structure for the Middle East Gulf region?

If the U.S. can responsibly push for better structuring and burden-sharing with allies, how best can we leverage our assets to get more in return for what we provide?

Nuclear Implications: Such considerations will have an enormous impact on our nuclear planning, given the central role that nuclear weapons have played and continue to play in U.S. alliance commitments. Because of this, nuclear forces will constitute a principal focus of alliance discussions and will thus be a major source of U.S. leverage, as Commission and expert advisor discussions have already amply illustrated. The United States might then seek to use these nuclear forces as means to pressure allied countries to shoulder more responsibilities in other fields or otherwise meet common needs. Of course such considerations must be balanced by others, such as our non-proliferation goals.

The very low cost of nuclear weapons will also prove salient in light of looming fiscal constraints born of economic conditions and a strategic environment characterized by a broader diffusion of sophisticated conventional military capabilities. The United States can rely on nuclear weapons in order to be more generous in reaffirming or even offering new security commitments if it seems useful to do so. Of course such commitments will have to be considered in light of our interests in preserving our credibility and in maintaining whatever "taboo" on nuclear use may exist (not to mention avoiding unnecessary and costly conflicts). A "no first use" pledge, substantial reductions constraining our ability comfortably to deploy nuclear weapons in defense of allies or abolition of nuclear weapons entirely would markedly increase the importance of conventional forces in our alliance relationships. This would yield a choice of either fielding substantially greater conventional forces to meet such alliance commitments—presumably including a substantial military build-up by our allies as well—or economizing on our alliance commitments in order to keep military expenditures capped.

These implications raise a number of questions regarding our nuclear forces in relation to our alliance structures, including:

To what extent should U.S. nuclear commitments to its allies be extended, reduced, or maintained? Should the U.S. be prepared, for instance, to extend nuclear guarantees to countries in the Persian Gulf in light of the Iranian threat?

What kinds of capabilities will be necessary to meet these requirements?

To what extent and how should U.S. nuclear commitments be used as leverage to restructure existing and create new alliances?

What are the implications of looming fiscal constraints and swiftly changing global power dynamics on U.S. alliance commitments? How do U.S. nuclear forces factor into addressing these developments?

What are the implications of deep reductions and even abolition of U.S. nuclear weapons on our alliance relations?

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1. The late Lt. Gen. William E. Odom (USA, ret.) described this system expertly in his *America's Inadvertent Empire*. (New Haven: Yale University Press, 2004).
2. For the "roughly thirty countries" figure, see The Report of the Secretary of Defense's Task Force on DOD Nuclear Weapons Management, cover letter from Dr. James R. Schlesinger.
3. For a discussion of this, see Barry Posen, "Command of the Commons: Military Foundations of U.S. Hegemony," *International Security* 28, 1 (Summer 2003), 5-46.
4. For a classic analysis of the near-inevitability of this behavior, see Mancur Olson, Jr. and Richard Zeekhauser, "An Economic Theory of Alliances," *The Review of Economics and Statistics*, 48, 3 (August 1966), 266-279.
5. Other advantages have included the status as attractive and reliable destination for capital, thus subsidizing a higher American standard of living; the ability to set the agenda for international efforts in ways favorable to U.S. interests; and so forth. See on this point and the broader issue of the interrelationship between strategic position and economic dynamics, Robert Gilpin, *Global Political Economy: Understanding the International Economic Order.* (Princeton: Princeton University Press, 2001).
6. See, e.g., G. John Ikenberry, *After Victory: Institutions, Strategic Restraint, and the Rebuilding of Order After Major Wars*. (Princeton: Princeton University Press, 2001).
7. "Rational alliance building [means] the principle of marginal utility…That is, a state should add allies and increase alliance commitments up to the point at which the 'last' unit of commitment to the last-chosen ally yields a marginal value equal to its marginal cost and risk." Of course, "a fully rational calculation of alliance values must be farsighted [and "wide-angled"]; it must take account of consequences in the distant as well as the immediate future." Glenn Snyder, *Alliance Politics*. (Ithaca: Cornell University Press, 1997), 45-46.

2

The Evolving Requirements of Extended Deterrence

Bradley H. Roberts

Key Issue

How should the requirements of extended deterrence inform the development of the next U.S. strategic posture?

Background

In the evolving security environment, the requirements of extending nuclear assurance to U.S. allies and friends have received relatively little attention, as U.S. nuclear policy has focused on the U.S.-Russian and U.S.-rogue relationships.

U.S. allies and friends are not of a single mind on this matter.

- Some in Europe see the security environment as having grown more secure and predictable, and prefer the removal of remaining U.S. nuclear weapons, especially if this can secure a draw-down or removal of Russian tactical nuclear weapons.
- Others in Europe (especially among NATO's new members but also along NATO's southeastern flank) see the security environment as having grown more threatening and less predictable, and privately argue that the removal of remaining U.S. nuclear weapons would be the shortest route to their own acquisition of a nuclear deterrent.
- Japan worries about a nuclear security environment evolving in complex new ways and also about whether the U.S. appreciates those changes and knows how to shape the East Asian security environment in ways that serve long-term Japanese interests. Japan has no immedi-

ate interest in nuclear weapons of its own but seeks improved nuclear assurances from the U.S.. Some in the U.S. defense establishment flirt with the notion that a nuclear-armed Japan would be a welcome addition to the club of nuclear democracies containing China, but fail to appreciate that the only plausible path to Japan's acquisition of nuclear weapons would be a Japanese decision to distance itself from dependence on the U.S.

- Elsewhere in East Asia there are concerns about the long-term balance of power with China and the reliability of the U.S. as a security guarantor.
- All U.S. friends and allies also have significant political constituencies favoring nuclear disarmament.

Key issues:

1. How can the U.S. provide the needed assurance?
   a. Assurance seems not to require much of the U.S. that is new or different. It requires dialogue, formal consultation, and coordinated defense planning. In each of these, the allies/friends look to the U.S. to set the agenda.
   b. U.S. reputation as a security guarantor is shaped by U.S. global behavior and not just the dynamics of particular bilateral relationships, and the outcome of the wars in Iraq and Afghanistan may yet have a significant impact on the desire of other states to closely align themselves with the U.S.

2. To what extent do U.S. allies perceive gaps in current U.S. strategic capabilities that the next posture review can help fill?
   a. A few clearly articulate concerns about specific weapon systems (e.g., DCA and TLAM-N). Some have also picked up on U.S. concerns about the viability and credibility of the U.S. deterrent and feed these back.
   b. On non-nuclear strike, some U.S. allies/friends are seeking new capabilities to complement U.S. capabilities or to enable independent action of their own against regional adversaries.
   c. More widespread is the perception that missile defense offers an important remedy to U.S. strategic vulnerability (and thus enhances U.S. credibility in the face of de-coupling pressures). How to integrate locally into a global U.S. missile defense is hotly contested by small expert communities.
   d. The "second to none" assurances of the Bush administration have played an important role in assuring allies. But the role also appears rather modest, as it is not clear how many U.S. allies attach value to the second-to-none criterion higher than the value they attach to con-

tinued nuclear risk/threat reduction with Russia (and to the health of the nonproliferation regime).

e. Signaling to allies/friends in time of crisis that the U.S. is committed to their nuclear defense can more easily be done with visibly deployable forces than without them. This is an argument for maintaining dual-capable aircraft and nuclear-armed bombers.

3. How should the U.S. address the potential collapse of the INF regime?
   a. Russia's withdrawal has been threatened periodically over the years, along with a desire to globalize the regime. But the conditions leading to actual withdrawal seem more plausible at this time, not least the failure of a concerted effort to enlist Asian participants in the regime.
   b. Russia's reconstitution of INF would create military imbalances around its periphery that would trouble U.S. friends and allies and otherwise undermine Asian nuclear stability.
      i. One of the key Russian arguments against INF withdrawal is that the U.S. would exploit it to deploy INF forces of its own into the new NATO members.

3

Tailoring the U.S. Strategic Nuclear Posture in Northeast Asia

Kathleen C. Bailey

Introduction

The security environment in Northeast Asia is very complex and is likely to become more so over the coming decade. North Korean WMD proliferation (see Appendix A) has defied resolution and the useful bargaining chip these weapons provide to Pyongyang assures that the problem is likely to remain. Chinese military expansion and modernization proceed apace (see Appendix B); the strength of both China's economy and its ambitions fuel the buildup. Japan is jittery about both North Korean and Chinese military intent. U.S. efforts to fulfill its obligations to Taiwan are met with objections by China. There are no signs that efforts to mitigate these tensions will succeed. Thus, while the U.S. can continue to work to resolve the problems, it must also be prepared in the event that these tensions trigger a security crisis.

As the 1998 U.S. Security Report on East Asia detailed, the U.S. applies a range of capabilities to assuring peace and security in the region. Diplomacy, dialog, basing, conventional forces, exercises—all play an essential role in helping to prevent and resolve disputes. Missile defenses also contribute to threat reduction with reference to North Korea, but inadequately address potential threats from China. At the backbone of our strategic posture is an essential element: U.S. nuclear weapons and delivery systems. They are essential, in part, because they: prevent proliferation by providing extended deterrence; provide incentive to resolve conflict and prevent escalation; and, deter and dissuade current nuclear-weapons states.

The remainder of this paper addresses the role of the U.S. strategic nuclear posture in Northeast Asia, with a focus on extended deterrence to Japan and

South Korea, and outlines the key considerations for revising or updating that posture for the coming few decades.

Extended Deterrence: Japan

Background

The U.S. extended nuclear deterrence to Japan in the 1960 Treaty of Mutual Cooperation and Security between Japan and the United States. The treaty states "…an armed attack against either Party in the territories under the administration of Japan would be dangerous to its own peace and safety and declares that it would act to meet the common danger in accordance with its constitutional provisions and processes."

As with other nations under the U.S. nuclear umbrella, the United States has reaffirmed the role of nuclear weapons in fulfilling its security treaty obligations in bilateral meetings over the years. For example, the *U.S.-Japan Alliance: Transformation and Realignment for the Future* (Security Consultative Committee Document, 29 October 2005) states that "U.S. strike capabilities and the nuclear deterrence provided by the U.S. remain an essential complement to Japan's defense capabilities in ensuring the defense of Japan and contribute to peace and security in the region."

Extended deterrence was reaffirmed following the October 2006 North Korean nuclear test. Japan asked for and received high-level assurances that the U.S. nuclear deterrent is in effect. Secretary of State Rice went to Tokyo where she said, "I reaffirmed the President's statement of October 9th that the United States has the will and the capability to meet the full range—and I underscore full range—of its deterrent and security commitments to Japan."

It is imperative that the U.S. continues to assure Japan of the U.S. security commitment. If Japan loses trust that the alliance is capable and effective, it undoubtedly will reconsider its own nuclear weapons options.

Japanese security concerns

The two most fundamental security concerns of Japan are North Korea and China. Although missile defense has somewhat mitigated concerns about North Korea, the Japanese public continues to deeply distrust the DPRK and believe it will not give up its nuclear weapons.[1] There are at least three scenarios that could increase Japan's sense of threat:

- Evidence of substantial nuclear weapons materials production—either new production or discovery of extant, clandestine production—by North Korea beyond what is currently known
- Collapse of North Korea's regime or reunification of the Koreas without elimination of the North's nuclear weapons and infrastructure

- Political use of North Korean or Chinese WMD to coerce Japan in any way

Regarding China, Japan is very concerned about the extensive build-up of China's military power, especially its nuclear weapons, nuclear-weapons delivery systems, and anti-satellite weaponry. And, for the first time in almost 150 years, the balance of power has shifted: where once Japan was on the steady ascendancy and China was not, now their roles are switched. Japan is seen, and sees itself, as static, whereas China continues to grow economically and militarily. If China uses its power in ways that Japan views as inimical to its interests, pressures will increase for Japan to reevaluate its nuclear option not only for security, but perhaps also for status.

Japanese requirements

Japan is currently confident in the U.S. nuclear umbrella, but it has some issues of concern. These fit roughly into three categories.

First, Japan wants assurance that the U.S. nuclear deterrent is credible. It is crucial to Japan that China never have the incentive to seek parity with the U.S. While Japan is not interested in discussing specific weapons systems, it wants the U.S. to craft the deterrent so as to provide an umbrella that will be effective into the future.

Second, while Japan supports disarmament, it is concerned that the U.S. might negotiate or make unilateral nuclear reductions without sufficient regard to Japan's needs and interests. Additionally, Japan advocates disarmament, but caveats that it must be both verifiable and compatible with security interests.

Third, Japan feels that there has been insufficient dialog with the U.S. Specifically, it would like to have a dialog to understand U.S. thinking and plans, and an input to U.S. decision-making on the strategic alliance. Multilaterally, it would like to establish interactions and discussions between itself, the U.S., and China on security affairs.

Extended Deterrence: South Korea

Background

The Mutual Defense Treaty between the Republic of Korea (ROK) and the United States says that an armed attack on either party obligates the other to meet the common danger in accordance with its constitutional processes. This language has been clarified, with specific regard to the role of U.S. nuclear deterrence, in a number of high-level meetings and communiqués since 1978.

In October 2006, also just after the nuclear test by North Korea, then-Secretary of Defense Rumsfeld met with Defense Minister Yoon to clarify defense commitments under the Mutual Defense Treaty. The communiqué stated, "The United States reaffirms its firm commitment to the Republic of Korea, including continuation of the extended deterrence offered by the U.S. nuclear umbrella ..." In October 2008, Secretary of Defense Gates met with ROK Defense Minister Lee to again clarify U.S. defense commitments. The communiqué stated: "Secretary Gates assured Minister Lee of firm U.S. commitment and immediate support toward the ROK, including continuation of the extended deterrence offered by the U.S. nuclear umbrella, consistent with the ROK-U.S. Mutual Defense Treaty."

South Korean security concerns

South Korea's security concerns are also North Korea and China, but their perspective is different from Japan's. Most South Koreans do not perceive North Korean nuclear weapons as a threat, accepting many U.S. claims that the 2006 nuclear test was largely a failure and that North Korea lacks the technology to mount a nuclear warhead on a ballistic missile. These views allow South Korea to avoid the cost of having to respond to the North Korean nuclear weapon threat. Of greater concern to most South Koreans is the potential for the North's collapse, not only because of the economic and security burdens it would impose on the South, but also because China might intervene.

South Korea also views China's military buildup with some apprehension. However, ROK officials believe that the U.S. nuclear deterrent is much more capable than China's and that the U.S. is committed to continual upkeep of its nuclear capabilities so that China will never catch up. Similarly, most officials believe that the U.S. is prepared for electronic warfare or anti-satellite weapons use by China. South Korea would like to have a stronger expression of the U.S. extended deterrent, perhaps including more military exercises.[2]

The South Korea Government views the U.S. nuclear deterrent as vital to preventing Japan from going nuclear. It believes any steps to reassure Japan of the umbrella should be taken but with consideration as to the impact of those steps on China. Any further reductions in the U.S. stockpile, in the view of South Korea, should be taken only if the nuclear deterrent the U.S. extends to its allies can be fully maintained.

Although more than 70% of South Koreans[3] believe that the U.S. is the most beneficial security partner for the foreseeable future, there is a growing sense of insecurity vis-à-vis the U.S.; many South Koreans, particularly in the military and diplomatic spheres, fear that the U.S. commitment is waning. Concerns have intensified because of the planned 2012 dissolution of the U.S./ROK Combined Forces Command and South Korea's assumption of command of their forces and operations.

South Korean requirements

South Korea has not yet expressed interest, as Japan has, in having more detailed dialog with the U.S. on the extended deterrent. However, South Korea is very interested in more explicit statements that the U.S. will defend South Korea against any attack, including attacks with all forms of WMD. Specifically, South Korea advocates military exercises in addition to high-level reaffirmation of the nuclear umbrella.

South Korea perceives that one of the most dangerous threats to the effectiveness of the U.S. nuclear deterrent are China's anti-satellite capabilities. South Korea attaches great importance to the U.S. being able to withstand such attacks and to being able to neutralize others' electronic communications.

Nuclear arms control is also important to South Korea, but it believes that any further U.S. reductions must be made only if the U.S. is able to maintain its complete and effective extended deterrent to its allies.

Defense of Taiwan

The Taiwan Relations Act states that it is the policy of the United States "… 4) to consider any effort to determine the future of Taiwan by other than peaceful means … a threat to the peace and security of the Western Pacific area and of grave concern to the United States; … 6) to maintain the capacity of the United States to resist any resort to force or other forms of coercion that would jeopardize the security, or the social or economic system, of the people on Taiwan."

No specific reference is made to the U.S. nuclear deterrent as a means of defending Taiwan. However, the wording of the Act is ambiguous. It is clear, however, that without a credible nuclear posture, the U.S. ability to fulfill its obligations to Taiwan would be inadequate. The U.S. security assurances to Taiwan have been and will continue to be pivotal to restraining its nuclear proliferation.

Requirements for the U.S. Strategic Nuclear Posture

A key requirement for the U.S. strategic nuclear posture is that it must continue to provide convincing assurance to Japan and South Korea. This is essential to insure their security as our friends and allies and to prevent their proliferation.

Although the U.S. has extended the nuclear umbrella over Japan and South Korea, and has pledged to defend Taiwan, the current U.S. nuclear force posture in East Asia may not be properly tailored to provide effective deterrence and assurance of the defense of these countries. One reason is that the type of planning employed in the NATO context, for example, has not been applied in East Asia.

Another reason that the current strategic posture may not be sufficient or capable to meet the needs of the future is force composition, as well as deployment and delivery options. When the current strategic posture was developed, there was little credibility lent to the idea that nuclear weapons would ever be used in a *limited way*—limited both in terms of numbers of weapons (perhaps only one or two) and yield (subkiloton). That has changed; both Russia and China emphasize "useable" nuclear weapons with, for example, low yield and/or enhanced radiation, and with more accurate delivery systems. The present U.S. nuclear force was tailored to bust hardened Soviet silos and our nuclear delivery systems are inaccurate compared to today's precision conventional systems.

Before we decide on what our strategic nuclear posture should be, we must decide what it should do. We must understand the perspectives and concerns of key allies in the region, as well as the threats we must deter. To do this, we must be clear in our objectives and plan against specific goals and challenges.

The nuclear capabilities required for an effective U.S. strategic posture in the East Asia region for the near- and mid-term should be determined based on our key objectives as well as the challenges likely to be faced. Our key objectives are:

- Maintain peace and security for our friends and allies in Northeast Asia
- Assure that Japan and South Korea don't proliferate
- Eliminate North Korean nuclear weapons and nuclear weapons capability
- Assure continued preeminence over China
- Protect Taiwan from coercion through use of force

In terms of future challenges, although there may be unforeseen developments, the present indicates that the strategic nuclear posture should be structured so that it can respond to at least four scenarios:

- Increasing Chinese military expansion and modernization,
- Possible expansion of North Korean WMD beyond "a few,"
- North Korean or Chinese use of WMD to politically coerce Japan or South Korea,
- North Korean reunification before the nuclear weapons roll back.

Conclusions

1. As part of the next NPR, the concerns and requirements of Japan and South Korea must be considered. A formal consultation process prior to completion would be helpful. In the absence of formal consulta-

tions, the U.S. should not make any significant further reductions in its nuclear force posture.
2. The U.S. has not used a clearly defined set of crisis scenarios to plan for evolution of the strategic nuclear posture in Northeast Asia. The U.S. nuclear umbrella's composition and deployment options should be determined based on such scenarios.
3. Japan particularly, and South Korea to some degree, have a keen interest in understanding U.S. plans for responding to China's strategic modernization. Government-to-government dialogs on this issue would be constructive. Consideration should be given to a structured security forum.
4. Japan, South Korea, and the U.S. need to develop a common set of principles, in advance of the next NPT review conference, to explain why maintaining a viable nuclear deterrent contributes to nuclear nonproliferation in Northeast Asia.
5. Discussions with China about controlling "loose nukes" in the DPRK in event of collapse might be useful.

Appendix A: North Korea's WMD Threat

North Korea currently poses significant threat to U.S. interests and allies due to its bellicose nature, burgeoning military capabilities, and propensity to share technology and weaponry with other states and, potentially, terrorists. It violated and then pulled out of the Nuclear Nonproliferation Treaty. For the last decade, the United States and the international community have negotiated with North Korea and reached multiple agreements, yet Pyongyang has repeatedly reneged on its commitments to roll back its nuclear program.

North Korea tested a nuclear device in October 2006. It has continued to amass fissile materials for weapons, despite international pressures and agreements to stop.

North Korea has Scud B and C short-range missiles as well as the Nodong 1, which can reach 1300 km. It has also tested the Taepodong missile, with a range of 2000 km, and the Taepodong 2, with a range of 5000-6000 km.

In addition to its nuclear capabilities, North Korea has had for many years an extensive stockpile of chemical weapons and trains regularly for operating in a chemical environment. It has also reportedly produced biological weapons, including smallpox.

Appendix B: China's Nuclear Weapons Modernization

China is introducing at least three new modern, mobil ICBMs, each fitted with new nuclear warheads. The 8000 km rang DF-31 is deployed, the 14,000 km range DF-31A is in the process of being deployed, and the 10000 km range SLBM based on the DF-31, called the JL-2, will be deployed within a couple of years. China may also place multiple warheads on its old CSS-4 ICBMs, the only missile prior to the moderinization that could strike U.S. mainland.

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1. In a poll conducted in May 2008 in Japan, 95% of respondents lack confidence that North Korea will give up developing nuclear weapons, no matter what it agrees to in the Six-Party Talks.
2. In this regard, U.S. officials should be mindful that the events of the late 1960s though the 1970s, during which U.S. statements for rapprochement with China and a decreased military presence in Korea resulted in Seoul's decision to initiate its own nuclear weapons program.
3. Poll taken April/May 2008.
4. For example, if Russia were to withdraw from the INF Treaty and deploy intermediate-range missiles in the east, it would seriously affect the security concerns of nations in Northeast Asia.

4

Reemphasizing the Continuing Importance of the Nuclear Force

Elbridge Colby

Summary: Necessary maintenance and modernization of the U.S. nuclear arsenal requires abiding political support undergirded by a belief in the arsenal's necessity and legitimacy. These foundations have eroded over the past two decades, in part as an unintended consequence of welcome developments in the political and arms control fields. Yet the arsenal will require sustained attention and support in the coming decades if it is to continue to serve its vital role. The Commission might therefore consider delivering a firm restatement of the continuing value of a modern and sufficient nuclear arsenal for the foreseeable future. Such a restatement, coming from such a highly-regarded yet politically diverse group, would contribute significantly to shoring up the legitimacy of the U.S. nuclear force.

Text: Despite differences among leaders in the nuclear field about the viability and advisability of the long term goal of a world without nuclear weapons, most agree that the U.S. arsenal continues and will for the foreseeable future continue to provide an indispensable element for our security and for that of our allies. And while there is disagreement about the posture and composition of the force, there is broad agreement that it must be structured to be "second to none" in its effectiveness, reliability, and survivability.

In order to field such a force over the coming decades, the United States will need to modernize key elements of the arsenal, including its warheads, delivery systems, and infrastructure. This significant and long-term program will require sustained political, financial, intellectual, and diplomatic support.

Unfortunately, this is currently lacking. A nuclear peace dividend in the wake of the end of the Cold War, the vastly decreased visibility of nuclear weapons in American security, and traditional discomfort with and outright opposition to nuclear weapons as such have combined to erode support for maintaining and upgrading the arsenal. Nuclear weapons have come to be "taken for granted," their valid perils emphasized while their deterring and stabilizing qualities lost sight of, especially to a generation not familiar with the intense and intricate nuclear issues of the Cold War. Most Americans, especially those too young to remember the Fulda Gap, do not realize the central role nuclear weapons played in allowing the United States and its allies to deter aggression at reasonable cost despite significant Warsaw Pact advantages in the conventional military balance. Reared on the RMA-driven wars of the 1990s and 2000s, many Americans see overwhelming conventional military dominance to be the natural state of things. The probability that we and our allies will face formidable challengers—either through symmetric or asymmetric means—that might require our again relying more on nuclear weapons appears a remote prospect. Yet even conservative forecasts of the coming century suggest that we would be extremely ill-advised to assume our current military dominance will persist unchallenged. A strong nuclear posture will provide an unshakable backstop—and perhaps more—against the challenges, both known and unknown, we will face.

Yet U.S. nuclear forces and infrastructure require urgent attention if we are to be able to field a nuclear deterrent prepared for such eventualities over the coming decades. Even medium-term preservation of the arsenal at its current level of reliability will require significant investment. For instance, whether or not one thinks the Reliable Replacement Warhead is the best answer to warhead aging issues, some coherent and sustained approach is needed. But such an approach will not be possible without an understanding by the American people and their representatives of the importance of our nuclear deterrent for the foreseeable future.

The Commission is uniquely suited to addressing this need. Composed of highly-regarded and experienced figures from across the political spectrum, the Commission has the political and intellectual legitimacy to provide a measured but strong restatement of the enduring centrality of a modern, reliable, and survivable nuclear force for our own security, for that of our allies, and, indeed, for the world as a whole (due principally to the U.S. nuclear force's stabilizing effects and its dampening of proliferation among allies and other "free-riding" beneficiaries).

A reaffirmation of the importance of the U.S. nuclear force would not only encourage congressional and public support for the proper maintenance and updating of warheads, delivery systems, and infrastructure. It would also play an important conceptual role in other respects, chiefly by rebalancing discussions of nuclear weapons to encompass their oft-neglected benefits. For instance, a firm statement of the importance of modern U.S. nuclear weapons to our alliance commitments could help recalibrate proliferation debates to emphasize accurately the role of the U.S. arsenal in dampening, rather than merely exacerbating, proliferation. More broadly, it could help underline the indispensable role of nuclear weapons in preventing major interstate wars among nuclear or nuclear-related powers, a remarkable phenomenon of the post-1945 Nuclear Era. Such a restatement would help to keep debate honest and accurate as we and our allies debate future military requirements, alliance commitments, burden-sharing, and related issues.

Nor need this restatement be unduly titled towards praising nuclear arms. It might, for example, be linked to calls for continued efforts in the arms control arena and for earnest efforts to handle problems of safety and security, especially among new nuclear powers. And it would not need to address the issue of whether abolition is at some point possible or desirable, but could focus on the role of nuclear arms in the long-term but foreseeable future.

Broadly, the United States in the last two decades has postponed coming to terms with the long-term role of nuclear weapons in its security and in its commitments abroad. The Commission would provide a great service by establishing an orienting point from which discussion of these issues could reasonably and honestly proceed.

5

Little Prospect for a New National Consensus on the Utility of U.S. Nuclear Weapons

Clark Murdock

Summary

This paper describes the different strains of thought concerning the role of U.S. weapons in U.S. security policy, and points out that the fundamental differences make it difficult for the Commission to take advantage of a policy consensus to make specific posture recommendations.

Many, including the U.S. Congress and the Defense Science Board, have called for a national debate on the role of nuclear weapons in U.S. national security and the forging of a new national consensus that would provide a compelling rationale for U.S. nuclear strategy and policy. While the Presidential candidates have devoted relatively little attention to this issue, what they have said is notable for how much they seem to agree with each other:

- Senator Barack Obama (7/16/2008): "It's time to send a clear message to the world: America seeks a world with no nuclear weapons. As long as nuclear weapons exist, we'll retain a strong deterrent. But we'll make the goal of eliminating all nuclear weapons a central element in our nuclear policy. We'll negotiate with Russia to achieve deep reductions in both our nuclear arsenals and we'll work with other nuclear powers to reduce global stockpiles dramatically. We'll seek a verifiable global ban on the production of fissile material for weapons. And we'll work with the Senate to ratify the Comprehensive Test Ban Treaty and then seek its earliest possible entry into force."

- Senator John McCain (5/27/2008): "A quarter of a century ago, President Ronald Reagan declared, 'our dream is to see the day when nuclear weapons will be banished from the face of the Earth.' That is my dream, too. It is a distant and difficult goal. And we must proceed toward it prudently and pragmatically, and with a focused concern for our security and the security of allies who depend on us. But the Cold War ended almost twenty years ago, and the time has come to take further measures to reduce dramatically the number of nuclear weapons in the world's arsenals."

Both candidates endorse the vision of a nuclear-free world and support deep reductions in global nuclear stockpiles, but believe that the U.S. needs a strong nuclear deterrent as long as other nuclear powers exist. Agreement at this broad policy level, however, does not translate easily into specific policy decisions on how aggressively to pursue arms control (e.g., Senator Obama endorses CTBT ratification while Senator McCain says he'll look at the issue again) or U.S. nuclear modernization (e.g., Senator Obama says he'll support no new U.S. weapons and Senator McCain opposes RNEP but will support modernization as necessary). Why is this the case?

On the fundamental issue of how important U.S. nuclear weapons are to U.S. security, there is no broad-based consensus. Instead, those within the policy community that follow these issues closely seem to fall into one of four "camps" on the saliency of U.S. nuclear weapons, which tend to lead adherents in each camp to take differing positions on key nuclear issues.

- High Salience—Adherents of this camp believe that nuclear weapons retain a Cold War-like importance, and that deterrence functions much as it did during that era. For these strict constructionists, new nuclear capabilities (e.g., low yield weapons, earth penetrators, etc) are needed to deter new 21st century adversaries. In addition, this camp's adherents are dismissive of those concerned that U.S. nuclear modernization undercuts U.S. efforts to prevent further nuclear proliferation.
- Moderate Salience—This camp believes that U.S. nuclear weapons still play a significant niche role, and that an effective nuclear deterrent requires a safe, secure and reliable stockpile (but not new capabilities). This camp recognizes that U.S. nuclear modernization may affect U.S. standing in international forums, but are willing to pay that price if necessary for a healthy stockpile and infrastructure.
- Low Salience—This camp acknowledges that U.S. nuclear weapons make residual contributions to U.S. security (largely limited to deterring direct nuclear attacks against the U.S. and its allies) as long as there are other nuclear-armed states. Adherents of this camp would support limited refurbishment of the U.S. stockpile, but not extensive

modernization, because it might reduce domestic and international support for nuclear arms control and non-proliferation policies.

- Negative Salience—For this camp, the very existence of nuclear weapons constitutes a threat to humanity and the emphasis should be on the complete elimination of nuclear weapons, not on deterring the use of nuclear weapons or pragmatic steps to reduce the threat from them. These "nuclear abolitionists" are willing to support deep unilateral reductions in the U.S. nuclear arsenal and oppose any nuclear modernization as wrong-headed (because it legitimizes nuclear weapons) and wasteful (since their goal is to eliminate them).

Although the four-camp construct risks pigeon-holing policy advocates (e.g., if she supports X, she must be in the Moderate Salience camp), it does explain why a policy community deeply divided on how salient U.S. nuclear weapons are to U.S. security is unlikely to reach a new consensus on the role of U.S. nuclear weapons. This suggests that the next Administration should focus more on "deeds" and less on "words," because it is probably easier to build support for a series of concrete actions than for the all-encompassing vision that might animate those actions. Of course, a broad-based consensus behind a compelling rationale for the utility of U.S. nuclear weapons would be desirable, but the nuclear agenda, which includes both nuclear arms control and modernization, is too pressing to be held hostage by the inevitable debates in a deeply-divided policy community.

6

Sizing the U.S. Nuclear Force Relative to Others

Franklin C. Miller

The Bush Administration elected in 2001-2002 to abandon sizing the deployed U.S. strategic nuclear force using a target based metric and decided instead to employ a "capabilities based approach." (This distinction was made somewhat academic by the fact that the force levels under consideration permitted adequate coverage of all potential targets that had been identified by DoD.) A key element of this approach involved the ramifications of international perceptions of the size of U.S. warhead levels compared to those of other nuclear powers and of potential nuclear powers. It should go without saying that the minimal force levels of rogue states or of potential nuclear powers were so small as to not enter into any serious calculations. The Administration believed, however, that the United States could not possess a smaller deployed strategic force than any other nation, which meant in practice that parity (more or less) with Russia was required. With respect to China, the Administration believed that U.S. deployed warhead levels should be sufficiently high that China could not contemplate achieving parity in deployed strategic nuclear warheads with the United States without undertaking a major and visible build-up, the extent of which would permit the United States to decide whether it needed to increase its own forces in order to frustrate Chinese ambitions.

Some eight years later, the questions remain as to whether allied, Russian, and Chinese behavior will be affected if U.S. deployed strategic warhead levels were to drop significantly below those deployed by Moscow and Beijing. Arguably, three or four years ago, U.S. allies would not have felt that the U.S. nuclear umbrella had contracted or become less credible if an imbalance was allowed to develop between the U.S. and Russia. All of that predated the highly provocative Russian nuclear saber rattling that has occurred during the second Bush term: resuming penetrations of Western airspace by strategic bombers, and explicit threats to target or attack the Czech Republic, Poland, and Ukraine. These, plus the Russian attack on Georgia in August 2008, have created new fears in NATO, particularly and understandably among the Alliance's new members that U.S. nuclear weapons may well be necessary again to deter Russia. Consequently, any U.S. reductions, either unilateral or negotiated, which resulted in a significant imbalance in U.S. and Russian deployed strategic nuclear warheads, are likely to further unsettle the NATO allies. This would be true even if the U.S. were to state that its deployed nuclear forces were more than capable of covering all of the Russian targets of high value to Moscow.

No U.S. ally is more sensitive to the U.S.-Chinese nuclear relationship than Japan. Even today, when the U.S. maintains a significant numerical superiority over all Chinese deployed nuclear weapons, let alone a massive superiority over Chinese strategic weapons, some highly influential Japanese official evince uneasiness about whether the U.S. would be able to deter effectively (and respond if necessary) to Chinese nuclear blackmail against or strikes on Japan. By extension, any dramatic change in the U.S.-Chinese nuclear "balance" could produce significant reverberations in the relationship between Washington and Tokyo, and indeed in Tokyo's thinking about an independent deterrent.

While the attitude of U.S. allies is fairly easy to predict, it is difficult in the extreme to discern whether Moscow or Beijing would become more emboldened in challenging the U.S. or our allies militarily if the existing nuclear relationships were to be altered in any major way. There appears to be no basis in intelligence to support the view that the current Russian or Chinese leaderships embrace the nuclear warfighting/nuclear superiority policies formerly held by the Soviet leadership in the 1970s and 1980s. Indeed the most worrisome activities by both governments are to be found in the areas of cyber operations, special nuclear effects such as EMP, and, in the case of Russia, using oil and gas as a weapon of coercion. It is likely that we will be unable to answer this question in the near future.

7

The U.S. Strategic Posture and China

Bradley H. Roberts

Key Issue

How should the U.S. posture its strategic forces vis-à-vis China?

Background

Since the end of the Cold War (if not longer), China has been essentially a footnote in U.S. strategic thinking. In the Nuclear Posture Reviews of 1994 and 2001, the focus was on how to create the posture needed to deny rogue states effective deterrence of the U.S. without destabilizing the political relationship with Russia. The U.S. has avoided choosing what offense/defense posture best serves its interests vis-à-vis China and instead has hedged against future competition. The hedging strategy consists so far of not publicly accepting or rejecting a specific strategic posture vis-à-vis China while tolerating some strategic vulnerability to a Chinese first strike.

- The 2001 NPR reflected also the view that dissuasion of a "sprint to parity" by China requires that the U.S. maintain a significant numerical advantage in operationally deployed nuclear weapons.

This "benign neglect" will prove ever less viable as a posture as China modernizes and diversifies its strategic strike posture. China's leaders assert that this modernization effort aims at ensuring the viability of China's deterrent in the face of developments in the U.S. strategic posture. Improving U.S. missile defenses impose a burden on China's forces to be able to penetrate. Improving U.S. non-nuclear strike and ISR impose a burden on China's forces to be able to survive a U.S. first strike, either nuclear or non-nuclear. In some respects, proposed improvements to U.S. nuclear forces are the least troubling aspects of the U.S. strategic posture from a Chinese perspective, as they do not add significantly to existing U.S. advantages (although China's nuclear experts see as worrisome U.S. efforts to improve low-yield and high-precision weapons, on the argument that this lowers the nuclear threshold). The deployment of missile defense penetration aids, multiple warheads atop existing delivery systems, new land-based mobile systems, and a revitalized sea-based leg will require that the U.S. address in a focused way the question of what it wants in the U.S.-China strategic military relationship.

The validity of China's assertions is a matter of intense debate. Is China merely seeking to maintain the status quo ante or is its modernization program aimed at gaining new advantages? China's lack of transparency inflames this problem. This debate is not so far informed by any criteria by which the U.S. would distinguish one from the other.

This key policy issue cannot be treated in isolation from other important U.S. interests.

- U.S.-Russia: Russia is eager to avoid new forms of nuclear competition with China and anticipates that more intense U.S.-China strategic military competition would create new requirements for Russian capabilities (especially INF to counter-balance Chinese theater systems). Some Russian hardliners believe that the U.S. is whipping up a China threat in order to create the strategic posture vis-à-vis Russia that the U.S. "really seeks."
- U.S.-Japan: Japan exhibits increasing concern about developments in China's strategic military posture and about the potential decoupling of the U.S. from Japan in a future confrontation over Taiwan. But it is eager also to avoid being drawn into an arms race.

Key issues

1. How should the U.S. respond to China's efforts to sustain a viable deterrent?
   a. Should it simply acquiesce to these developments and offer assurances that it is not the U.S. intention to deny China a viable deterrent?
   b. Or should it compete with those developments to prevent China from (re)gaining confidence in its deterrent?
2. How should the U.S. posture missile defense toward China?
   a. On the one hand, various Bush administration officials have offered assurances that "missile defense is not pointed at China."
   b. On the other hand, MDA has confirmed that it is developing capabilities against China because "of course it is the prudent thing to

do." The actual possibility of fielding a defense effective against a PRC 1st strike is hotly contested; the possibility of fielding a defense effective against a PRC 2nd strike is not contested.

3. How should the U.S. posture improving ISR capabilities?
   a. Close in and continuous
   b. Remote but rapidly deployable
4. How should the U.S. nuclear force be shaped by the desire to deter, potentially defeat, but also dissuade and even assure China?
   a. Is a "sprint to parity" plausible?
   b. Are new strike capabilities necessary because of China-specific requirements?
5. How should Washington engage with Tokyo and Moscow (and Delhi) as it pursues its strategic relationship with Beijing?
6. How should China be discussed in any report?
   a. China's officials keenly objected to be characterized as a nuclear threat and an object of U.S. nuclear war planning in the 2001 NPR. They also argued that the NPR messages seemed grossly at odds with the assurances coming from elsewhere in the administration.

8

Relationship of Offensive and Defensive Forces

Barry Blechman

An essential question in determining the U.S. nuclear posture is the relative priority to accord to offensive and defensive forces in seeking to deter nuclear attacks on this nation, its forces overseas, and its allies.

During the Cold War, of course, except for brief flirtations with defenses, the U.S. relied strictly on offensive capabilities, believing that if it maintained the capability to ride out any attack and inflict unacceptable levels of damage on the attacker in retaliation, the adversary would be deterred. As a result, except for bomber defenses in the 1950s and relatively small expenditures for civil defenses and missile defense R&D, the U.S. allocated the vast preponderance of the resources it devoted to strategic forces to offensive capabilities. Indeed, the U.S. ensured that the Soviet Union pursued a similar posture by negotiating the ABM Treaty in 1972 that prohibited all but two sites of 100 interceptors to each for "national missile defenses," and placed additional limits on ABM radars and R&D.

Given that deterrence is inherently uncertain, depending on the credibility of the threat of mutual suicide and many other psychological and situational factors, including effective communications with the adversary, this offensive posture is not necessarily preferred. If it were possible to have a perfect defense, it would clearly be better than relying on offensive capabilities for deterrence. Dependence on offensive forces during the Cold War was necessitated by two factors: (i) during this period, effective missile defenses seemed technologically impossible, and (ii) the large size of the Soviet Union's offensive forces magnified the problem enormously.

In the 21st century, with the emergence of new but smaller nuclear threats to the United States, as well as advances in the technologies of defenses, the Bush Administration determined that the U.S. should change its mix of offensive and defensive forces. While conceding that the U.S. strategic relationship with Russia would have to remain dependent on offensive, deterrent capabilities, the Administration exercised the U.S. right to withdraw from the ABM Treaty and began to develop and deploy defenses to protect the nation against smaller threats. The land-based system now deployed in Alaska and California, combined with space-based and sea-based components, is intended to defend against any North Korean missile threat, while the third site now planned for Eastern Europe is intended to protect the U.S. and its allies against any Iranian missile threat. This change in policy and posture has markedly altered the allocation of resources between offenses and defenses within the DoD strategic budget.

If one accepts that the U.S. should continue to depend on defenses for smaller threats, but on offenses to deter the larger Russian threat, a key question for the Commission is how to configure the U.S. strategic posture with respect to the potential threat from China—a threat which is now small but expected to grow markedly in the future. The Chinese already believe that when U.S. leaders say Pyongyang is the target of the missile defense system they really mean Beijing, but the currently planned system would likely be ineffective against the long-range missile forces China will deploy over the next ten years. Some argue, however, that U.S. capabilities could be beefed up and, combined with preemptive attacks with conventional weapons against China's strategic forces, provide an effective defense of the United States against prospective Chinese capabilities. The pros and cons of the argument are provided below.

Depend on Offenses Only to Deter China

On the positive side, like the Soviet Union, China has a hierarchical leadership that recognizes the realities of military power and typically acts rationally in the country's self-interest. Recognizing that any nuclear attack on the United States would result in vast damage to China in retaliation, Chinese leaders, like Soviet leaders during the Cold War, will likely not only be deterred from attacking but will act to avoid the emergence of crises or conflicts in which the risk of deterrence failing would rise. Moreover, as China continues to develop economically and technologically, it will be able to improve its offensive forces quantitatively and qualitatively to the point where they could overwhelm any plausible expansion of U.S. defensive capabilities.

On the negative side, the Taiwan issue has the potential to precipitate a crisis in U.S.-China relations at any time through no fault of leaders in either Washington or Beijing. In such a situation, if China has the capability to strike the U.S. with nuclear-armed missiles, they may believe that by threatening such an attack, they could deter the U.S. from intervening to protect Taiwan from a Chinese attack and occupation. Such statements were made by at least one Chinese military leader during the 1996 Taiwan crisis. If that belief proves correct, Taiwan would be lost and U.S. security guarantees and alliances around the world would be jeopardized. If it proves incorrect, the two sides might end up exchanging nuclear strikes with devastating consequences for both. Moreover, Japan's restraint in developing nuclear arms depends on the credibility of U.S. security guarantees. Japanese leaders are likely to find such guarantees more credible if the U.S. is able to defend itself from a Chinese attack and not depend solely on deterrence.

Depend on Defenses to Deter China

On the positive side, deterrence through "denial"—a combination of preemptive conventional capabilities and effective defenses—may be more stable than deterrence through offensive capabilities alone, because of the many psychological and situational factors that affect the latter. Moreover, although China is modernizing its long-range nuclear forces, it is starting from such a small base that it may be feasible in both technological and financial terms for the U.S. to maintain an effective capability to defend against any conceivable improvements for many years. Indeed, knowledge of the U.S. ability to maintain its defensive edge might "dissuade" China from attempting to compete and cause it to curtail its nuclear modernization rather than waste resources.

On the negative side, if China did choose to compete, it seems inevitable that eventually its offensive capabilities would overwhelm any conceivable improvements in U.S. defenses, or at least change the cost calculation so that it would be more expensive for the U.S. to maintain a defensive edge than it would be for China to overwhelm it. Another possibility would be that China would find other ways to hold valued U.S. assets at risk, such as cyber or space attacks, diverting the competition to pathways in which the U.S. might have problems competing effectively. More importantly, the offense/defense arms competition envisioned by this posture would likely complicate political relations between the two countries. The overall U.S. goal of building stable, cooperative, and mutually beneficial relations with a China rapidly emerging as a global economic power might be better served by a posture in which both sides retained survivable retaliatory capabilities, rather than engaging in an offense/defense arms race.

9

Nuclear Deterrence and War Plans

Dennis C. Blair

Background

The United States maintains war plans for potential conflict with several nuclear nations. There is the danger of escalation to the use of nuclear weapons. These nations currently include North Korea and China, and could in the near future include Iran. This paper examines the requirements for nuclear weapons to maintain deterrence during a war with a nuclear adversary.

Should any of these wars occur, the objective of the United States would be to win with conventional forces and deter the adversary from using its nuclear weapons. Although regional commands and Strategic Command have done basic planning for the use of nuclear weapons in regional conflicts, the circumstances of a nuclear confrontation during a regional conflict would be unique. The decision to use nuclear weapons—how many and against what targets—would be made by the President. The factors the President would consider would be:

- The type and effect of the adversary's strike—against U.S. forces? Against an ally? Against U.S. territory and Americans?
- Likely and possible escalatory responses by the adversary
- Effect of the use of weapons on the course of the war-enabling U.S. victory in the field or stopping the war
- The effect on allied and adversaries and the global precedent of using nuclear weapons

Conventional war context

For the immediate future, the United States has the capacity to achieve its war aims in conflict with North Korea, China and Iran without the use of nuclear weapons. The situation is entirely changed from the Cold War when the United States and its allies were generally inferior at the level of conventional conflict. The most likely circumstances of nuclear exchanges in these wars arise from American military superiority at the conventional level of war. With the United States on the way to victory, the governments of North Korea, China or Iran might threaten or actually use nuclear weapons to attempt to stop the war short of complete defeat.

Should one of these three countries threaten to use nuclear weapons unless the United States halted its forces moving deep into adversary territory (North Korea and Iran), or withdraw its support for Taiwan (China), then the U.S. president would have to decide whether to continue non-nuclear combat operations or to negotiate with the adversary.

His decision under these circumstances would be strongly affected by the capability and the likelihood of the adversary to carry out the threat.

Capability

In the cases of North Korea and Iran, U.S. missile defenses will have the capability to intercept a portion of ICBMs launched at the United States, although effectiveness will not be perfect; each of these adversaries could deliver weapons against the U.S. in unconventional ways—by clandestine ship, for example. A U.S. president could have confidence that neither of these countries could devastate the United States, but would have to consider the likelihood of either country being able to detonate several weapons on U.S. allies, deployed forces or even homeland. In the case of China, U.S. missile defenses could intercept only a small portion of an ICBM strike, so China will have the capability to deliver dozens of large nuclear warheads on the United States.

Likelihood

Predicting the mindset of adversary leadership is difficult and conclusions have to be treated with care. However some logical inferences can be made. The likelihood of a country actually carrying out a threat to conduct a nuclear attack on the United States if it is losing at the conventional level of warfare depends on its estimate of the American reaction to its threat.

North Korean and Iranian leaders believe that the United States opposes the very existence of their regimes, and they believe an American president would like to end them by using nuclear weapons, if he had the chance to do so. On the other hand, most authoritarian leaders believe that they are tougher than the United States, more able to endure losses and still survive. They understand that the American nuclear weapons capability is vastly superior to their small stockpiles, only a few of which might be successfully delivered. It is possible that they, like Castro during the Cuban missile crisis of 1962, are so ideologically convinced of the justice of their cause and the inevitability of deadly conflict with the United States that they are ready to accept the devastation of an American nuclear strike if they can cause damage with their own weapons. In this case, the American president has only the choices of negotiating, hoping that more rational, less ideological subordinate North Korean or Iranian commanders will not carry out suicidal orders, or riding out whatever strike North Korea or Iran can make that defenses do not intercept and retaliating in a way that reinforces victory at the conventional level. If these leaders are most strongly motivated by regime and personal survival, however, their only hope is to make the American president believe they are more determined to use their weapons than he is to use his, and that they are more willing to risk nuclear devastation to their own countries than he is willing to risk a few weapons detonating on the United States. In this case it is likely that if the United States were to continue its conventional operations after a nuclear threat, then a North Korean or Iranian leader would either give in, choosing suicide or attempt escape to a friendly country, or else would launch a nuclear attack that would be calculated to show their own resolve while not being so damaging to the United States as to justify an overwhelming retaliatory strike. If such a limited strike were launched, then the American president would be faced with the same set of considerations, but now the nuclear threshold would have been crossed.

In the case of China, most Chinese leaders believe that their national interests at stake in a confrontation over Taiwan are more vital than are American national interests. If they threaten to use nuclear weapons against the United States to prevent Chinese defeat, they believe that the United States ought to negotiate an end to the conflict. It is most probable that the United States would enter negotiations in some form with China under these circumstances. If the negotiations were not offering China terms that were acceptable, and if internal Chinese leadership dynamics impelled a hard line, and Chinese leaders actually decided to launch nuclear weapons, it is most likely that they would target American forces at sea or overseas bases such as Guam. The Chinese objective would be to end the conflict. They would have to believe that the American president would most likely retaliate with a commensurate nuclear attack in order not to be disadvantaged in negotiations or in his political standing at home. Although Mao believed that China could survive a nuclear war with either the Soviet Union or the United States, current and future Chinese leadership knows that their leadership would not survive a large-scale nuclear attack by the United States. They would be counting on an acceptable negotiated settlement following an exchange of limited nuclear strikes.

American considerations: Allies, adversaries and precedents

In addition to the considerations specific to the conflict and confrontation in which the United States was involved, there would be an additional set of considerations that would be important to an American president. These include the effect on allies of either using or refraining from use of nuclear weapons, the effect on other potential adversaries, and the concerns about history's judgment.

"History's judgment" seems theoretical, but the accounts of the Cuban missile crisis are clear that neither President Kennedy nor Premier Khruschev wanted to be remembered as the world leader who had started a nuclear exchange that devastated his country and another. It is likely that the pressure not to use nuclear weapons would be very strong in the early stages of a nuclear confrontation, before weapons had been used, but when their use had been threatened. An American president would be seeking every possible way to avoid pushing the confrontation to a nuclear exchange. He would be restrained, however, by the consequences of stopping short of achieving war objectives in a conventional conflict that had cost many American lives.

Once an adversary had used a nuclear weapon against American forces, allies or U.S. territory, however, the pressures on a President would shift dramatically. Depending on the severity of losses, there would be strong domestic pressure to avenge American losses, and not to allow an adversary to achieve its objectives against the United States by the use of a nuclear weapon and the danger of escalation. Such an action, it would be argued, would encourage every other regime that feared the United States to develop nuclear weapons.

Reassurance of allies would also be an important factor in a president's decisions in responding to a nuclear threat and to nuclear use. In case of a nuclear threat without use, allies would most probably be urging restraint on a U.S. president, even to the point of a negotiated settlement that did not favor the United States, but ended the fighting. Once a nuclear weapon had been used, however, especially if it had been used against an ally or friend (for example, Iranian use against the American air facilities in Qatar, or North Korean use against the U.S. air base at Osan, or Chinese use against the U.S. air base at Kadena) then there would be heavy pressure on a U.S. president to retaliate to demonstrate that the United States nuclear assurances to allies were credible.

Nuclear force posture to deter North Korea and Iran

Almost any American nuclear force posture will have enough capability for the United States to pose a threat of regime-ending damage to North Korea or Iran. In the case of a war with either country, the United States nuclear position would be improved significantly with a higher confidence missile defense system, and with a high-confidence ability to defeat clandestine attempts to smuggle nuclear weapons into the United States by unconventional means such as shipping. Without such improvements, American success in a nuclear confrontation arising from a war with either country will depend on whether the adversary regime believes that the U.S. President will continue to pursue a victory with conventional forces even though he risks a small nuclear attack on the United States, followed by a devastating American nuclear attack on the adversary homeland.

In retaliating against a limited North Korean, Iranian or Chinese nuclear attack, an American president would be looking for nuclear options that would destroy substantial portions of the adversary's military capability, both nuclear and conventional, in a way that would minimize collateral damage. Current strategic nuclear weapons—SLBMs, ICBMs and ALCMs—have the precision and can be adapted to provide the lower yields to strike these targets. However, specialized new weapons such as the RNEP are more suited to these missions, and would allow the construction of more tailored strike packages, especially against command centers and storage areas that adversaries are digging deep underground to hide and protect.

Nuclear force posture to deter China

Since an effective missile defense against China's modernizing ICBM force is unlikely in the future, a nuclear confrontation with China will be decided by escalation considerations. There will be actual or virtual negotiations without the use of nuclear weapons, or else negotiation while escalating nuclear attacks are taking place.

There have been several careful government-sponsored studies of escalation sequences between the United States and China in the context of a Taiwan Strait conventional conflict. While the details are classified, the overall conclusion is that there is no escalation strategy for either country that gives a decisive advantage at any level of escalation. No nuclear attack sequence by one country places the other country in a position in which its only realistic choice is to concede defeat. The attacked country always has the potential to retaliate with a devastating attack. These results are reached with the expenditure of only a small portion of America's current inventory of strategic nuclear weapons. The conclusion is that both the United States and China have extremely strong incentives not to use nuclear weapons, and an initial nuclear exchange would most likely be followed by negotiations, as neither side has an incentive to escalate.

Conclusion

The only actions that the United States can take to improve its nuclear posture in the case of wars with nuclear adversaries are further improvements in its missile defense systems, and capabilities against unconventional delivery of nuclear weapons by North Korea and Iran. The development of earth-penetrating, low fallout weapons such as RNEP would provide improved options for retaliatory strikes against North Korea and Iran. However, overall, the current offensive nuclear capabilities of the United States, even if reduced substantially, will be as capable as today's posture for deterring nuclear escalation in case of a conventional war with North Korea, Iran or China.

Elimination of nuclear weapons?

It is instructive to think through these same situations if nuclear weapons were eliminated.

It would be to the advantage of the United States if nuclear weapons could be verifiably eliminated, that is, if China, North Korea and Iran did not have them, and neither did the United States. In this case, American non-nuclear military superiority would be decisive in achieving its war objectives.

However, if the United States eliminated its nuclear weapons, and China, North Korea or Iran maintained a secret supply of a dozen warheads, it would be disastrous for the United States. As the United States was prevailing with non-nuclear weapons, the adversary would demand an end to hostilities and reveal its nuclear weapons capability. At that point the United States' only logical decision would be to enter into peace negotiations. Although the United States would have the capability ultimately to invade and conquer North Korea or Iran despite the losses caused by nuclear attacks, the cost would be in the tens of thousands of troops and their equipment, and in the hundreds of thousands of U.S. citizens or the citizens of our allies. In the case of China, there would be no logical alternative except to negotiate with China, as the United States could not invade and conquer China, and China could use a small number of nuclear weapons to destroy American forward bases and make it impossible for the United States to support Taiwan.

10

Sustaining the Nuclear Force

Thomas Scheber

Summary

This paper summarizes the status of the current nuclear force and identifies when the different types of systems will require further modernization or replacement.

During the Cold War, the U.S. maintained a triad of strategic nuclear forces as well as a diverse collection of nonstrategic nuclear forces (NSNF). Thus far in the post–Cold War environment, the U.S. has modified its nuclear force exclusively by eliminating weapons deemed as excess. The U.S. has not developed any nuclear weapons specifically for the contemporary environment. For some weapons and delivery systems, sustainment and life extension programs have been initiated to sustain capabilities beyond the planned service life of each.

This paper summarizes a briefing on nuclear force sustainment by OSD Program Analysis and Evaluation (PA&E) and presented to a 27 August 2008 meeting of expert working groups of the Commission on the Strategic Force Posture. The paper lists the current status of, and sustainment issues for, existing U.S. nuclear forces (both strategic and nonstrategic) and supporting command and control.

Overall, nuclear forces appear to be supported adequately for the near-term. However, lack of a mid- to long-term investment strategy is evident.

Total DoD funding for the Strategic Nuclear Triad

- Currently the annual DoD budget allocates about $10B (in FY2007 dollars), for the strategic nuclear triad; this accounts for about 2% of the total DoD budget. For comparison, annual funding for strategic

forces during 1962–1993 averaged about $40B (in FY2007 dollars) and accounted for 10% of the DoD budget.
  - Since 1994, strategic force funding has been relatively flat.

Minuteman III ICBMs

- Currently 450 Minuteman III ICBMs are located at 3 bases.
  - The 2006 QDR reported the decision to reduce the ICBM force from 500 to 450.
- There are several programs in progress to replace and upgrade aging components (e.g., for guidance and propulsion).
- Planned end of service life: 2020.
  - Congress has directed, and Air Force officials reportedly have committed, to extend service life through 2030.
  - Extending the life of the ICBM force from 2020 to 2030 requires applying MMIII life extension upgrades (e.g., guidance and propulsion replacement programs) to 50 retired missiles and using these missiles for reliability test flights.
- However, no funding is identified in the DoD budget to extend the ICBM force through 2030.

Ohio Class SSBNs

- There are 14 SSBNs in the current inventory; typically 2 are in overhaul and 12 available for deployment.
- The service life of SSBNs was extended and is now listed as 42-44 years.
- The first SSBN replacement will be needed by 2027 to sustain a force of 12 deployable submarines.
  - A Navy analysis of alternatives for follow-on options is in progress.
  - PA&E estimates that Navy funding for a next generation SSBN needs to begin in FY2010 to meet a 2027 deployment date.
- U.S. SSBN development will be able to leverage a U.K. initiative to develop a next-generation SSBN force with an initial deployment needed about 2022.

Trident II (D5) SLBMs

- Each Ohio Class SSBN is capable of carrying 24 D5 missiles. The Navy is procuring enough D5 missiles to support 12 deployable SSBNs.
- Production of the Trident II (D5) missile is still active with a current production rate of 12 missiles per year.

- Additionally, a Trident II life extension program is being funded by the Navy and has, to date, been supported in Congress. The intent is to ensure reliable performance and a sufficient quantity of D5 missiles for the extended service life of the SSBN force.
- The U.K. expressed its intent to buy Trident II (D5) Life Extension missiles for its next-generation SSBN force. U.K. officials also stated that they will keep open the option of participating in the development and possible acquisition of a U.S. next-generation SLBM.

Bombers

- The current inventory of nuclear-capable bombers consists of 76 B-52s and 20 B-2s.
  - B-52s can carry ALCM-B (air-launched nuclear cruise missiles).
    - The Advanced Cruise Missile (ACM) can also be carried on the B-52; however, the ACM is being retired.
  - B-2s are capable of carrying B61 and B83 nuclear gravity bombs. One version of the B61, the mod 11, is an earth-penetrating weapon.
- Recent upgrades to the B-52 and B-2 bomber force have been driven primarily by conventional weapons delivery considerations.
- End of life of current bombers is estimated to be 2035 to 2045.
- The Air Force also maintains a force of 67 B-1s which formerly had a nuclear weapon delivery capability. Following the 2001 Nuclear Posture Review, DoD eliminated the contingency requirement for the Air Force to be able to return the B-1 to a nuclear role.
- The 2006 QDR stated the intent to procure a next generation bomber by 2018.
  - PA&E reports some funding in the DoD budget to begin developing a new bomber. No decision has been made on whether the new bomber will be nuclear capable. Funding for this program was deleted from the DoD budget for 2010.

Air-Launched Cruise Missile (ALCM-B)

- The ALCM-B entered the force in the early 1980s.
- Currently, the Air Force is completing an ALCM-B service life extension program to sustain this missile through 2030.
- No replacement is currently programmed.

NonStrategic Nuclear Forces (NSNF)

Dual-Capable Aircraft with B61 nuclear gravity bombs

- Current dual-capable tactical aircraft are the F-15 and the F-16.

- A nuclear-capable version of the F-35 Joint Strike Fighter is a programmatic option.
- U.S. DCA are deployed to Europe. The B61 nuclear bombs that are deployed to Europe for NATO incorporate advanced security features.

Tomahawk Land Attack Missile-Nuclear (TLAM/N)

- TLAM/N missiles are currently not deployed, but the Navy maintains the capability to deploy these cruise missiles on some attack submarines.
- The Presidential Nuclear Initiative of 1991 pledged to remove all U.S. sea-based tactical nuclear weapons from routine deployment.
    - 1994 Nuclear Posture Review eliminated the redeployment option aboard surface ships but retained the TLAM/N redeployment option for submarines.
- TLAM/N reaches end of service life about 2013; no follow-on weapon is programmed.

Nuclear Command and Control (C2) forces

- 4 Boeing 747 / E-4B National Airborne Operations Center (NAOC) aircraft
    - The plan is to modernize three and retire one aircraft.
    - Service life estimated through about 2020.
    - Air Force analysis of alternatives is underway to examine options for replacement and life extension.
- 16 Boeing 707 / TACAMO aircraft
    - Adequate funding is reported for modernization and sustainment.
    - Estimated end of life is beyond 2025.
- 1 Mobile Consolidated Command Center (MCCC)
    - The only other MCCC was recently retired.

Sustainment issues

- Sustainment appears adequately funded for:
    - The SSBN force: sustainment is planned through 2027+.
    - Nuclear C2 aircraft: sustainment is planned through 2020.
- Uncertainties:
    - ICBMs: There are conflicting views as to whether or not Air Force plans to, and is able to, support the ICBM force through 2030.
    - Bombers: No commitment exists to develop a next generation, nuclear-capable bomber or nuclear weapons for bomber force. DoD estimates the end of service life of existing bombers to be 2035 to 2045.
- NSNF: With the possible exception of a nuclear-capable F-35, there are programs identified to extend the service lives or to modernize NSNF. TLAM/N service life is projected to end about 2013.

11

Sizing and Shaping U.S. Nuclear Forces for the 21st Century

Clark Murdock

Summary

This paper proposes a judgment-based methodology for determining the size and composition of the U.S. nuclear posture.

Preface

From an analytic perspective, determining how many (sizing) of what types (shaping) of nuclear forces the United States needs for a credible deterrent has always been tough. As Ambassador Linton Brooks recently observed:

> Strategic [nuclear] forces pose particular challenges for analysis because there is no agreed way to relate force structure to specific military outcomes. The primary national security output of nuclear forces is deterrence, a widely accepted concept that has never been quantified. We know that doubling the number of infantry divisions increases the amount of terrain that can be defended… But we have no idea whether doubling the number of operationally deployed strategic offensive warheads has the slightest effect on deterrence or on any of the other policy goals often cited for nuclear weapons.

It's no surprise that debates over sizing and shaping U.S. nuclear forces become very political very quickly when it's analytically difficult to determine whether nuclear cruise missiles on forward-deployed naval surface ships have more or less reassurance value to the Japanese than fully-loaded Trident submarines "in the box" somewhere in the Pacific Ocean.

The analytic challenges are compounded in the post-Cold War era because, as argued in a companion 2-pager ("Little Prospect for a New National

Consensus on the Utility of U.S. Nuclear Weapons"), there is no broad-based consensus in the policy community on how important U.S. nuclear weapons are to U.S. security in the post-9/11 era. During the Cold War, few disputed that U.S. nuclear weapons were a core component of U.S. national security; today, however, policy advocates are divided about how salient (High, Moderate, Low or Negative) U.S. nuclear weapons are to U.S. security. Washington used to be consumed by debates over how new U.S. nuclear weapons will be deployed (remember basing modes for the Peacekeeper?); today Washington barely pays attention as a small group of Congressional opponents block the replacement of Cold War-era warheads. Sizing and shaping U.S. nuclear forces for the 21st century in this policy and political environment will not, to say the least, be easy.

A [Modest] Proposal

Target coverage requirements for an ever-changing SIOP used to drive decisions about how many and what types of nuclear weapons the United States needed to counter its superpower rival. Today, target coverage is only one of many considerations as the Bush Administration predicated its 2001 Nuclear Posture Review (NPR) on the assumption that, since "Russia is no longer our enemy," the Russian target base should no longer be used to justify U.S. nuclear force deployments. Moreover, decisions that the United States makes with respect to its own nuclear stockpile and infrastructure must take into account how those decisions (and perceptions of those decisions) affect U.S. efforts to prevent nuclear proliferation and pursue lower global inventories of nuclear weapons (policy goals that have been embraced by both Presidential candidates). In addition to these interactive effects, those charged with sizing and shaping U.S. nuclear forces must factor in domestic political support, namely, can Congressional support for the way forward be sustained over several administrations?

Analyzing how deterrence might work in a range of scenarios is useful and could yield insights into how 21st century adversaries are likely to react to U.S. deterrent threats. But for the reasons cited above, they will not be much help in determining specifically what "deterrent forces" are needed. Moreover, the scenario-based approach does not capture key factors—such as the international perception of U.S. stockpile modernization or the prospects for sustaining domestic support for stockpile modernization—that should influence the next Administration's decisions with respect to U.S. nuclear forces. Judgment, not analysis, will drive those decisions, in part because of the diverse nature of the factors—"apples and oranges," from an analytic perspective—that will influence these decisions. Accordingly, this proposed methodological approach is judgment-centric and, hopefully, quite straightforward:

1. Identify the principal factors (no more than five to nine) that a group of senior decision-makers should consider as they decide how to size and shape U.S. nuclear forces for the 21st century.
2. For each factor, provide a 2–3-paragraph analysis of how that factor should affect U.S. nuclear capabilities (the qualitative variables in the nuclear algorithm) and capacities (the quantitative coefficients).
3. Develop a roster of possible nuclear force structures that includes the "as is" posture projected forward and a reasonable number of distinct alternatives to it.
   a. One design principle—the list of alternative nuclear force postures should include the likely preferred choice of key stakeholders.
4. Ask the group of senior decision-makers (or their surrogates) to:
   a. Begin with a "first principles" discussion on the factors themselves with particular attention paid to prioritizing among them;
   b. Then ask them to "tee up" a decision for the President by identifying the principal 3–5 options (and their principal pros and cons) that the President should consider;
   c. Ask each senior decision-maker (or his surrogate) to state which option (or options) he or she favors and why (in 3 sentences).
   d. Provide the decision matrix to the President (or whoever "the decider" is) who, after an in-depth discussion with his key advisers, decides the future size and shape of U.S. nuclear forces.

Analysis, in this approach, is high-level and concerned with identifying logical connections and cause-and-effect relationships. It informs the many judgments that have to be made in the hope (which is often not the case) that an informed judgment is a better one.

An Initial Cut at a List of Factors (without analysis but with my judgments in italics)

Key considerations affecting the size of the stockpile

- Need to continue to reduce the total U.S. stockpile (active and reserve) as part of an effort to re-establish U.S. leadership in nuclear arms control/disarmament (prior to 2010 NPT Rev Con) by demonstrating commitment to lower global nuclear inventories (which also reduces the risk of non-state acquisition of nuclear weapons).
   - *Further U.S. stockpile reductions should not be unilateral but achieved first through agreements with Russia on deployed weapons (and verification protocols for the entire stockpile) and then through global negotiations.*
- Size of U.S. nuclear stockpile should be influenced by the size of the stockpiles of the other major nuclear powers, Russia and China.

  - *While exact numerical parity with Russia is probably not required, the United States must avoid the perception, particularly by Moscow, that its nuclear forces are inferior to Russia's.*
  - *U.S. forces should remain several times larger than those of China's because Sino-American nuclear parity would likely undermine the credibility of U.S. extended deterrence to Japan (making the latter more likely to join the nuclear club).*
    - *On the other hand, U.S. counterforce (both nuclear and conventional) and missile defense capabilities should not be so robust that they undermine Chinese confidence in their second-strike nuclear deterrent capabilities.*
- If current trends (limited refurbishment of U.S. nuclear warheads and gradual erosion of the nuclear infrastructure) continue, further reductions in the total stockpile, which now serves as the primary hedge against potential systemic failures in specific warheads, could jeopardize the continued reliability of U.S. nuclear weapons.
  - *Both for technical and political reasons, further reductions in the stockpile should be linked to modernization (to include replacement of existing warheads) of the stockpile and of the infrastructure.*

Key factors affecting the composition of the nuclear stockpile

- As currently called for in the 2006 QDR, deterrence must be tailored to address 21st century threats and new nuclear capabilities may be more credible than existing ones (which were developed to deter the Soviet Union over two decades ago) in deterring today's adversaries.
  - *While this is certainly true analytically and may be politically true at some point in the future (if relationships between the major nuclear powers worsen), U.S. efforts to acquire new nuclear capabilities are "dead on arrival" in Congress, in part because of likely international blowback they would spark. Despite the fact that the other nuclear powers are modernizing their nuclear forces (and, in some cases, adding new capabilities), U.S. nuclear modernization, if it is to be sustained politically, must not include new nuclear capabilities.*
- To ensure the continued reliability of U.S. nuclear weapons and to improve their surety (defined as safety, security, and use control), as well as to permit further reduction in the overall size of the stockpile, U.S. nuclear weapons must be refurbished (via incremental and robust life-extension programs or LEPs) and modernized (via replacement) as necessary.
  - *The issue of whether the reliability of an existing warhead can be sustained through incremental or robust (involving the extensive re-use of components) LEP or requires replacement by new-design warhead (the reliable*

replacement warhead or RRW) is a technical matter. Warhead replacement, however, has a far more positive impact on the nuclear infrastructure, particularly with respect to attracting and retaining capable and motivated scientists and engineers, than life-extension programs and, for this reason alone, should be part of U.S. nuclear modernization. A warm and healthy nuclear infrastructure is the best hedge against the pervasive uncertainty characteristic of the 21st century security environment.

- The composition of the stockpile (as well as the size of each of its components) will both be influenced by the number of delivery systems the U.S. maintains (e.g. the existing triad of SLBMs, ICBMs, and air-delivered weapons or some new dyad) and will influence decisions about which delivery systems the U.S. retains (e.g., the W80 warhead and the future of nuclear-capable cruise missiles).

The loss of competence in the Air Force air-delivered leg (particularly in its B-52 forces) raises significant concerns about the sustainability of this leg of the old triad. It also reinforces Admiral Blair's observation that the military services are better able to sustain dedicated nuclear forces than dual-purpose ones (for the nuclear mission). Moreover, if the U.S. were to move to a dyad of SLBMs and ICBMs, sustaining a missile-only force (particularly from a career management perspective) is probably best done by only one service, the Navy. Taking the nuclear role from B-52s would also obviate the need to maintain the W80, since B-2s carry the B61. In the longer run, perhaps, a nuclear-tipped JASSM on the next generation bomber (NGB) is the future of the air-delivered leg of the triad. Finally, although "tactical aircraft" capable of delivering forward-deployed B61s are declining rapidly, U.S. nuclear weapons deployed in Europe play a critical political role in Alliance politics and should be sustained as long as the European allies want them sustained.

12

Conducting an Analysis of Alternative Strategic Force Options

James Miller

This memo attempts to answer the question you posed at the Working Group meeting on 26-7 August: How might the Commission on the Future of the U.S. Strategic Posture, and/or the next Nuclear Posture Review, consider the implications of reductions in strategic forces below SORT levels?

During the Cold War, addressing this question would have involved scenario-based exchange calculations with U.S. and Soviet strategic forces. The scenarios would have included various nuclear postures (e.g., day-to-day and generated alert) and perhaps alternative employment policies (e.g., launch under attack or ride-out an attack). The central question would have been whether the United States could adequately hold at risk a range of targets in the Soviet Union (e.g., leadership, nuclear weapons, non-nuclear military targets, and war-supporting industry). The question of "how much is enough" for deterrence and stability would have been considered by reference to existing or presumed future targeting requirements.[1]

The basic approach of considering scenarios is still valid today. And exchange calculations vis-à-vis Russia still matter, because even after the next round of reductions, U.S. and Russian strategic forces will still be the largest in the world. Finally, however remote the possibility of deep crisis or war between Russia and the U.S., the stakes are high enough that bilateral deterrence and crisis stability will still matter.

However, other factors which had little or no weight in the Cold War now carry significant weight. For example:

- ***Nuclear terrorism.*** A regime that controlled or eliminated "tactical" nuclear weapons in Russia, if feasible, could reduce the risk of loose nukes.
- ***Nuclear proliferation.*** Further reductions below SORT levels could in principle raise risks of nuclear proliferation, e.g., by causing U.S. allies to doubt the U.S. nuclear umbrella. On the other hand, reductions could meet Article VI obligations of the NPT and strengthen the regime.
- ***Third-party nuclear forces.*** Reductions well below SORT levels could bring the U.S. and Russia to levels where it is important to consider China and other nuclear powers.
- ***Strategic conventional capabilities.*** Conventional Trident Modification and other long-range strategic strike capabilities could affect the stability of the strategic balance—even if their only effect were to increase Russian worries.
- ***Missile defenses.*** The U.S. withdrawal from the ABM Treaty pursuit of national missile defenses, and continued advances in naval and ground-based defensive capabilities mean that missile defenses can no longer be ignored in considering the strategic balance.
- ***Upload and Non-Deployed Warheads.*** At Cold War levels of nuclear weapons—and overkill—the fact that both sides had non-deployed nuclear weapons that could be added over a period of days/weeks/months was not central. In considering deeper reductions, upload and breakout capabilities are more salient.

Such changes mean that a strategic nuclear assessment today must address a much wider range of variables. It should address the U.S.-Russia balance, but include prompt global strike capabilities, missile defenses, and (perhaps) varying alert levels. It should also consider limits on non-deployed warheads and fissile materials, tactical nuclear weapons, and the nuclear capabilities and postures of other states.

Similarly, the Cold War scenario-based analysis of alternative options must be broadened to a more general risk assessment. Computer-based exchange calculations will still play an important role, and can help address the potential impact of defenses and conventional capabilities on the U.S.-Russian strategic balance. Broader analysis and gaming is needed to consider the full range of potential issues, including any impacts on the risks associated with nuclear terrorism, proliferation, and third-party nuclear forces.[2]

Proposed Approach

The proposed approach is to develop a range of interesting force structure/posture options, and then assess them through analysis and wargaming and compare them according to a common set of metrics. Because subjective judgments are involved, and because it is unlikely that one option will dominate across all metrics, it must be understood that this is not an "optimization" process, but a process to inform discussion and debate, and ultimately help guide presidential judgment.

Possible options to consider

The first step is to identify possible policy alternatives for the next administration. Options should be winnowed to a tractable number of serious contenders, probably no more than five to seven. Each of the major options might have one or two variants, e.g., larger (or smaller) national ABM deployments. Following are very brief descriptions of possible cases to consider.

Baseline Case:	*Extend START and SORT.* Under this option, the U.S. and Russia would agree to extend START and SORT, but would go no further. U.S. nuclear doctrine would remain as it is today.
Alternative #1:	*No follow-on agreement.* Under this option (which is not preferred but could occur despite U.S. efforts), START expires at the end of 2009, and no additional protocols to SORT are negotiated. A key question under this alternative is whether (and how) Russia and others would change their postures.
Alternative #2:	*Keep SORT levels but include tactical nuclear weapons.* Under this option, the U.S. would attempt to get counting rules in which all operationally available nuclear weapons are included under the SORT limit of 1700-2200 weapons. This regime could also include separate limits on non-deployed warheads. In order to be palatable to the Russians, it might limit both missile defenses and prompt global strike (e.g., by making ABM interceptors and conventional warheads count under the 1700-2200 limits).
Alternative #3:	*Reduce to 1500 strategic nuclear weapons.* This option would reduce the SORT levels to 1500 per side, and retain verification provisions of the START Treaty.
Alternative #4:	*Reduce to 1000 strategic nuclear weapons.*
Alternative #5:	*Reduce to 500 strategic nuclear weapons.*

Analysis, wargaming/simulation and assessment

One of the biggest challenges in conducting the needed analysis is that different nuclear doctrines, targeting practices, etc. may need to be created for each option. One way to finesse this issue is:

- Apply today's nuclear doctrine and targeting in analysis and wargaming of the most analogous alternatives (#1 and #2 above), then adjust as appropriate.
- Use the previous doctrine and targeting as the starting point for later options (e.g., #2 above would provide a starting point for #3, #3 for #4, and so on).
- In addition to being tractable, this approach will help explicitly identify the key risks and tradeoffs between options.

A degree of competitive analysis would be very helpful, e.g., two teams might independently develop revised doctrine and targeting for each of the options considered.

The baseline and each alternative option should be evaluated according to a common set of metrics. Cold War metrics are still relevant, e.g., basic deterrence, crisis stability, extended deterrence and assurance, and arms race stability. Other metrics would include impacts on nuclear terrorism, proliferation, etc.

Conducting such an effort would probably take 3–4 months. It would require a core team of several people, participation from DoD, DOE, State and the intelligence community, and modeling and simulation support from STRATCOM and PA&E (and perhaps outside analysts). It would also require a modest commitment of senior leadership time to give guidance, review interim results, and participate in a few several-hour-long high-level wargames.

Such a review could be the centerpiece of the next NPR. Given the range of relevant issues, the next NPR should be a "whole-of-government" effort. As suggested separately by Michèle Flournoy, it could be accomplished as part of, and in parallel with, the first Quadrennial National Security Review.

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1. A good example of such work in the unclassified realm is "Strategic Arsenals after START: The Implications of Deep Cuts," by Michael May, George Bing, and John Steinbrunner (*International Security,* Summer 1988).
2. More broadly, the U.S. government should establish a strategic net assessment process that involves analysis and gaming of major strategic choices for the country, including but not limited to nuclear weapons issues. Such a process—a "whole of government" analogue to the extensive analysis and gaming conducted by the military in the inter-war period, is needed to improve American strategic thinking and adaptability today and over the long term.

13

Whither the Triad: Considerations for a Triad, Dyad or Monad

Thomas Scheber

Summary

This paper describes the unique contributions to deterrence of each leg of the triad, and of NSNF systems, and the actions that could be taken to mitigate the elimination of a leg.

Since the beginning of the Cold War, the U.S. has maintained a triad of strategic nuclear forces as well as a diverse collection of nonstrategic nuclear forces (NSNF). The strategic nuclear triad of ICBMs, SLBMs, and long-range bombers offered a way to manage risk by providing forces with complementary and overlapping capabilities. The thinking was that if any one leg of the triad was rendered ineffective, the remaining two legs would be sufficient to hold at risk Soviet capabilities and therefore, it was asserted, to deter.

Thus far in the post–Cold War environment, the U.S. has modified its nuclear force exclusively by eliminating weapons deemed as excess. The U.S. has not developed and produced any nuclear weapons specifically for the contemporary environment.

If further nuclear reductions are to be made consistent with this trend, could one type of the extant nuclear weapons be eliminated? Would eliminating a complete leg of the nuclear triad or all remaining nonstrategic nuclear weapons be an acceptable option?

This paper focuses on the *capabilities* inherent in each leg of the nuclear force—not on numbers. The paper briefly examines this issue by listing the unique capabilities provided by each leg of the strategic nuclear triad and NSNF, the consequences of complete elimination, and options for "buying back" the lost capabilities using the remaining nuclear forces.

ICBMs

Unique attributes

- During a crisis, most reliable connectivity between decision-makers and forces.
- Highest "alert rate" of nuclear forces; provides prompt response capability.
- Silos and launch control centers are hardened and dispersed. Any nuclear attack intended to destroy these sites would be large-scale and unambiguous.

Consequences of complete elimination

- All remaining strategic nuclear forces located in the U.S. (at total of 5 bases: 2 SSBN bases; 3 strategic bomber bases) could be destroyed or neutralized by a small-scale attack. Only SSBNs at-sea would remain with no support base available.

Options to buy-back lost capability

- To replace lost offensive potential and prompt response, increase number of SSBNs on alert and/or increase warhead loading on SLBMs. May consider additional investment for assured connectivity with sole remaining prompt nuclear response capability (SSBNs).
- To complicate adversary plans to attack and destroy U.S.-based strategic nuclear forces, increase optempo of SSBNs (keep more at sea) and/or disperse bombers among larger number of bases.

SLBMs

Unique attributes

- Survivability. SSBNs at-sea are considered invulnerable. SSBNs can remain at-sea for an extended time. All other nuclear forces are vulnerable to attack to varying degrees.
- Two-ocean SSBN posture provides mobility, complicates enemy planning, and decreases risk from natural disasters (e.g., hurricanes, earthquakes, fires).

Consequences of complete elimination

- Entire strategic nuclear force could be destroyed by nuclear attacks on ICBMs and three bomber bases.
- Takes away President's option to authorize prompt (ballistic missile) strike against some WMD-armed regional adversaries without overflying Russia.

Options to buy back lost capability

- To reduce vulnerability and provide for a small, survivable nuclear force, mobile ICBMs could be developed and deployed in place of or in addition to silo-based weapons. During periods of heightened tension, bombers could be loaded and placed on strip alert or airborne alert. Alternatively, routinely deploying submarine-launched cruise missiles (e.g., TLAM/N or a follow-on weapon) on general purpose submarines could provide a small, survivable nuclear force.
- To provide an adequate number of operationally deployed nuclear weapons, increase warhead loading on each ICBM and/or bomber.

Bombers

Unique attributes

- Capable of carrying bombs (both B-2 and B-52) and air-launched cruise missiles (B-52 only) with diverse range of yields (low to high).
- Only delivery platform for the B-61 mod11, nuclear earth penetrating weapon.
- Man-in-the-loop capability provides option of launch and recall.
- Ability to "signal" resolve by putting bombers on alert or deploying OCONUS.
- Long-range, ability to route aircraft and cruise missiles and attack from any azimuth complicates adversary planning.
- Could be temporarily forward-deployed (e.g., Guam) as warning to adversary.
- Primary role of bombers is for conventional warfare. Force would not be retired if nuclear role eliminated.

Consequences of complete elimination (of nuclear role)

- Loss of unique hard-target defeat capability. Loss of recall option.
- Loss of low yield options that provide reduced collateral damage. Adversaries would not need to defend against nuclear threat from air-breathing delivery platforms and may elect to concentrate more on ballistic missile defenses

Options to buy back lost capability

- To provide hard target defeat, configure some ballistic missiles to deliver earth penetrating warheads.
- To limit collateral damage, configure some ballistic missiles with lower yield warheads.

- To provide recall option, add command destruct to some or all ballistic missiles (but concern over introducing new vulnerability that could be exploited).
- To complicate enemy defenses, develop and deploy follow-on sea-based nuclear weapons (e.g., cruise missile, hyper-glide vehicles).

NSNF

Unique attributes

- Currently deployed (dual-capable aircraft and B61 gravity bombs) or deployable (TLAM/N) to threatened regions for extended time-frame.
- NSNF can provide overt, local presence to reassure threatened allies.
- Land-based, dual-capable aircraft capable of carrying nuclear gravity bombs are central to "nuclear burden-sharing" for NATO. Can deploy within NATO as needed in response to changes in threat environment.
- Sea-based (TLAM/N on submarines) can be deployed to threatened regions without need for approval from other countries. Can remain deployed for extended time.
- NSNF weapons provide a variety of yields.

Consequences of complete elimination

- All remaining nuclear forces would be based in CONUS. For assurance, allies may question credibility of U.S. extended deterrence guarantees. For deterrence, adversaries may not fear distant U.S. threat as much as closer, deployed nuclear capabilities.

Options to buy back lost capability

- Develop new concepts for *deployable* nuclear weapons.
- For NATO, work with allies to develop alternative deterrence and burden-sharing concept supported by all 26 members of the alliance. (Concept may include advanced conventional strike, ballistic missile defenses, and sea-based forces).

Considerations

As the commission evaluates options to eliminate one or more of the legs of the triad or NSNF, considerations should be given to the following:

- The potential implications of lost capabilities for deterrence, assurance, and dissuasion for specific adversaries and allies and in various contexts.

- The implications of lost capabilities on targeting options available to the president.
- The potential for lost capabilities to be "bought back" through modifications to other weapon systems, and the costs and the effectiveness of each.
- The ability to manage technical risk (e.g., failure of a warhead type) and geopolitical risk (e.g., resurgent Russia) provided by the "excess" capacity of residual force structure.
- The potential challenge an adversary would face in trying to counter or defeat a less diverse portfolio of U.S. nuclear capabilities.

14

Integration and Separation of Nuclear and Non-nuclear Planning and Forces

Dennis C. Blair

Summary

Based on previous American experience, this paper argues that nuclear weapons should be separated from conventional weapons, both in planning and in organization. The only exception is conventional missile defense.

Concepts, Systems, Plans and Wargames

Nuclear weapons have sometimes been considered and planned as a part of overall non-nuclear campaigns, and sometimes been considered and planned as an entirely separate phase of a conflict.

During the Cold War the dominant conceptual and planning construct was that once nuclear weapons had been used in a conflict, it would be fought to its conclusion as a predominately nuclear war. The U.S. objective in these nuclear exchanges was to end the war on conditions favorable to American interests short of mutual destruction. At a disadvantage in conventional military capabilities, NATO planned to use nuclear weapons to stop Warsaw Pact mechanized forces, hoping that the Soviet Union would agree to halt its advance and stop the fighting after at worst a limited exchange of nuclear attacks.

There were concepts, plans and deployed tactical nuclear weapons to be used together with non-nuclear weapons to achieve tactical or operational successes on the battlefield.

At sea, tactical nuclear anti-submarine depth charges had much greater lethality than non-nuclear anti-submarine torpedos, and NATO naval commanders in theory could request permission to use nuclear depth charges to deal with large numbers of Warsaw Pact submarines threatening NATO's sea lines of communications. In war games, however, NATO naval commanders generally considered it to their disadvantage to use tactical nuclear weapons. They calculated that the Soviets would use nuclear anti-ship missiles and torpedoes that would do as much or more damage to NATO surface battlegroups than would be done to the Soviet submarine fleet by NATO nuclear weapons. In addition, although in theory nuclear war at sea did not have the escalatory implications of war on land, NATO naval commanders and appointed officials were deeply worried that use of nuclear weapons at sea would lead to an unstoppable spiral of nuclear escalation leading to strategic exchanges.

On land, NATO tactical nuclear weapons were justified, deployed and planned to offset Warsaw Pact superior numbers of mechanized forces. NATO had a full arsenal of nuclear landmines, artillery shells, short range missiles and aircraft-delivered nuclear bombs, and there were procedures for tactical level commanders to request their release when they were losing on the battlefield at the conventional level. However in most wargames in which these scenarios were examined, NATO commanders considered that their use of tactical nuclear weapons would quickly be answered by Warsaw Pact use of similar weapons, either bringing major combat operations to a halt, or leading to escalation to higher level exchanges of nuclear strikes.

In the early years after the Cold War, when the United States had strong conventional force superiority over potential adversaries, concepts for the use of nuclear weapons became separated from the use of conventional weapons. The trend was to raise the nuclear threshold very high. In fact, in planning for conflict with Korea, the combined conventional force superiority of South Korea and the United States was so great that there were plans to fight through limited North Korean use of chemical weapons of mass destruction without necessarily retaliating with nuclear weapons.[1]

Prior to the Nuclear Posture Review at the beginning of the Bush Administration, the only circumstance in which nuclear weapons were considered for use in a generally non-nuclear campaign was to destroy very valuable deeply buried military facilities that could not be neutralized by non-nuclear weapons. However even in these cases, there was a strong preference for using non-nuclear weapons against the supporting systems for these facilities—entrances, power and air supplies, etc., and considerable resources were spent on analysis and weapons development of non-nuclear systems to attack them.

The Bush Administration's nuclear posture review of 2001 attempted to break down some of the conceptual isolation of nuclear weapons from non-nuclear weapons, creating a "new triad" that included precision non-nuclear strike and defensive systems along with offensive nuclear weapons. However there is little evidence that this new concept has resulted in actual plans that combine the use of nuclear and non-nuclear weapons to achieve operational level campaign objectives against either nuclear or non-nuclear potential adversaries of the United States such as North Korea or China.

There is one campaign in which nuclear and non-nuclear weapons are integrated—ballistic missile offense and defense. The United States has built a non-nuclear missile defense system to intercept ballistic missiles, including nuclear-armed ballistic missiles. In theory, it would seem logical to arm a system to defend against nuclear ballistic missiles with nuclear warheads. By definition, the opponent has crossed the nuclear threshold, and nuclear warheads would be much more lethal than conventional warheads. However there are at least three reasons the United States has not done so: First, the United States has signed an international treaty that forbids the use of nuclear weapons in space; second, it is impossible to distinguish a nuclear ballistic missile from an identical missile with a non-nuclear warhead, and so the United States could not be sure it was under nuclear attack, and, third, the effects of detonating a defensive nuclear weapon in space could adversely effect American satellites, long-distance communications, and other electronic equipment in the region. For all of these reasons, both the Clinton and Bush administrations have chosen to develop non-nuclear missile defense systems designed to shoot down North Korean nuclear missiles.

Organizing Nuclear and Non-nuclear forces

At the organizational level, there have been two different categories of nuclear forces in the past—dedicated and dual purpose.

During the Cold War there were dedicated forces for nuclear missions. In the Navy it has been the strategic ballistic missile submarine force, and in the Air Force it has been the intercontinental ballistic missile force, and a segregated portion of the long-range bomber force. The Army also for a time had dedicated nuclear units—Ground-Launched Cruise Missile (GLCM) and Pershing II units.

All the services maintained dual-purpose units that in addition to their primary non-nuclear missions had tactical nuclear roles. The nuclear missions were supported by additional training, personnel and administrative requirements and inspections. Sometimes these dual purpose units carried nuclear weapons on board along with non-nuclear weapons, and other times the units maintained the capability to employ weapons that were stored separately.

Dual purpose units during the Cold War took their nuclear missions seriously—safety procedures were inspected rigorously, and it was a careerkiller for the commander of a unit to fail a DNSI or NTPI inspection. While often doubting the tactical effectiveness of their systems, crews nonetheless took their duties seriously, since war with the Warsaw Pact was the primary mission for all services, and nuclear escalation was a distinct possibility.

Current dedicated forces are the Trident SSBN force armed with submarine-launched ballistic missiles and the Minuteman III force. These units are organized up through the squadron level (for the Tridents) and wing level (for the MM III) entirely for the nuclear mission. All their personnel and administrative programs are subject to the extra requirements of the nuclear program—Personnel Reliability Program, two-person control, safety inspection regimes, etc. All their training and exercises activity is based on nuclear scenarios. These units actually have possession of nuclear warheads, uploaded on missiles. They are entirely focused on the nuclear mission.

Dual purpose forces include B-52s (no longer are separate squadrons dedicated to nuclear missions) and B-2s, nuclear attack submarines that are certified for launching the nuclear Tomahawk Land Attack Cruise Missiles (TLAM-N), and fighter aircraft of NATO allies that are certified for carrying American nuclear gravity bombs. These units are primarily trained and administered for their non-nuclear missions, but in addition devote some of their exercise time to training for nuclear missions, maintain separate personnel and administrative systems for the nuclear missions and weapons, and receive separate inspections of their nuclear readiness. Generally these units do not have possession of nuclear weapons. They conduct weapons handling training with inert replicas of the actual nuclear weapons. In general, under today's conditions, with the possibility of nuclear war remote, these crews give more attention to their more likely non-nuclear missions, and attempt to minimize the administrative and time burdens of their nuclear capability.

The Future

An important principle to establish for future nuclear posture planning is the extent to which the United States should integrate nuclear and non-nuclear weapons planning and organizations.

Integrated vs. separated concepts for the use of nuclear weapons

With the single exception of planning and developing non-nuclear missile defense systems against nuclear ballistic missiles, past attempts to plan the use of nuclear and non-nuclear weapons in an integrated campaign plan have not persisted. In nuclear wargames over the years, for both military commanders and appointed officials, once nuclear weapons were introduced into a campaign, nuclear escalation considerations dominated the conflict, rather than questions of the effective use of tactical nuclear weapons within an otherwise non-nuclear campaign that had not escalated. This syndrome has even been true for the use of nuclear weapons at sea, where collateral damage considerations are far less than they are on land. In wargames and planning, even when an adversary like North Korea resorts to the use of chemical weapons (like nuclear weapons, a weapon of mass destruction) commanders and officials have shown a preference for refraining from retaliatory use of nuclear weapons if the United States and the Republic of Korea can fight through the chemical weapons with non-nuclear forces and prevail.

The weight of observation over the years is that American leaders strongly prefer not to consider the use of nuclear weapons to achieve overall campaign goals in predominately non-nuclear conflict. This trend has generally been strengthened since the end of the Cold War. If U.S. forces are superior to their adversaries in non-nuclear capability they prefer to win without the use of nuclear weapons even if the adversary has used weapons of mass destruction against them. If the adversary uses nuclear weapons to the extent that it would affect the outcome of the war, they prefer to retaliate with nuclear weapons sufficient to end the war, but not in such great numbers that they cause escalation to major strategic exchanges.

Dedicated vs. dual-purpose forces

The experience of the armed forces over the years is that both efficiency and safety are better with dedicated than with dual-purpose nuclear forces. Dedicated nuclear forces devote all their training, personnel and administrative energies to their nuclear missions, and are accustomed to the more detailed administrative requirements, higher personnel standards and more rigorous inspections. It is their way of life. Dual-purpose forces can maintain high separate standards for their nuclear missions, but these missions are inevitably considered by the officers and enlisted personnel to be a burdensome nuisance detracting from their non-nuclear missions which seem more important, because they are more likely to be executed.

Conclusion and Recommendation

In conclusion, although they are not the only considerations, the history of integrated vs. separated nuclear concepts and planning, and of dedicated vs. dual-purpose forces argue for the United States to support only dedicated nuclear forces in the future, and with the exception of non-nuclear missile defense systems, to plan for the use of nuclear forces only to deter the use of nuclear weapons by an adversary, and to end conflict quickly on favorable terms should deterrence fail.

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1. Not all members of the deterrence expert working group concur with this assertion—if the Commission is interested in discussing this point, a classified meeting should be arranged.

15

Nuclear Weapons and Expanded Deterrence Against Catastrophic Attacks

Elbridge Colby

Summary: The United States and its allies will face increasingly sophisticated and dangerous weapons of catastrophic destruction due to the accelerating advance and dissemination of technology. Nuclear weapons will play a key role in deterring the use of these weapons by state or non-state opponents as long as the United States continues credibly to threaten retaliation, to include nuclear usage, in response to catastrophic strikes. A "no first use" posture would be incompatible with an effective deterrent of this kind, and the Commission should consider stating so. Nuclear weapons will not, however, be sufficient to deter catastrophic attacks. Instead, the Commission should consider voicing support for the Administration's commendable but poorly implemented policy of expanding deterrent threats to include those who enable or support catastrophic attacks against us or our allies.

Text: Accelerating advances across science and technology, to include in computing, nanotechnology, biotechnology, as well as in the more mature nuclear field, combined with our staggering advantages in conventional warfare, make it a near certainty that the United States will in the coming decades face increasingly powerful, sophisticated, and dangerous weapons, tools, and systems. Though traditional state rivals will likely be the principal wielders of these new technologies, their dissemination outwards to marginal states and downwards to non-state actors means that the U.S. will confront threats from a variety of types and groupings of actors. While the parameters of these new technologies are uncertain, we can be confident that they will be not only tremendously powerful, disruptive, and damaging, but also supremely elusive and cost-efficient. Non- and counter-proliferation efforts will be a critical mitigant of these deleterious trends, but, given that they are the necessary obverse of the benefits of new innovation and that challenger powers will so clearly benefit from them, they cannot be halted. They instead must be managed.

U.S. nuclear weapons should play a partial but central role in dealing with the rise of these threats. Our nuclear arsenal will do so because, so long as it is maintained at a sufficient level of quality and quantity and appropriately postured, it constitutes a decisive asymmetric retaliatory capability that ipso facto makes the use of any weapon of catastrophic consequence, however novel, against us or our allies more costly than beneficial. Further, by ensuring this decisive asymmetry they allow us and our allies the freedom not to have to match (either with similar weapons or defensively) every advance in weapons technology our opponents and rivals may make (though maintenance of an edge in some fields is advisable and even necessary). As with the NATO allies' effective decision not to match Warsaw Pact capabilities after the failure of the Lisbon Treaty commitments and the formal decision to forswear chemical and biological weapons in the face of massive Soviet superiority (the latter clandestine) in those fields, the U.S. and its allies in the 21st century can reliably invest in maintaining an assured nuclear deterrent to render catastrophic acts of destruction irrational as such rather than seeking symmetry in armaments.

This logic would counsel continuing to resist adopting a "no first use" doctrine and perhaps even considering, as our opponents and rivals begin to field disruptive new technologies, reminding them of our willingness to respond to catastrophic aggression of any kind with the tools most suited to our purposes. This would point towards restraining and perhaps walking back what has, in light of overwhelming conventional U.S. military superiority over the last two decades and an unusually calm international scene, become an informal "no first use" policy. More broadly, it would counsel shoring up the credibility of our threats to respond asymmetrically as we deem appropriate, whether with nuclear weapons or otherwise. This approach would have both direct deterrent as well as dissuasive benefits. Opponents facing the real prospect of firm and potentially severe retaliation by the U.S. will price the reality of this American commitment into their strategic calculations, thus rendering arms competitions less likely.

But while nuclear weapons will play a vital cornerstone role in our security against these threats, our deterrent against catastrophic attacks (however conducted) must be both more flexible in its ability to respond as well as expansive in its understanding of responsibility and accountability. The U.S. cannot contemplate the real prospect of catastrophic attack with the sanguine comfort that we can respond only as we have been prepared to in the preceding two decades. Instead, in concert with an integrated strategy employing defensive, diplomatic, intelligence, consequence management, and other tools, the U.S. should adopt and publicize broadly its intent to use an expanded but more realistic standard of accountability with respect to such strikes. Those targeted (with appropriately varying degrees of severity) would include not only those actively involved, but also those who materially supported, cooperated in, were complicit with, or were grossly negligent in catastrophic attacks.

The logic of deterrence is very strong and its effectiveness is manifest in, for instance, the success of the U.S. and its allies in the Cold War. But it must be properly postured to speak to the threatened parties. Following the lead set in areas as diverse as Israel's approach to terrorism and modern Western tort law, the U.S. should expand the scope of responsibility for preventing such attacks in order to enlist the assistance of those who have the power, as well as the obligation, to frustrate them. Our nuclear forces will play a critical role in this policy both directly as a backstop and ultimate resort as well as an indirect indicator of the seriousness of U.S. retaliatory threats. But they will only be an element, as the U.S. will need to be able to respond flexibly in order to threaten different targets with appropriately (though ambiguously) differing degrees of retaliation.

The Commission has the opportunity to help push the United States in this direction before we suffer a catastrophic strike. (A frequent criticism of the policy is that it is not credible before a strike occurs and the U.S. retaliates.) The U.S. Government has begun rolling out a commendable policy to emphasize the determination of the U.S. to strike back overwhelmingly at those who "enable" or "support" a WMD attack against ourselves or our allies. But the policy has, frustratingly, been poorly publicized (its rollout was a speech by National Security Advisor Stephen Hadley at a closed door meeting at Stanford) and thus little noted beyond professional security circles. The Commission could help shape the policy and jumpstart its implementation with a firm statement of support for the approach.

16

The Costs and Benefits of a No-First Use Declaratory Policy

Scott D. Sagan

Throughout the Cold War, the United States maintained a declaratory policy emphasizing our commitment to use nuclear weapons first, if necessary, as part of our extended deterrent commitment to key alliance partners. This declaratory policy was repeated in the 2001 Nuclear Posture Review, which also added a more explicit option to respond with nuclear weapons to a chemical and biological weapons attack. This paper reexamines the role of nuclear weapons in extended deterrence and deterrence of chemical and biological weapons use, and also broadens the analysis by including the impact of U.S. declaratory policy on efforts to reduce the dangers of nuclear proliferation and nuclear terrorism. It seeks to outline the costs and benefits if the United States adopted a No-First Use (NFU) declaratory policy, stating that "the role of U.S. nuclear weapons is to deter nuclear weapons use by other nuclear weapons states, or terrorist groups supported by a nuclear weapons state, against the United States, U.S. allies, or forces deployed overseas."

Extended Deterrence, Reassurance, and the Nuclear Umbrella: U.S. nuclear "extended deterrence" commitments to key allies—especially in East Asia and NATO—is the most often cited reason to maintain current declaratory policy. Yet, most discussions of the "nuclear umbrella" fail to differentiate between U.S. commitments to use nuclear weapons first, if necessary, to defend an ally if it is attacked by overwhelming conventional force or nuclear weapons (the Cold War policy) and the more tailored guarantee to use U.S. nuclear weapons in retaliation against a nuclear attack, but only a nuclear attack, on U.S. allies. This second kind of a U.S. nuclear guarantee need not undermine the security of key U.S. allies who do not fear conventional aggression;

indeed, it would likely be welcomed by those allies who continue to value more credible conventional military commitments, but feel that first use nuclear threats encourage proliferation elsewhere.[1] Serious consultation with other allies, especially Turkey and new members of NATO, would be required, however, to reassure them of the continued U.S. commitment to use nuclear weapons in response to nuclear aggression against them and to maintain the credibility of conventional defense options within the alliance.

The Special Case of CBW Deterrence: Both the Bush and the Clinton Administration embraced "calculated ambiguity" regarding the role of nuclear weapons in deterring chemical and biological attacks. Advocates maintain that such threats enhance deterrence, because they raise the potential costs that any government would face if it considered using chemical or biological weapons. Critics stress that such threats are contrary to the U.S. negative security assurances—promises that the U.S. would not use nuclear weapons against a non-nuclear weapons state, in compliance with the NPT and not aligned with a nuclear state—and that they can encourage further nuclear proliferation, by leading governments of non-nuclear states to believe that they may need nuclear weapons to deter such WMD threats as well. Both arguments may be right. Such verbal declarations do add credibility to the U.S. threat to respond with nuclear weapons, not just by creating uncertainty about the likely U.S. response (uncertainty which can never be entirely eliminated anyway), but also by creating a "commitment trap": if deterrence fails despite such threats, a president will feel increased pressure to use U.S. nuclear weapons to maintain the U.S. international reputation for honoring commitments. In short, such threats do not just signal commitment; they create commitment. Thus, calculated ambiguity statements enhance the credibility of deterrent threats, but only by increasing the likelihood that the U.S. will use nuclear weapons if deterrence fails. So unless one believes that such threats will work one hundred percent of the time, the calculated ambiguity doctrine increases the likelihood that the U.S. will use nuclear weapons first in response to a perceived imminent or actual chemical or biological attack. A balanced assessment of U.S nuclear weapons doctrine should therefore include an assessment of the consequences of both kinds of deterrence failure: the immediate consequences of a chemical or biological attack by an adversary, and the long term consequences of potential U.S. nuclear retaliation in the event that deterrence fails.

Deterring Terrorists' Use of Nuclear Weapons: A new strategy to deter nuclear terrorism indirectly was outlined in February 2008 by then NSC advisor Stephen Hadley: "Many terrorists value the perception of popular or theological legitimacy for their actions. By encouraging debate about the moral legitimacy of using weapons of mass destruction, we can try to affect the strategic calculus of the terrorists. And finally, deterrence policy targeted at those states, organizations, or individuals who might enable or facilitate terrorists in obtaining or using weapons of mass destruction, can help prevent the terrorists from ever gaining these weapons in the first place." It is difficult, however, to encourage a debate about the moral legitimacy of using weapons of mass destruction if the U.S. insists that it has the right to use nuclear weapons first. A new NFU declaratory policy would make U.S. engagement in such a global debate about the moral legitimacy of nuclear weapons and other WMD appear more credible and thus potentially more effective. The threat to retaliate against a foreign government that has deliberately passed on nuclear weapons to a terrorist organization, however, would not be constrained by a U.S. NFU doctrine since that government would be responsible for the first nuclear use by its terrorist proxy.

Declaratory Policy and Non-Proliferation: As part of the effort to discourage nuclear proliferation, previous U.S. administrations have declared at NPT review conferences that they would not threaten or use nuclear weapons against non-nuclear weapons states, who are members in good standing of the NPT, unless such states attack the United States or U.S. allies in conjunction with an attack by a nuclear weapons state. The perceived credibility of the U.S. commitment to honor such "negative security assurances," however, was significantly reduced when portions of the 2001 NPR—which listed Syria and Libya as potential nuclear targets—were leaked to the press. A U.S. NFU declaration would enhance the credibility of future negative security assurances, especially if they could be coupled with similar assurances from other nuclear weapons states. With respect to the 2010 NPT Review conference, U.S. nuclear declaratory policy is unlikely to be the most important factor determining whether or not the NNWS are satisfied at the 2010 NPT Review Conference that the nuclear weapons states have honored their Article VI commitment to work in good faith to eliminate nuclear weapons. (Progress towards the ratification and coming into force of the CTBT is likely to be more critical.) Nevertheless, it is worth remembering that the NNWS included a statement in the final consensus document at the 2000 NPT Review Conference calling for "a diminishing role for nuclear weapons in security policies to minimize the risk that these weapons ever be used and to facilitate the process of their total elimination." A declaratory policy that reduced the role for U.S. nuclear weapons would therefore help address that stated concern at the next NPT Review Conference.

Mimicry Effects of U.S. Declaratory Policy: U.S. declaratory policy also influences the doctrines of other nuclear weapons states, especially new nuclear powers at early stages of doctrinal development. The best example of this is India's movement away from a strict NFU doctrine. In 2003, the New Delhi government adopted a new doctrine including the explicit threat of Indian nuclear first-use in response to biological or chemical weapons use, a change that was the result of copying the United States and other nuclear states.[2] India's new doctrine should alarm American policy makers for it makes it more likely that India would use nuclear weapons in a future conflict with Pakistan and increases the pressures inside India to develop a larger and more diverse nuclear weapons arsenal. The signaling and legitimizing effects of U.S. nuclear doctrine are by no means the only factors leading to such negative trends in India, or in potential other cases in the future, but they should not be minimized. A U.S. NFU declaratory policy would similarly have some positive influence in pushing India and other new nuclear states in the opposite direction in the future.

Conclusions: A central message of this paper is that the next Nuclear Posture Review needs to focus on both potential effects of declaratory policy on the multiple dimensions of extended deterrence and on its effects on non-proliferation policy. All too often, nuclear doctrine and declaratory policy are analyzed only with respect to "requirements" of deterrence, without taking into account the diversity of views in different allied nations and the potential negative effects of U.S. declaratory policy on our ability to achieve other critical non-proliferation objectives. Trade-offs often exist between different goals in this arena and reasonable people may well therefore disagree over the value they place on various costs and benefits of different declaratory policy statements. Serious diplomatic issues still remain to be addressed—concerning how best to consult with allies and how to encourage other nuclear powers, especially the Russians, to reduce their reliance on nuclear weapons—but I hope the arguments and evidence presented in this paper will spark more thorough and broader analysis to take place inside the U.S. government about the costs and benefits of a No-First Use declaration in the next Nuclear Posture Review.

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1. For example, four former German leaders have recently called for "a general non-first-use treaty between the nuclear-weapons states." Helmut Schmidt, Richard von Weizacker, Egon Bahr, and Hans-Dietrich Genscher, "Toward a Nuclear Free World," *International Herald Tribune,* January 9, 2009.

2. An unidentified member of India's National Security Advisory Board stated that "all five nuclear weapon states...reserve the right to launch nuclear weapons first. Then why should India not do so?" Elizabeth Roche, "India Evaluating, Fine-Tuning Nuclear Doctrine" *Hong Kong AFP,* January 14, 2003.

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The Role of U.S. Strategic Posture in Deterring and Preventing Nuclear Terrorism

Scott D. Sagan

Description of the Problem

It is widely recognized that al Qaeda has a strong interest in acquiring nuclear weapons. Osama Bin Laden issued a statement justifying the use of nuclear weapons against the United States prior to the 9/11 attacks, and after 9/11, crude drawings of nuclear weapons designs were found in caves in Afghanistan and retired Pakistani scientists from the Khan Research Laboratory were discovered to have established ties to al Qaeda. Earlier cases of terrorist interest in nuclear weapons, however, are less well known. The Baader-Meinhof gang attacked a U.S. Army base in West Germany in the 1970s seeking to steal the nuclear weapons there; the Red Army in Italy kidnapped U.S. Brigadier General James Dozier in 1981 and questioned him about locations of NATO nuclear weapons storage sites; the Aum Shinrkyo sought uranium in Australia and penetrated the Russian military seeking weapons and expertise, prior to settling for the use of chemical weapons (sarin gas) in Tokyo in 1995. Al Qaeda was not the first terrorist group to seek nuclear weapons; nor is it likely to be the last.

It is also widely recognized that no known terrorist organization is likely to have the resources or expertise to produce fissile material on its own. The risk of nuclear terrorism is therefore directly related to the risk that a government, or individuals working within a government, could deliberately or inadvertently provide nuclear materials or actual weapons to a terrorist group. There are, however, many different scenarios through which terrorists could gain access to a nuclear weapon or weapons usable material (HEU) with which they could construct their own gun-type device like the one used at Hiroshima. Terrorists could be given or sold a weapon or weapons usable material by a sympathetic government, an insider, or a group of insiders in a government's weapons program; terrorists could steal a weapon or weapons usable material; terrorists could acquire nuclear weapons or materials in the chaos if a nuclear weapons state (Pakistan, North Korea, Iran) collapsed into civil war or became a failed state. In many of these scenarios, the U.S. government may not know whether the weapons were acquired because of the complicity of the central government, or because of its negligence to maintain adequate physical security, or some mixture of negligence and complicity, or whether the terrorist group somehow overcame what could be considered a strong physical security protection system.

Finally, it is widely recognized a deterrent threat is unlikely to be effective in preventing a terrorist leader with nuclear weapons from using those weapons, and therefore more attention has focused on preventing terrorists from getting access to nuclear weapons or materials and on detecting and interdicting any weapons or materials that might be acquired despite such prevention efforts. This does not mean, however, that deterrence and the U.S. strategic posture have no possible role to play in deterring and preventing nuclear terrorism. Indeed, U.S. government's current strategic posture and declaratory policy currently seeks to deter and prevent nuclear terrorism through three distinct strategies. This paper will describe and analyze those current policies, describe some additional indirect ways in which U.S. strategic policies might influence the likelihood of nuclear terrorism, and provide a set of alternative policy options for the Commission to consider to address these challenges in the future.

Description of Current "Deterring Nuclear Terrorism" Policies

The first policy pronouncement in this regard was limited to a single government, in President Bush's declaration after the October 2006 North Korean nuclear test that "the transfer of nuclear weapons or material by North Korea to states or non-state entities would be considered a grave threat to the United States, and we would hold North Korea fully accountable of the consequences of such action." The second policy pronouncement was the direct and more expansive declaratory statement made by National Security Advisor Stephen Hadley in February 2008: "The United States has made it clear for many years that it reserves the right to respond with overwhelming force to any use of weapons of mass destruction…The United States will hold any state, terrorist group, or other non-state actor fully accountable for supporting or enabling terrorist efforts to obtain or use weapons of mass destruction." This Hadley statement was more direct, by threatening response with "overwhelming force" and more expansive both in terms of applying the doctrine to any state, not just North Korea, and by broadening the set of actors whom the U.S. would hold accountable after an attack. The third policy by which the current government seeks to deter terrorist use of nuclear weapons is an indirect one, by trying to delegitimize the use of nuclear weapons in the eyes of supporters of specific terrorist organizations. This was also announced by Hadley in his February 2008 speech: "Many terrorists value the perception of popular or theological legitimacy for their actions. By encouraging debate about the moral legitimacy of using weapons of mass destruction, we can try to affect the strategic calculus of the terrorists."

It is worth noting that these policy statements did not differentiate between deliberate transfers or assistance and those that derived from lapses regarding nuclear materials or weapons security. Senator Joseph Biden, however, did draw a connection between the intent and responsibility for nuclear terrorism and the potential U.S. responses when he stated in May 2007 that "we must make clear in advance that we will hold accountable any country that contributes to a terrorist nuclear attack, whether by directly aiding would-be terrorists or willfully neglecting its responsibility to secure the nuclear weapons or weapons-usable material within its borders." It is also worth noting that this more nuanced statement by Senator Biden did not include the possibility that terrorists might successfully seize or acquire nuclear weapons or weapons-usable material despite sincere and serious efforts on the part of the government involved to provide adequate security. It also did not address the difficulty that the U.S. could have in determining both the source of the materials or weapon used in a terrorist attack and the manner in which the terrorist organization acquired the materials or weapon.

Analysis of Deterrence Dilemmas

Attempts to deter the nuclear terrorism through threats of retaliation face both technical and political problems. Deterrence, it is often noted, requires both a perception that attribution of identity (where did the weapon come from) is likely and a return address (against whom will retaliation be targeted). Both confident attribution and appropriate retaliation may be problematic in many nuclear terrorism scenarios. There is much that needs to be done both in terms of technology development and international cooperation to improve overall U.S. nuclear forensics capabilities, as noted, most recently, in the 2008 American Physical Society report. Currently, attribution capabilities are generally considered to be better regarding the DPRK (because of past IAEA access to the Yongbyon facility) than regarding Pakistan (where access has not existed). Confidence in our ability to attribute whether materials or a weapon came from Russian sources is likely to be somewhere in between the DPRK and Pakistani cases.

As difficult as it may be to determine the *source* of a terrorist nuclear weapon in many scenarios, understanding the *cause* of the terrorist acquisition of nuclear materials or a weapon could prove even more difficult. Was the government that produced the materials or weapons in question complicit in the terrorist attack? This is commonly assumed to be the case in what is called state sponsored terrorism. But it could also be the case that only "rogue" lower level officials were involved in helping a terrorist organization get nuclear materials or a weapon, which could be called "insider supported terrorism." A government that was complicit in supporting an attack could, in fact, find it convenient if caught to claim that the terrorists were supported only by a rogue scientist or military officer. Furthermore, it could be exceedingly difficult to determine whether a government was truly complicit or merely negligent in maintaining security and management over nuclear materials or weapons. Efforts to provide assistance to the government in question ahead of time could be helpful in evaluating the effectiveness of their physical security systems as well as evaluating whether government officials are being negligent in their responsibilities. Finally, it is worth noting that intelligence and good local and international police work after a terrorist attack could be as important, if not more important, in determining the sources and causes of terrorist acquisition of a weapon than even the most advanced nuclear forensics program.

An additional challenge has been identified in a number of studies that focus on the desire for cooperation, if possible, with the government from which weapons or materials came in order to assist in their efforts to determine the cause of the breach in physical protection systems and to help secure the remaining weapons or materials in the country. Making deterrent threats ahead of time, however, could both increase and reduce the incentives for a government to accept assistance from the United States in securing its materials and weapons. It might heighten the incentives for governments to improve physical security at nuclear sites, through what has been called "deterrence of negligence." But it might also reduce incentives to cooperate ahead of time by increasing fears that the U.S. would use any information gained through cooperation for intelligence and targeting purposes. Deterrent threats would also create political difficulties for foreign government officials whom otherwise might want to provide and accept security and intelligence cooperation from the United States. Such officials could be criticized by others inside foreign governments as cooperating under pressure or coercion. Finally, U.S. deterrent threats could compound nuclear physical security dangers in a target state if the government chose to alert its nuclear forces or deploy them to forward positions, instead of locking them down even more effectively, fearing an American response in the event of a nuclear terrorist incident.

A related dilemma is that U.S. strategic doctrine and declaratory policy can influence the likelihood of nuclear terrorism indirectly and inadvertently by influencing the doctrine and declaratory policies of other states, which in turn more directly influence the likelihood of nuclear terrorism. A case in point is the 2003 Indian government declaration that it had modified its traditional strict no-first-use doctrine to include the threat to use nuclear weapons first in the event of a biological or chemical attack ("calculated ambiguity") and statements by some New Delhi officials that the government was considering preemptive nuclear or conventional attacks against Pakistani nuclear sites ("anticipatory self-defense") as being legitimate options in the future. Both of these changes in Indian doctrine were strongly influenced by New Delhi officials' perceptions of existing U.S. nuclear doctrine and discussions of preemption in Washington policy documents. This change in India's policy, however, creates "a vulnerability/invulnerability paradox" in Pakistan. Pakistani military leaders have increased incentives, in a crisis, to take Pakistani weapons out of their storage sites inside secure military bases where they are vulnerable to an Indian attack and to place the arsenal on alert and deploy the weapons to hidden field positions outside the main bases. Such a deployment, however, would make Pakistani nuclear weapons more vulnerable to a terrorist seizure, either through a direct attack at a less secure site or through assistance from an insider from the Pakistani military.

The logic behind the "deligitimizing nuclear use" strategy outlined by Steven Hadley in 2008 is clear: some financial supporters or logistical helpers of a terrorsist organization might be persuaded not to help in efforts to acquire or use nuclear weapons if stronger moral norms against nuclear use are expressed and accepted. One could imagine an assistant in the logistics change of a terrorist operation, for example, refusing to participate in nuclear terrorism even if he or she supported the organization more generally. In addition, if popular support for a terrorist organization or insurgency was based on a perception that it fought for a just cause with just means, nuclear weapons use against civilian targets might be seen to reduce the support base for the organization. What is not clear, however, is whether there is any firm evidence that such a "deligitimizing strategy" has been effective in the past or in recent years. For example, while it is true that some Islamic theologians have issued fatwas opposing Osama Bin Laden's call, on moral grounds, for nuclear attacks on the U.S., I know of no study of how such fatwas have influenced either popular opinion or individual beliefs among potential al Qaeda supporters.

Deterrence Policy Options

The options outlined below are not exclusive, that is, the United States could adopt one or more of them. Some of the options counter the effectives of others; but some are synergistic. It will thus be important to recognize both when trade-offs have to be made and when policy options could be mutually reinforcing. It is also important to note that the U.S. has many other arrows in its quiver to prevent nuclear terrorism, including non-proliferation strategies, efforts to secure nuclear facilities around the world, the Proliferation Security Initiative, nuclear detection and incident mitigation programs, and initiatives to reduce use of HEU in research reactors. The points below represent a range of options to deter and prevent nuclear terrorism through U.S. strategic posture and declaratory policy as a supplement to other U.S. strategies.

- More Direct Nuclear Threats: The U.S. could adopt a declaratory policy similar to that announced by French President Chirac in January 2006: "The leaders of states who would use terrorist means against us, as well as those who would envision using . . . weapons of mass destruction, must understand that they would lay themselves open to a firm and fitting response on our part…This response could be a conventional one. It could also be of a different kind."
- "Hold Accountable" Threats: The U.S. could continue to state that it would hold accountable any state or non-state actor that provided assistance leading to an act of nuclear terrorism.
- Parsing between Failure, Negligence and Complicity: The U.S. could seek signal cooperation with governments that have failed to protect nuclear materials or weapons, while simultaneously threatening to hold accountable any government that is complicit in attacks or is willfully negligent in physical security measures. The statement would be something like: "The U.S. stands ready to provide assistance in securing nuclear materials to cooperative governments after a nuclear terrorism incident anywhere in the world. But we will hold accountable any government or individual whose complicity or willful negligence has contributed to such a tragic event."
- Continue to Support "Deligitimizing" Declarations: Encouraging debates about the morality of using nuclear threats or nuclear weapons attacks could produce some loss of support for nuclear terrorism among terrorist sympathizers or logistic supporters.

18

Proposed Strategy for Designing the 21st Century U.S. Nuclear Posture

Clark Murdock

Tasking

- At 24 Feb 09 SPRC meeting, Force Structure Tiger Team was asked to develop a strategy for the future U.S. nuclear posture, drawing on the charts on General Principles and External Factors.

Ends (of the Strategy)

- Recognizing that nuclear terrorism and nuclear proliferation are the primary nuclear dangers in the post-9/11 era, the U.S. still needs a strong and credible nuclear deterrent for as long as nuclear weapons exist.
- In order to be credible, the U.S. nuclear deterrent must be safe, secure and reliable, as well as visible to potential adversaries and allies:
  - Deterring use of nuclear weapons and other weapons of mass destruction (WMDs)[1] against the U.S. and its allies.
  - The strength and credibility of U.S. assurances to its allies critical in the 21st century security environment, both as an end itself (that is, extended deterrence) and as a means to prevent nuclear proliferation (by reducing the incentive to acquire nuclear weapons).

1. In keeping with U.S. declaratory policy of "strategic ambiguity" (which should continue), the U.S. should not specify what it includes in non-nuclear WMD attacks that could trigger a U.S. nuclear response. Certainly includes high-casualty BW and CW attacks, but may not include low-casualty CW ones. Could include massively-disruptive (with attendant high casualties) cyber attacks.

- Ensuring crisis stability between the U.S. and potential nuclear-armed adversaries to minimize the risk of a nuclear exchange:
  - Minimize the possible gains opponents might find in initiating nuclear use—whether intentional, accidental, unauthorized or due to miscalculation—especially in crisis situations.
- In achieving the ends listed above, the U.S. should strive to:
  - Avoid provoking Russia and China into changing their nuclear postures that are damaging to U.S. interests and those of its allies and friends.
  - Negate the potential strategic leverage of proliferators.

Operational Implications for the U.S. Nuclear Posture

- Deployed U.S. nuclear forces must be survivable under all scenarios in sufficient numbers to respond overwhelmingly (taking adversary defenses into account).
- Sustain current power relationships with key strategic powers:
  - "Essential equivalence" with Russia.
  - Suggested definition includes: (1) numerical parity in ODNW; (2) acceptable (to each side) infrastructure hedges; and (3) "tacticals" sufficient for the needs of U.S. alliances.
  - U.S. and Russia will not have mirror-image postures.
  - Greater U.S. reliance on SLBMs; greater Russian reliance on ICBMs
  - Maintain sufficient nuclear capability in comparison to China so Beijing lacks incentives to seek parity with U.S. (and Russia).
  - "Distance" between U.S./Russia and China likely to decrease from current 10:1 ratio, but unknown how "small" the disparity has to become (e.g., 2:1 ratio) for China to be tempted.
- As U.S. stockpile goes lower (in tandem with Russians), the importance of the following increases:
  - High confidence in the reliability of the stockpile and in the expertise and experience of the scientists, engineers, and production workers required to sustain it (*Interim Report*).
  - Assumes sufficient investment in the physical infrastructure (as a means) to both sustain confidence in stockpile and maintain the necessary human infrastructure (the essential ends).
  - Also assumes the infrastructure is exercised periodically.
- Even at very low numbers, U.S. maintains not just an SSBN force but a full triad:
  - Single-RV ICBMs both stabilizing in a crisis and hedge against SLBM vulnerability.
  - Bombers both visible for signaling purposes and flexible.

- Reducing the number of non-deployed weapons and upload capacity (in comparison to the deployed force) to limit rapid breakout capability, thus ensuring greater crisis stability at lower stockpile levels.
- Need for increased and unprecedented levels of transparency on national nuclear inventories:
  - Campaign to secure all loose nuclear material around the world in four years (as promised by the Obama administration) could begin with a U.S. decision to fully reveal the details of its total inventory of nuclear weapons (active and reserve, and awaiting dismantlement) and national supplies of SNM.
- Accounting for the asymmetries in the force postures of the key players in terms of their emphasis, for example, on ICBMs, SLBMs, "tacticals," non-nuclear strategic strike, etc.
- Impact of missile defenses on each nation's calculus of how much nuclear capability is enough increases as global stockpiles go lower.

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Reflections

James Dobbins

One may wish to begin by considering how the threat has changed. To do so one might rate the likelihood of nuclear attack from a) an existing nuclear power, b) a new nuclear power, or c) a non-state. During the Cold War, these would have been rated, on a 1-10 scale, as perhaps 3-0-0. Today the risks may be closer to 1-2-3. This suggests that it may be prudent to accept some additional risk in deterring existing nuclear powers if it helps reduce the risk from new or non-state nuclear actors. This is the underlying logic of current policy, the question being whether it has been taken far enough.

During the Cold War nuclear weapons were thought to be a necessary hedge against conventional defeat. Given America's crushing conventional superiority, this danger no longer exists. This change suggests that the U.S. could prudently make a no-first use pledge if that advanced other agendas. It also suggests that the United States would be safer in a world without nuclear weapons, assuming such a condition could be reliably achieved and maintained. This is the logic behind the Four Horsemen's proposal.

On the other hand, the current environment presents an increasing threat to U.S. allies from new nuclear powers. In the near term future, therefore, a main driver for the size of the U.S. arsenal will be the needs of extended deterrence designed to dissuade friendly countries from following hostile ones down the nuclear path. This requirement has long been established with respect to Europe, has become an issue with Japan, and is likely, in some form, to come into play in the Middle East in response to an Iranian bomb.

There appears to be a negative relationship between how expansively an Administration defines its nuclear employment doctrine and the level of funding it can get from Congress to maintain the arsenal. The more expansive the employment doctrine, the more leery will Congress be about funding improvements in weapons and infrastructure. This might change if Russia becomes much more menacing. In the absence of such a development, a restrictive doctrine, which limits nuclear use to a response to nuclear attack, may improve the prospects for Congressional funding of the RRW and modernization of the nuclear infrastructure. The promise of a renewed effort to ratify the CTBT might also help persuade skeptical members of Congress to vote for these programs.

As regards arms control, some movement toward a nuclear free world will need to be registered if one is to strengthen the NPT and the larger counter-proliferation regime. I would advocate a three-stage process, only two of which could be initiated in the short to medium term. The first would be a new round of U.S.-Russian negotiations, leading to some further reduction in arsenals. The second phase would be a dialogue among the established nuclear powers, by which I mean the P-5, in which the others were asked to agree to freeze while the U.S. and Russians come down, against an eventual time when all five could go further down together. There may also be confidence building measures all five powers can be asked to sign onto, e.g. detargeting. The third stage, which would be referred to but not launched until that (distant) future date when all the established nuclear powers begin to reduce together, would consist of a stated intention to then seek the participation of India, Pakistan and Israel.

As regards Prompt Global Strike, like Congress, I would be reluctant to fund a limited capability unless I was convinced that a larger one was desirable. I could be so convinced in the context of an arms control regime that clearly and unambiguously distinguished conventionally armed systems from nuclear. I am also somewhat skeptical that the increase in timeliness represented by using ballistic instead of cruise missiles (from a few hours to half an hour) can justify the added costs of deploying such an expensive way of delivering a conventional weapon. If it is found to be cost effective to deploy a completely distinct conventional intercontinental ballistic missile system, however, we should go ahead. If not, then we should not deploy conventional warheads on missiles that are counted and regarded as nuclear.

So, in sum, I would recommend further U.S. and Russian reductions, the elaboration of a path toward a nuclear free world, and the embrace of no-first use and ratification of the CTBT in order to strengthen the counter-proliferation regime, and secondarily, to improve prospects for modernizing our existing arsenal and infrastructure.

Part II: Infrastructure

A nuclear weapon is both a formidable and sophisticated device as well as the end product of considerable intellectual innovation and financial investment. Since its inception, the U.S. nuclear weapons complex, including national research laboratories and production facilities, has developed and maintained the nuclear weapons that have been part of the U.S. military arsenal since 1945 and has supported nuclear-related research. Beginning in 2000, the National Nuclear Security Administration (NNSA)—an agency within the Department of Energy—has managed the funding, research, maintenance, and security of the nation's nuclear weapons complex. In recent years, however, the changing mission and aging of the nuclear weapons themselves, along with resource constraints, are posing fundamental challenges to the organization and funding of the nuclear weapons complex. To better understand this situation, the Commission requested that experts examine the relevant issues, including overhauling the management and funding structure of the NNSA complex, the mission of the nuclear weapons labs, retaining expertise at the labs and production facilities, and the future physical infrastructure requirements of the complex.

To begin the chapter, Linton Brooks, who is a former NNSA administrator, provides an overview of the complex, which set the stage for the Commission's visit to Lawrence Livermore National Laboratory in September 2008. Since the commissioners did not all have an extensive nuclear infrastructure background, Brooks wrote this overview as a guide to understand the basic structure of the complex, including information on the three national laboratories, the Nevada Test Site, the four production facilities, and a description of plans to transform the complex. In his subsequent paper, Brooks expands on his primer by including a more substantive description of the general functioning and missions of the national laboratories. He broadens the scope by describing the main issues confronting the complex in the near future and includes the minimum requirements to maintain the status quo.

With the objective of providing a current analysis and alternatives for future complex transformation, several experts from the Nuclear Infrastructure expert working group offered their views to the Commission on the organizational problems and financial shortcomings that may affect NNSA and the labs in the future. Linton Brooks provides an in-depth look at the organizational structure and its regulations and bureaucracy, proposing several alternative models for NNSA's structure. This list of alternatives provided the Commission with insights and options to inform their future recommendations. Building on the theme of "complex transformation," Harold Smith offers a series of managerial and organizational reforms intended to help make NNSA and the labs more functionally efficient and cost-effective. Smith suggests that the weapons labs should be renamed "national security laboratories," and that the President should place them under the supervision of several agencies with a vested interest in their health, including the Departments of Defense, Energy, Homeland Security and the Directorate of National Intelligence. From a financial perspective, author Troy Wade examined the increased security costs at NNSA sites compared to security costs at DOD facilities. Increased costs in operating weapons labs, organizational inefficiencies, and a faltering budget have heightened fears that NNSA will not be able to maintain the country's "second to none" nuclear capabilities in the future, when NNSA is considering upgrading aging facilities as well as building new ones at existing locations. Given current funding difficulties, commissioners faced a quandary: which building and/or renovation projects—if any—should be funded, and in what order? Which should receive priority? In an extensive paper on the subject, Earl Whiteman examines the projects themselves, their funding projections, budgetary concerns, and the very the logic behind the projects.

When the Commission visited Lawrence Livermore National Laboratory in September 2008, it saw that the most obvious and precious resource committed to the weapons complex was the people. The human capital component of the nuclear weapons complex cannot be underestimated: it is the intellectual infrastructure that is responsible for the innovation behind, and upkeep of, the nation's nuclear stockpile. In another short primer for the Commission, Linton Brooks describes the basic challenges that pose a threat to retaining and attracting exceptional science and engineering talent. In a more in-depth look at the issue, Hank Chiles submitted a paper to the Commission that drew heavily from a Defense Science Board (DSB) report on the importance and sustainability of maintaining a skilled nuclear weapons report. To view the executive summary of the DSB report, see the appendix in this volume. With future science and technological advances in mind, Elbridge Colby met with the NNSA Director of the Office of Research and Development for National Security Science and Technology, Dr. Dimitri Kusnezov. Dr. Kusnezov and his team emphasized the powerful implications of developments in the science and technology fields and human capital needs as they relate to nuclear weapons in the coming years. Colby concludes that Congress must strive to maintain, and provide funding for, our "peerless national security science and technology base" in order to counter these future threats.

Physical infrastructure is another critical component of the labs, and production facilities are in danger of falling into serious neglect. In his paper, Robert Barker focuses on the infrastructure needed to support strategic ballistic missiles; he points out that there appears to be a lack of long-term planning and strategic vision for maintaining the health of the nuclear weapons infrastructure, specifically Navy and Air Force delivery systems. In a more specific piece concerned with funding difficulties related to air-delivery infrastructure, Barker examines the future of the nuclear-capable F-35 Joint Strike Fighter. He and the rest of the Nuclear Infrastructure expert working group agree that there is a lack of sustained budgetary support, which poses a real problem for the development of badly needed next generation delivery systems and their respective infrastructure.

In an effort to inform the debate surrounding the controversy between life extension programs for nuclear weapons—the Life Extension Program (LEP) approach—and proceeding with a new nuclear weapons design—Reliable Replacement Warhead (RRW)—Everet Beckner explains the details of each option for the Commission in terms of the infrastructure that would support these efforts. With advantages and disadvantages inherent in both approaches, Beckner leaves aside the controversy and focuses on the physical infrastructure requirements of both options, the possible future changes to stockpile size, the implications for lab personnel, and the building schedule for new NNSA facilities that may affect these options. In a subsequent paper, Thomas Scheber focuses on the definitional uncertainties of the term "new" when used to describe weapons: what is considered a "new" weapon and does the proposed RRW fit this definition?

To close the section, Linton Brooks discusses several additional nuclear infrastructure issues. His brief guide hones in on several important issues such as NNSA complex transformation funding, nuclear test readiness, and the advisability of maintaining all current NNSA labs and productions facilities, while providing options for the Commission to consider in making their final decisions on nuclear infrastructure.

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Primer on the Nuclear Weapons Complex

Linton F. Brooks

Overview

The current Complex consists of eight sites located in seven states. These include the three national laboratories (Los Alamos, Lawrence Livermore and Sandia),[1] the Nevada Test Site, and four production facilities:

- The Pantex plant in Amarillo, Texas.
- The Y-12 plant in Oak Ridge, Tennessee.
- The Kansas City plant.
- The Savannah River Tritium Facility in South Carolina.

Note that there is no production facility for plutonium components (pits). An interim capability is being established at Los Alamos and NNSA proposes that the permanent production capability be established there as well.

The National Laboratories

The three national laboratories (often called the weapons laboratories to distinguish them from other DOE national laboratories) are all multi-purpose, multi-disciplinary facilities with strong basic science and engineering components. Their missions and sizes are:

Los Alamos National Laboratory, Los Alamos, NM

- Function—A multi-program laboratory supporting research (Weapons Design and Physics) and a limited production mission (Pit and Detonator) predominately in national security.

- Number of employees: 6,071
- Budget: $1.5 B

Lawrence Livermore National Laboratory, Livermore, CA

- Function—A multi-disciplinary research and development program supporting the design, development, and certification of the nuclear stockpile (Weapons Design and Physics).
- Number of Employees: 4,477
- Budget: $1.0 B

Sandia National Laboratories, Albuquerque, NM, and Livermore, CA

- Function—Several areas: 1) Nuclear weapons (Nonnuclear Component Design/Production), 2) Nonproliferation and Assessment, and 3) Military Technologies and Applications.
- Number of employees: 4,307
- Budget: $1.2 B

Each laboratory houses major supercomputing facilities. Each has unique, large and expensive research tools such as the National Ignition Facility (Livermore), Microsystems and Engineering Sciences Applications (MESA) (Sandia), or the Dual Axis Radiographic Hydrodynamic Test facility (DAHRT) (Los Alamos. For security reasons NNSA has removed all significant quantities of special nuclear material (plutonium and highly enriched uranium) from Sandia and plans to remove all such material from Livermore by 2014.

The Nevada Test Site

Located 65 miles north of Las Vegas, NV, the Nevada Test Site maintains the capability to conduct underground nuclear testing; conducts high hazard experiments involving nuclear material and high explosives; provides the capability to disposition a damaged nuclear weapon or improvised nuclear device; conducts non-nuclear experiments; and conducts research and training on nuclear safeguards, criticality safety, and emergency response. It also performs significant high-hazard work for other agencies.

- Number of Employees: 2,085
- Budget: $0.2 B

The Production Complex

There are four production plants, each performing unique functions:

Pantex Plant, Amarillo, TX

- Function—Pantex dismantles retired weapons; fabricates high explosive (HE) components and performs HE research and development (R&D); assembles HE, nuclear, and non-nuclear components into nuclear weapons; works on and modifies weapons; performs non-intrusive pit modification; and evaluates and performs surveillance of weapons. It also provides interim plutonium pit storage pending completion of a U.S. capability to eliminate surplus pits.
- Number of employees: 3,309
- Budget: $0.5 B

Y-12 National Security Complex, Oak Ridge, TN

- Function—1) Manufacturing and assessing nuclear-weapon secondaries, cases, and other weapon components, 2) dismantling weapons returned from the stockpile, and 3) providing safe and secure storage and management of uranium. Y-12 also supplies highly-enriched uranium for use in the Navy nuclear reactors for submarine and aircraft carrier propulsion.
- Number of employees: 3,820
- Budget: $0.9 B

Kansas City Plant, Kansas City, MO

- Function—Manufactures and procures non-nuclear weapons components, and evaluates and tests these weapons components. Manufactures classified components for weapons and for the secure transportation system that NNSA maintains. NNSA primary non-nuclear production plant.
- Number of employees: 2,379
- Budget: $0.5 B

Savannah River Site, Aiken, SC

- Function—Three core mission areas: 1) performs loading, unloading, and surveillance of tritium reservoirs, and provides tritium reservoirs to meet the requirements of the Nuclear Weapons Stockpile Plan, 2)

conducts Stockpile Evaluation Program and 3) extracts tritium produced at the Tennessee Valley Authority reactors. Also performs tritium related research and development.
- Number of employees: 1,382
- Budget: $0.3 B

Complex Transformation

NNSA plans to modify weapons complex according to a "preferred alternative" which has been subject to extensive review and public comment. It would maintain all of the existing sites, but would shrink the floor space devoted to weapons work from 35 million square feet to 26 million square feet.

The NNSA approach would consolidate functions (especially at the laboratories) to avoid duplication. Specifically:

- Non-nuclear design and engineering and major environmental testing, now done at all three labs, would be consolidated at Sandia.
- Plutonium work, now done at both Livermore and Los Alamos, would be consolidated in Los Alamos.
- High hazard testing, now done at all three laboratories and the Nevada Test Site, would be consolidated to Nevada.
- New supercomputing platforms would be at Los Alamos and Livermore, rather than all three laboratories.

Both Los Alamos and Livermore would retain nuclear design and engineering responsibilities in order to provide for peer review.

The production complex would be modernized in place, with significant consolidation, especially at Y-12. Several major new nuclear facilities would be built, including a plutonium pit production capability at Los Alamos, a Uranium Processing Facility at Y-12 in Tennessee and a Pit Disassembly and Conversion Facility for eliminating surplus pits (this facility at Savannah River is separate from complex modernization but will compete for funds).

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1. Sandia includes two laboratories; a larger facility in New Mexico and a smaller facility adjacent to the Lawrence Livermore National Laboratory in California. Sandia also operates the Tonopah Test Range for flight testing of gravity weapons.

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Minimum Requirements for Maintaining the National Laboratories and the Intellectual Infrastructure

Linton F. Brooks

Summary. The Commission has concluded that the three weapons laboratories are a crucial—perhaps the most crucial—part of the nuclear infrastructure and that their health must be assured. This paper discusses the size, number and activities necessary at the weapons laboratories to ensure their continued health. Although this paper focuses on the laboratories, it is important to recognize that "intellectual infrastructure" includes more than laboratory scientists. A true responsive infrastructure requires development and production engineers at both laboratories and production plants.

How Large Must the Laboratories Be?

There is consensus that the overall capabilities of the laboratories are crucial to the weapons program and to the nation. In their interim report, the Commission noted that

> The Department of Energy's laboratory system provides invaluable support to the nation in three ways. First, it actively maintains the safety, security, reliability and effectiveness of the stockpile over the long term. Second, the system is the wellspring of the talent and tools needed to address a multitude of national problems, such as nonproliferation research, nuclear threat reduction, nuclear forensics, bioterrorism defense, missile defense, countering improvised explosive devices, nuclear energy, and alternative energy options.

> Finally, the system plays an important role in maintaining the intellectual scientific leadership of the United States.

There is, however, no consensus on the minimum total laboratory size needed to preserve those capabilities. NNSA has established a goal of reducing the number of laboratory personnel funded by the weapons program by 30 percent.[1] There is, however, no analytic basis for this reduction. NNSA does not know whether such a reduction would leave the weapons program too large or too small.

The absence of an agreed minimum level for the laboratories raises several dangers. First, the United States could inadvertently reduce laboratory capabilities below some tipping point, after which it would be difficult to design weapons if there is a future requirement to do so (or, less likely, where it would be difficult to continue to maintain an effective Stockpile Stewardship Program). This would remove an important hedge against an uncertain future. Second, in seeking to avoid this outcome, the United States could maintain more capability than needed, thus diverting resources from other important weapons capabilities. Finally, not having some standard for what is required leaves NNSA and the laboratories vulnerable to the charge that we simply seek the largest laboratory complex we can get. A reaction to this belief could be for Congress to reduce laboratory funding in an uncoordinated and unacceptable fashion.

The situation is complicated by the fact that it is not simply the number of people associated with the weapons program that matters, but the maintenance of specific critical skills in a variety of disciplines. In addition, it takes a decade or so beyond earning a Ph.D. in physics (or some other relevant technical field) before laboratory workers take on independent responsibilities for nuclear weapons design or surveillance tasks. Thus, the analysis of requirements is a difficult and complex task.

There has been analysis of some specific areas such as weapons designers and radio-chemists, but we lack any agreed understanding of how many people of what expertise are required. Such an agreed understanding could allow more aggressive attempts to ensure that funding and laboratory assignments are sufficient to maintain an acceptable (though minimal) enduring capability. As the EWG noted in an earlier paper, "the Executive Branch [should] conduct a rigorous study to determine the minimum size (by discipline), that the national laboratories need to maintain and support the weapons program." We reaffirm that recommendation.

An important—and difficult—issue is who should conduct such a study and how it should be managed. While laboratory participation is clearly required, a study conducted by the laboratories without external validation could lack credibility both with Congress and with portions of the

Executive Branch such as the Office of Management and Budget. In EWG paper 3—Nuclear Weapons Personnel Expertise (based on the September 2008 *Defense Science Board Task Force on Nuclear Deterrence Skills*)—the EWG endorsed the following approach:

- The Secretary of Defense, along with the Secretaries of State, Energy, and Homeland Security and the Director of National Intelligence should lead the development of a clear U.S. vision and strategy for nuclear deterrence.
- The Secretary of Defense should then establish nuclear requirements for capabilities, including nuclear competencies, force structure and programs for the next twenty years, using the Nuclear Posture Review (NPR), and should provide requirements for NNSA planning.[2]
- The NNSA Administrator should make development of capabilities and competencies an explicit part of NNSA planning.

This process should include establishing the minimum required size of the weapons program. In one possible model, the Advanced Strategic Computing (ASC) program recently attempted to analyze needs for the entire program. This was driven by continued erosion in funds for that element of the weapons budget. The program assembled a group of outside experts, (including some with little weapons experience but knowledgeable of the business of high-performance computing). The laboratories provided initial recommendations on the numbers of required personnel in various aspects of ASC activity and then the assessing group reviewed their process and results.

Based on this apparently successful experience, NNSA should form a special task force with heavy participation of retired weapons experts to assist in evaluating laboratory proposals for the minimum necessary size for the weapons program. The results should be reviewed (as a form of "sanity check") by non-NNSA entities such as the Defense Science Board or the Strategic Advisory Group (SAG) of the U.S. Strategic Command. Following these reviews, the Secretary of Energy, based on the recommendations of the NNSA Administrator, should formally promulgate these minimum standards. The Congress should require that annual NNSA budget submissions include an assessment of whether the budget as proposed will maintain these minimum capabilities.

It will be important to allow flexibility to make adjustments in both numbers and type of skills as technologies change (new technologies and techniques are developed) and the threat evolves in ways we may not anticipate. Such changes will need to be transparent to the Congress.

One Physics Lab or Two?[3]

Livermore and Los Alamos are design laboratories that each focus on the physics package of nuclear weapons (Sandia, often referred to as an engineering laboratory, concentrates on components outside the physics package). Periodically questions are raised about the need for two physics laboratories. Two separate laboratories provide peer review in the one area—the functioning of the physics package—that we cannot test and where our theoretical understanding remains incomplete. Such peer review will be even more important if, as many expect, the United States ratifies the Comprehensive Test Ban Treaty in the future.

It is, of course, possible to create a form of peer review within a single organization (Sandia National Laboratory has done this, for example). But even if we were convinced that true peer review could exist in a singe organization, the benefits from combining the two physics laboratories are illusory. There are unique facilities at both Los Alamos (plutonium, DAHRT) and Livermore (NIF) that the weapons program requires and that would be prohibitively expensive to duplicate. Thus, a new "single" design laboratory would need to maintain both the California and New Mexico facilities, drastically reducing any anticipated savings. Some efficiencies might accrue from common management, but these are likely to be small and not worth the disruption. This is particularly true because both laboratories are completing a period of transition to new management arrangements after decades of being operated by the University of California. The transition has been turbulent and what both Los Alamos and Livermore need now is stability. The approach set forth above for determining the minimum needed to support the weapons program, is a better approach to eliminating redundancy.

What Must the Laboratories Be Allowed/Required to Do to Maintain Proficiency?

The right number of people with the right skills and educated in the right disciplines is a necessary but not sufficient precondition for maintaining proficiency. Those skills must be exercised. This requires meaningful work that involves the entire nuclear weapons complex, including both the laboratories and the production plants. Just like scientists, development and production engineers need to be exercised if they are to maintain proficiency. Indeed, some argue that these engineers are more important than production facility rebar and concrete in maintaining a responsive infrastructure. Reestablishing production engineering capabilities (if lost) has a long response time. All examinations of the nuclear enterprise have concluded that there is no substitute for real and challenging work in maintaining proficiency. As the Defense Science Board noted in describing the historic approach to maintaining proficiency:

> The other reality check was the continuous design, development, production, and surveillance cycle for new weapons....The vast majority of the technical people in the nuclear weapons complex were engaged in this cycle. While nuclear testing was supremely important, the vast majority of data collected to assess the quality of the weapons came from non-nuclear product acceptance testing at the production plants and surveillance testing throughout weapon life. Rigorous product testing provided continuous feedback on the competence of the people who designed and produced it. Knowledge and experience in weapons design is the keystone that supports decisions on all other the elements of the mission. **Decisions on how to resolve technical problems in production, surveillance, or dismantlement have to be rooted in a thorough understanding of the design.** [emphasis added][4]

The Bush Administration's approach to implementing the need to maintain proficiency was to proceed with the cost and feasibility study (and, almost certainly—assuming support from Congress—with the ultimate deployment) of the Reliable Replacement Warhead (RRW).[5] This is not the only approach that could be taken. For example, Richard Garwin advocates that:

> Substantial nuclear design and capability should be maintained at the national labs….the system ought to be challenged every five years with a competition for the design of simplified nuclear warheads, including a much broader range of options, such as the total elimination of plutonium from U.S. nuclear weapons.[6]

In his briefing to the Commission, Dr. Garwin suggested that these efforts might lead to prototypes but should not necessarily lead to deployment. It is unclear whether the necessary creativity will be forthcoming from the design and production engineering communities for designs that are not actually planned for production. While Dr. Garwin's solution may have a long term role, the Infrastructure EWG believes it would be preferable to move forward with development of modified designs that can actually be deployed. If it proves infeasible to move forward with an enhanced safety, security, and reliability design for a replacement W76, the recently announced modernization of the B61 bomb should serve as a mechanism for exercising the necessary design and production skills, including those associated with a new plutonium pit.

The Importance of National Leadership

None of the steps implied by the discussion so far will succeed over the long term without support from senior leadership, including the President and the Secretaries of Defense and Energy. As a recent Defense Science Board report noted:

> **In both the short and long term, retention of the right caliber technical staff for the mission will depend significantly on staff perception of the national importance of the mission and the amount of time they are allowed to spend on the technical aspects of the mission.** A number of staff interviewed perceived the nuclear weapons enterprise as a declining industry. [emphasis in original][7]

The Infrastructure EWG strongly endorses this view, which is also one of the fundamental conclusions of the recent Schlesinger panel.

The Bottom Line

The Commission should consider making the following recommendations to the Congress:

1. That the Congress direct the Administration to conduct a review of the minimum size of the weapons program after the Nuclear Posture Review has established the size of that program, that it require the annual budget submission to indicate whether the budget as proposed will maintain these minimum capabilities, and that it ensure the funding necessary to sustain that program.
2. That the Congress reject any consideration of eliminating one of the existing weapons laboratories.
3. That the Congress support the development of modified designs to ensure the safety, security and reliability of specific U.S. warheads with the intent, inter alia, of maintaining the design and production engineering capabilities of the nuclear weapons enterprise.
4. That the Congress firmly endorse and urge the President and the appropriate cabinet officers to make it clear that the maintenance of an effective nuclear weapons complex, including maintaining a design capability, is an important national goal.

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1. This is *not* the same as reducing the overall laboratory by 30 percent, although it has been misinterpreted as such. NNSA assumes that many of these individuals will remain at the laboratory but will be funded by other programs. This is one aspect of the NNSA attempt to convert the weapons laboratories to national security laboratories. As the EWG made clear in an earlier paper (EWG paper 1—Arrangements for broadening support for the weapons laboratories), NNSA efforts to implement this new approach have thus far been insufficient. Further, it is unclear the degree to which NNSA assumes these individuals could return to the weapons program if required. Some EWG members are skeptical of any concept that assumes these individuals would serve as some form of "nuclear weapons program reserve."
2. Past NPRs have not provided this level of detailed guidance. The forthcoming one needs to do so.

3. The argument in this section was previously made in EWG Paper 12—Miscellaneous Issues for the Commission. It is included here for completeness.
4. *Defense Science Board Task Force on Nuclear Deterrence Skills,* September 2008, page 26.
5. The term "Reliable Replacement Warhead" most appropriately refers to a concept for modifying existing warhead designs to enhance safety and security and improve performance margins and thus reliability. The past Administration planned the initial RRW development as a replacement for some of the W76 warheads on the Trident II submarine launched ballistic missile.
6. Richard L. Garwin, "A Different Kind of Complex: The Future of U.S. Nuclear Weapons and the Nuclear Weapons Enterprise," published on Arms Control Association (http://www.armscontrol.org/act/2008_12/Garwin), page 7.
7. *Defense Science Board Task Force on Nuclear Deterrence Skills,* September 2008, page 25.

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Alternatives to the Current NNSA Model

Linton F. Brooks

Summary. This paper examines alternatives to the current organizational location of NNSA. The primary (but not the only) reason for considering these alternatives is to improve performance of the plants and laboratories by reducing unnecessary and obtrusive DOE/NNSA oversight and regulation.

Background. At their September meeting in Livermore, the Commission was briefed that there are numerous reports of excessive regulation by DOE/NNSA that increases overhead costs and reduces morale and efficiency. In theory, a semi-autonomous NNSA could act to reduce excessive regulation. In practice, this has proven exceptionally difficult. Because attempts to reduce intrusive and excessive oversight and regulation within DOE have been unsuccessful, it may be appropriate to consider different organizational arrangements, including removing NNSA from DOE. The Commission asked the Infrastructure Working Group to consider alternative models that might reduce the burden of regulation and thus reduce the overall cost and increase the overall effectiveness of the weapons program.

Will moving NNSA yield significant improvements? It is important to recognize that we do not *know* that removing NNSA from DOE will actually reduce the regulatory burden on the plants and laboratories. In 2005, a Defense Science Board Task Force examined production at the Pantex plant and concluded that excessive regulation originating outside NNSA but within a risk-averse DOE was raising cost and hampering production. An internal review by NNSA leadership concluded that some of the problems lay within NNSA itself. More recently, there has been anecdotal evidence of NNSA micro-management of the new contract at Lawrence Livermore National Laboratory. Organizational changes may be necessary for reducing the regulatory burden (see discussion below), but may not be sufficient or even the most important factor.

In 2006 and 2007, NNSA conducted a pilot program exempting the Kansas City Plant from essentially all DOE regulations and making other management changes in oversight. Kansas City was selected for the pilot because it conducts no nuclear operations and thus could depend entirely on commercial standards and the contractor assurance system. An external audit documented $24 million in first year savings and estimated future additional savings of $4 million/year.[1] These savings represent about five percent of the Kansas City annual budget. Extending this approach throughout the complex is feasible, although savings at most other sites would not be as high, assuming no change in regulation of high hazard nuclear operations. If the full five percent could be achieved at Sandia National Laboratory (which conducts no nuclear operations) and roughly half that at all other sites, total potential savings would be about $170 million annually. Savings of this magnitude, even if they can be achieved, may not, by itself, be sufficient to justify the disruption of a major organizational change. This is particularly true because external review revealed that "the success of this cost reduction initiative was made possible only by the direct involvement of the highest level DOE and NNSA executives"[2] and the sustainment of such involvement may prove difficult.

Are there other benefits from a different organization? Even if cost savings do not materialize or are insufficient for justifying an organizational change, there are other potential benefits from a new organizational arrangement. Among those sometimes cited:

- Currently the Department of Defense establishes requirements for nuclear weapons with limited regard for NNSA costs and expects NNSA to fulfill those requirements. If NNSA were within the Department of Defense, DOD would be forced to make tradeoffs between weapons requirements and other strategic capabilities. On the other hand, the weapons program could also be used as a bill payer (as would have been likely during parts of the Bush Administration, given the lack of DOD interest in nuclear weapons during most of the past eight years).
- Oversight and inspections by the Defense Nuclear Facilities Safety Board (DNFSB)[3] is widely believed to contribute to the regulatory burden on NNSA facilities. Legislation moving NNSA facilities out of DOE could remove those facilities from DNFSB cognizance. On the other hand, the DNFSB was established to deal with legitimate safety concerns, many of which remain.
- Although NNSA is under the jurisdiction of the Armed Services Committees for authorization, appropriations are handled by the Energy and Water Appropriations Subcommittees of the House and Senate.

> Having two subcommittees (Energy and Water, and Defense) that provide separate appropriations for DOE and for DOD results in significant inconsistencies that might be eliminated were NNSA removed from DOE.[4]

Finally, the Kansas City experience may understate the value of reducing the regulatory burden, especially at the national laboratories. The staffs of all three weapons laboratories believe that the regulatory burden is excessive. That imposes a significant cost, even if the cost cannot be measured in dollars. The existence of numerous DOE directives of varying utility may not be as important as the overall attitude of those performing Federal oversight. Two broad attitudes are often cited as contributing to excessive regulation. The first is the failure of NNSA and DOE to distinguish between what to do (a government function) and how to do it (a contractor responsibility). This attitude leads to overly prescriptive requirements in both DOE regulations and plant and laboratory management and operations contracts. The second unhelpful attitude is the tendency of the government to respond to problems by imposing new rules that will "guarantee" that the problem does not recur. This is particularly noticeable in the area of security, where it is, in part, driven by the tendency of some in Congress to react very strongly (some would say overreact) to security problems at weapons laboratories.

Can the regulatory burden be reduced without moving NNSA? In principle, as the Kansas City pilot demonstrates, it should be possible to reduce micromanagement within the existing structure. Although NNSA was formed in response to security problems, the Administrator has, in theory, broad authority over all areas of operation, including the power to exempt NNSA from DOE regulations and to substitute NNSA-specific procedures.[5] In practice, however, using the flexibility intended for a separately organized or "semiautonomous" Administration has proven difficult. Some illustrations:

- During the first term of the Bush Administration, the DOE General Counsel effectively prevented any NNSA actions exempting NNSA from any DOE regulations, arguing any such action required DOE staff concurrence.
- In 2005, the incoming Secretary surveyed senior non-NNSA officials[6] concerning the NNSA Act. All opposed the NNSA Act as written, primarily because it denied them the ability to provide direction to NNSA. This attitude was equally strong among political appointees and within the career staff.
- In 2005, as noted earlier, a Defense Science Board Task Force examined production at the Pantex plant and concluded that excessive regulation originating outside NNSA in a risk-averse DOE was raising cost and hampering production. Although the Task Force specifically attrib-

uted the problem to non-NNSA DOE staff, the department limited its response to an intensive review of internal NNSA procedures.
- The Kansas City pilot described above was delayed because of concerns of non-NNSA offices over exempting Kansas City from regulations for which they had responsibility. Although the initial intention was to extend the pilot to other NNSA sites if successful, it now appears this will not happen because of objections from non-NNSA offices.

Despite excellent working relationships in some areas, implementation of the NNSA Act and maintaining NNSA autonomy require constant, low-level bureaucratic warfare. Some would assert that the NNSA approach has not so much failed as it has never been tried. Improvements in this situation would require both vigorous action by NNSA leadership to shift oversight to a less intrusive approach and a strong, activist Secretary of Energy who wanted to increase NNSA autonomy. The presumptive Secretary of Energy, Steven Chu, is deeply familiar with the DOE laboratory system but has essentially no experience with the nuclear weapons program. His attitude toward NNSA is not known. In addition, audits and reviews by the Government Accountability Office (GAO), DOE Inspector General, and Defense Nuclear Facilities Safety Board add significantly to the regulatory burden and are not under the control of either the Secretary or the Administrator.

Dealing with the question of attitude. A major driver of micromanagement and excessive regulation is the attitude of the Federal workforce. Without changes in attitude, organizational changes will not solve the problem. An attitude that the Federal workforce knows best is reflected in both unreasonable regulations and excessive oversight in implementing them. Moving NNSA is only justified if it assists in changing this attitude. The following steps appear necessary:

- The Administrator must be committed to reducing micromanagement. This should be a condition of both appointment and confirmation.
- The Administrator must have flexibility to issue regulations without being bound by existing DOE regulations or staff. This implies removing NNSA from its current structure within DOE.
- The Administrator should issue no regulations concerning occupational health and safety but should depend on the Occupational Health and Safety Administration (OSHA) for both regulations and oversight. The Kansas City pilot shows this is feasible.
- The Administrator should manage a transition over a three year period to full nuclear regulation by the Nuclear Regulatory Commission. Jurisdiction of the Defense Nuclear Facilities Safety Board and NNSA oversight of nuclear safety should cease at that point.

Under this approach, NNSA would retain security oversight (since there is no logical external body to provide such oversight), oversight of contracting, and of construction management. Because this revised oversight model should require a smaller Federal force, not all NNSA employees would transfer to the revised organization, wherever it is located. Those to transfer should be selected, in part, based on their understanding and acceptance of the need to reduce Federal micromanagement and on their commitment to the distinction between the government's duty to determine what is to be done and contractor's responsibility to decide how to do it.

Issues with any major organizational change. Some issues must be dealt with if any significant change is to be implemented, especially one removing NNSA from DOE. The first is which functions move with NNSA and which do not. In addition to the weapons program, NNSA is responsible for a large nuclear nonproliferation effort and (at least formally) for the Navy nuclear propulsion program. The nuclear propulsion program has a dual reporting structure to both the Navy and DOE. It requires limited supervision from NNSA, is exempt from most DOE regulations, and has a fifty-year history of exceptionally sound management. Prior to the establishment of NNSA the naval propulsion program reported to the Assistant Secretary for Nuclear Energy; reestablishing that relationship would be easy and is the obvious choice.

What to do with the nonproliferation program is less clear. It could remain within NNSA even if NNSA moves from DOE, could revert to being a separate organization within DOE headed by an Assistant Secretary (as it was prior to the establishment of NNSA), or could be merged with the Defense Threat Reduction Agency, especially if NNSA were shifted to the Department of Defense. Because much (but not all) of the NNSA nonproliferation program involves the national laboratories, it is probably best to retain the program within NNSA, wherever NNSA ends up.

A related issue is the need to identify those functions now being performed by DOE on behalf of NNSA. These include some financial and legal functions, for example. Adequate numbers of people will need to be transferred (or billets authorized) to allow these functions to continue in the separate NNSA.

A third issue involves environmental remediation at NNSA facilities. Under a complex and confusing system, DOE's Office of Environmental Management is responsible for remediation of legacy conditions at NNSA sites (work that is not expected to be complete for another decade) while NNSA is responsible for the environmental consequences of current operations. Because the NNSA Act precludes the Office of Environmental Management from giving direction to NNSA contractors, a parallel chain of command system has been created that is clearly sub-optimal. In 2004, the Administration sought to transfer all environmental responsibilities at NNSA sites to NNSA. Congress rejected this proposal and the second term leadership in DOE elected not to renew it. The current arrangements are too fragile to work if NNSA is removed from DOE; the obvious solution is to renew the current Administration's 2004 proposal.

A final issue is philosophic. Today, the nation benefits from having two independent voices (Defense and Energy) on technical nuclear issues. Either any future organizational changes should preserve two independent voices by keeping NNSA out of the Department of Defense or the nation should make a conscious decision that the risk of giving up this condition is acceptable.

Not all NNSA problems will be solved by organizational change. Several Experts Working Group (EWG) members believe that NNSA needs greater attention to the inherently Federal functions of program management and strategic planning. Reducing the effort NNSA devotes to oversight may facilitate that greater attention, but it will not create it. There are doubtless many other examples.

Options

Any major change to the current organization will require legislation. One possibility would be to abolish NNSA and return to the integrated DOE organization that existed before 2000. With one exception, the members of the EWG reject this option, believing that the reasons for attempting to provide NNSA with autonomy still pertain.[7] Assuming increased autonomy from DOE to be a goal, the following options are possible:

1. *Strengthen NNSA within DOE.* Under this approach, legislation would clarify the intent of Congress to maximize NNSA's autonomy. It would establish a separate Chief Financial Officer, mandate a separate NNSA budget,[8] mandate that DOE regulations apply to NNSA only if either the Administrator desired them to or the Secretary specifically directed their applicability in each individual case (with a legislative presumption that they would not apply), and allow the Administrator to determine both the timing and scope of inspections by the DOE oversight organization. These changes would allow a determined Administrator to change the oversight model in NNSA. They would also almost certainly increase friction between NNSA and the rest of the Department. They would do nothing to encourage DOD to consider the NNSA costs of its requirements, to reduce the burden imposed by the Defense Nuclear Facilities Safety Board, or to eliminate the inconsistencies incident to having NNSA and DOD dealt with by separate Appropriations subcommittees.
2. *Establish NNSA as an independent agency reporting to the President through the Secretary of Energy, in the same way that the former Arms Control and Disarmament Agency (ACDA) reported through the Secretary of State.*[9]

Under this approach, NNSA would have a completely separate budget, would issue its own regulations, and would establish and operate its own internal oversight organization. It would receive intelligence support from DOE and would remain under the jurisdiction of the DOE Inspector General. The Secretary would provide very broad oversight (similar to that now provided by the NNSA Administrator to Naval Reactors) and would serve as the Cabinet level contact with the White House (for example in National Security Council issues or stockpile certification). This option would remove most internal obstacles to a streamlined oversight process at NNSA sites (although establishing such a process would still require strong action by the NNSA Administrator). Like the previous option, it would not lead DOD to consider the NNSA costs of its requirements. If coupled with a shift to external regulation (discussed above), it could reduce the burden imposed by the Defense Nuclear Facilities Safety Board. Properly implemented, it could also eliminate the inconsistencies inherent in separate Appropriations subcommittees.

3. *Make NNSA a Defense Agency, similar to the Defense Advanced Research Projects Agency.*[10] In this option, NNSA would become a Defense Agency but would be headed by a Senate-confirmed Administrator at the Executive Level III (under secretary equivalent) to ensure adequate influence within OSD. This approach would force tradeoffs involving weapons requirements, leave the Defense Nuclear Facilities Safety Board behind, and lead to the NNSA budget being considered by Defense Appropriations subcommittees along with the rest of DOD. It would allow the Administrator flexibility in establishing an oversight model, since DOD has limited experience with Government Owned, Contractor Operated (GOCO) facilities.[11] On the other hand, DOD periodically (including much of the last eight years) ignores nuclear weapons, giving the topic only minimal senior level attention. Having nuclear weapons within the DOD budget may make it too easy to slight long term needs and to use the weapons program as a bill payer. In addition, there are those who question DOD's ability to properly operate world-class multipurpose laboratories like the weapons laboratories. Finally, this option eliminates the independent voices in the process of annual stockpile certification that come from involving multiple agencies. It is noteworthy that the Defense Science Board considered and rejected this option.[12]
4. *Transfer the production complex to DOD while retaining the weapons laboratories and the Nevada Test Site within NNSA.* This option would be combined with either the option to strengthen NNSA within DOE or the option to establish NNSA as a separate organization reporting to DOE.

It is based on the assumptions that production is more consistent with the DOD mission (DOE has no production facilities except for those associated with the weapons program), that DOD culture is ill-suited to managing national laboratories and that the weapons laboratories benefit from ease of association with the other DOE national laboratories. Thus, the Pantex Plant (weapons assembly), Y-12 National Security Complex (uranium components), Kansas City plant (non-nuclear manufacturing) and Savannah River Tritium Facility would transfer to DOD. The plutonium facilities at Los Alamos conduct both production and research. At least initially, they should remain in NNSA on the assumption that the science is the more important mission.[13] Splitting the production complex from the national laboratories would alleviate the concern that the Experts Working Group has that complex modernization will squeeze out funding for science. This option means the interface between research and production will be more complex, but the interface between production and the military's operations of nuclear weapons would be simpler. It encourages better coordination between weapons production (but not research) and other DOD programs. On the other hand, the greatest perceived problems with the current arrangements (or at least the most vocal concerns) are at the weapons laboratories, which would remain within NNSA/DOE.

5. *Establish NNSA as an independent agency reporting directly to the President, similar to the National Aeronautics and Space Administration.* This option would give the Administrator the maximum flexibility to establish a new oversight model. It could be implemented in a fashion that would eliminate the jurisdiction of the Defense Nuclear Facilities Safety Board and shift the NNSA budget to the Defense Appropriations subcommittees. There is a serious question, however, as to whether the nuclear weapons program is seen as important enough politically to receive adequate White House attention if separated from a cabinet department, especially since the NNSA budget is relatively small for an independent agency. Thus, this may not be a practical option. Further, having no Cabinet officer responsible for nuclear weapons issues will inevitably mean that technical and production issues will be given insufficient consideration in interagency deliberations. Finally, on issues of weapons certification, the views of the Secretary of Defense could overwhelm those of the head of a small independent agency.
6. *Replace NNSA with an independent National Nuclear Weapons Agency reporting to the President through a "Board of Directors" chaired by the Secretary of Defense and including the Secretary of Energy, Secretary of Homeland Security, and Director of National Intelligence.* This option seeks to maintain the advantages of the previous option while providing both oversight and "top

cover" for the weapons program. It was proposed by a Defense Science Board (DSB) Task Force in 2006 but was not seriously considered by either DOD or DOE. The Board of Directors would ensure the "fundamental viability of the enterprise" and that its objectives were "clearly defined and achieved."[14] While the DSB was silent on budgeting, it would appear that the new agency would require a separate budget. Otherwise, it will become a *de facto* sub-agency to whichever department provides its budget.[15] This approach relies on a model that is not well understood and has never been attempted by the Federal government. Taking this much of a risk with something as central to U.S. security as the nuclear weapons program would be a major decision.

The members of the Infrastructure EWG all believe that the present arrangement is not working and that strengthening NNSA within DOE (option 1 above) is unlikely to be enough. Most (but not all) members reject a move to DOD (option 3) as tending to submerge the weapons program in a large department focused elsewhere, risking neglect and underfunding. Most (but not all) members also reject transferring the weapons production complex DOD (option 4) because we believe that integration of production and science will be more, not less, important at low production rates. Finally, we see having NNSA report through a "Board of Directors" (option 6) as unsustainable in the long term. Therefore, the majority of the EWG recommend that NNSA be established as an independent agency reporting to the President either through the Secretary of Energy (option 2) or directly (option 5). Reporting through the Secretary of Energy is preferable, but only if the necessary autonomy can be assured.

Recommendations

The Strategic Posture Commission should recommend the following:

1. *That the Congress amend the NNSA Act to establish NNSA as a fully separate agency reporting to the President through the Secretary of Energy.* The legislation should include the following provisions:
   - That DOE regulations will not apply to NNSA and that the Administrator should issue appropriate regulations without external approval.
   - That the Administrator should issue no regulations concerning occupational health and safety but should depend on the Occupational Health and Safety Administration (OSHA) for both regulations and oversight.
   - That NNSA will be responsible for all environmental management, including legacy remediation, at NNSA sites.

- That the NNSA budget will be administered completely separate from the budget for the Department of Energy. To implement this separation, the NNSA budget should be considered by the defense appropriations subcommittees of the House and Senate Appropriations Committees, thus ensuring both expertise and concern for defense issues.
- That the NNSA Administrator and the Nuclear Regulatory Commission will jointly prepare and implement a plan for a three year transition to NRC regulation throughout the NNSA weapons complex.
- That once the Administrator and the Commission certify to the Congress that this transition is complete, Defense Nuclear Facilities Safety Board jurisdiction over NNSA will cease.
- That the Inspector General of the Department of Energy be assigned a dual position as Inspector General of NNSA with either the Secretary of Energy or the NNSA Administrator empowered to request an investigation by the Inspector General.
- That with the exception of the Inspector General and intelligence support, the new organization be self-contained and not depend for services or support on the rest of DOE.
- That the NNSA Administrator be designated an advisor to the National Security Council and attend NSC meetings when issues under NNSA's responsibility are being discussed. This would be similar to the procedures that applied to the former Director of the Arms Control and Disarmament Agency.[16]
- That the Secretary of Energy will retain his or her responsibilities with respect to stockpile certification and that the Administrator be obligated to provide the Secretary and those members of the DOE staff the Secretary designates with access to all information necessary to aid the Secretary in carrying our his responsibilities.[17]
- That, three years after the effective date of the new changes, the Government Accountability Office (GAO) should formally evaluate whether the necessary independence from DOE has been achieved. If it has not, Congress should consider having NNSA report directly to the President.

2. *That the Senate ensure during confirmation that the next NNSA Administrator and his or her confirmed Deputies are committed to reducing micromanagement, to maintaining the distinction between the government responsibility for deciding what is to be done and the contractor responsibility for deciding how to do it, and to the GOCO model of operations.* To ensure this, the Administrator should commit to a review of all individuals with oversight responsibilities prior to approving them for transfer to the new organization. The Administrator should also commit to reporting to

Congress on the number of positions to be reduced by the changed oversight.[18]

3. *That none of the changes discussed above apply to Naval Reactors, which should retain the current procedures set forth in the NNSA Act.* Congress could specify this policy in the legislation or could return Naval Reactors reporting to the Assistant Secretary for Nuclear Energy. The Director of Naval Reactors should be consulted in deciding which option to mandate.

Risks. The EWG recognizes that there are risks and difficulties with these recommendations. At a time when the nation's focus should be on the fundamental purposes of the weapons program, they could divert Congressional attention to organizational and turf issues. The nation faces a number of nuclear policy issues that will be resolved over the next 1-2 years. Moving forward on organizational change prior to resolving those issues has risks, although delay perpetuates the problem and risks a loss of focus. Disentangling NNSA from DOE is more complex than we suggest.[19] Further, Congressional action could result in changes quite different from those proposed in this paper. In addition, some fear that moving NNSA could lead to funding drying up. Finally, organizational changes can aid and empower leadership but cannot substitute for it. The success of this proposal will depend on sustained leadership from the next NNSA Administrator and Deputy Administrators. But success could make a major improvement in the effectiveness of the nuclear weapons complex and there is no better time than the start of a new Presidential Administration to begin.

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1. J.W. Biber and Associates, Kansas City Site Office Oversight Plan: Assessment of Implementation Cost Savings, January 2008. All costs are in FY 2006 (deescalated) dollars.
2. Ibid., p. 55
3. The DNFSB is a board of Senate-confirmed safety experts that was established in the 1990s to provide oversight of safety in defense-related DOE facilities.
4. The Office of Management and Budget handles the NNSA budget in the National Security Division, separate from the remainder of the Energy Department.
5. Section 3212 (d) of the NNSA Act provides that "The Administrator may establish Administration-specific policies, unless disapproved by the Secretary of Energy."
6. These included the General Counsel, Chief Information Officer, head of Human Resources, Chief of Staff, Chief Financial Officer, heads of Congressional and Public Affairs, and Safeguards Security and Performance Assurance (DOE's internal oversight organization).
7. In a separate paper, the EWG recommends broadening the base of support for the weapons laboratories. We accept that increasing NNSA independence will make this goal more difficult with respect to support from the rest of DOE.
8. The Office of Management and Budget treats the NNSA budget as distinct from that of the rest of DOE, but the Secretary retains—and has occasionally used—the ability to shift funds between the two budgets.
9. Although ACDA reporting through a cabinet office illustrates the relationship proposed in this option, it is important to note that ACDA was a pure policy organization and thus the day to day relationship between State and ACDA may not be an appropriate model.

10. The nuclear weapons program was established outside of DOD to ensure adequate civilian control of nuclear weapons at a time when the Department of Defense (and its predecessors) was dominated by uniformed officers. With the strong civilian control of the modern DOD, this anachronistic issue should not be a bar to a transfer to DOD.
11. Some arsenals operate on the GOCO model, although they do not perform nuclear operations. DOD operates shipyards conducting nuclear work but they are either operated by government employees or privately owned and subject to less prescriptive oversight. Even the legendary strong oversight by Naval Reactors primarily focuses on ensuring contractors follow their own procedures rather than prescribing specific procedures.
12. Report of the Defense Science Board Task Force on Nuclear Capabilities, December 2006, pp. 29-30.
13. The contract with Los Alamos allows the government to break out these facilities for separate management, which would facilitate a future decision to shift the plutonium facilities to DOD.
14. Report of the Defense Science Board Task Force on Nuclear Capabilities, p. 31.
15. This was the experience of the Onsite Inspection Agency established in the 1980s. It was to be under interagency supervision but was funded by DOD. It rapidly became a pure DOD agency and was ultimately absorbed into the Defense Threat Reduction Agency. The parallels are not exact, but they are suggestive.
16. This proposal was not included in the draft of the paper presented to the Commission and is thus not included in the Commission's final report.
17. This will ensure that the Secretary has access to the same information on certification that he has today.
18. As noted above, although the number of Federal employees doing oversight will reduce, some functions now being performed by DOE will need to be established in the separate NNSA.
19. Two obvious examples: NNSA transports all nuclear material for the entire DOE and some NNSA facilities are located within larger DOE sites.

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Arrangements for Broadening Support for the Weapons Laboratories

Harold P. Smith

Introduction: A Precarious Situation

All is not well with the weapons laboratories. If a CEO of an established corporation were to examine the markets available today to LANL, LLNL, and SNL, s/he would be appalled. The laboratories provide and maintain essentially one product that is purchased by NNSA,[1] whose independence of DOE is strained; for DOD, a customer only mildly interested in the product; under an ill-defined policy by a (now) lame duck administration. To make matters worse, appropriations for the product are provided by committees of Congress whose primary interest is directed elsewhere, and although not specifically cited in the FYNSP (Future Years National Security Program), it is widely believed, although unsubstantiated, that the laboratories face a 30% reduction in funding over the next (very) few years. During these years, the new administration will face the largest national deficit in history and the largest recession since 1929. It follows that constant, let alone increased, funding under the present conditions, even if the new administration were so inclined, would not be a high priority and would not receive active consideration anytime soon. The situation is bleak; what to do?

Because nuclear weapons represent, for the foreseeable future, the last line of national defense, in an increasingly fragmented and dangerous world, simple acceptance of the bleak forecast does not seem responsible. A reduction in staff of 30%, in a situation where the government has decided against testing its weapons and must rely, therefore, on the capability of that staff and its resources to maintain the deterrent, is a serious question, deserving of careful examination.[2] In the interim, however, a significant reduction in staff will adversely affect the pool of talented personnel having the special skills associated with the arcane world of nuclear weapons. Recruitment will be difficult; the best of the younger staff will seek employment elsewhere, and the best of the older staff, some of whom designed the weapons in the present arsenal, will look forward to early retirement and a second career. Morale and, with it, capability will plummet. A better way to maintain the present staff must be found, but where to look?

Because it is widely assumed that a nuclear weapon in the wrong hands is the foremost challenge that the United States faces,[3] one would think that laboratory personnel, facilities, and experience should be forcefully brought to bear and given a wider mandate than just the weapons themselves. Nuclear weapon intelligence, forensics, detection, verification, cooperative reduction, and avoidance of technological surprise are certainly appropriate; even more diverse areas could be considered.[4] These all involve highly sensitive information and require commensurate security, which the laboratories are equipped and administered to handle. Occasionally, such endeavors require careful meetings with foreign nationals. Laboratory personnel are experienced and skilled in this as well. What is lacking is the mandate and support of those agencies having such responsibilities to provide the necessary long-term, significant commitment.

Develop a Strategic Plan

That same (appalled) CEO, before closing the operation, would take a straightforward business approach and develop a strategic plan:

- Define the strategic advantages and disadvantages facing the three laboratories.
- In areas where there are strategic advantages, define the major missions and the customers, who should invest over a long term in laboratory infrastructure and staff.
- Describe the work that would be performed to fulfill those missions.
- Define the infrastructure, both existing and required, that is needed to accomplish the work.
- Systematize, reduce, and properly allocate direct and indirect costs.
- Organize to meet the needs of the potential (and established) customers.

Although such an approach is reminiscent of "your management accepts with enthusiasm, the challenges of a changing market"[5]—just before going out of business, a widely accepted strategic plan is the necessary first step towards justifying broader and sustained support for the weapons laboratories.

Once the three laboratories have developed and coordinated an institutional plan among themselves, the responsibility should shift to NNSA for coordination within all the national laboratories and, most importantly, for obtaining broader support within the federal government and the Congress. It is here that the Commission plays the key role.

Outside Investment Cannot Be at the Margin; Infrastructure Must Be Supported

In the days when nuclear weapons were being designed and tested in a near-continuous process, the laboratories operated under a few, very large contracts, which at the margin, supported WFO (Work for Others) in areas of national interest at relatively low cost to the sponsors. Such work was permitted but not encouraged. Those days are gone. Now, the concept—even the title—of WFO no longer applies. If the weapons laboratories are to become national laboratories, all sponsors must pay their share of the total costs. There should be no work at the margin and there should be no "others"—all sponsors will have to be treated equally.[6]

Laboratory personnel are well aware of the uniqueness of their skills, broadly defined, and are cognizant of those federal agencies that should support national efforts that need those skills. In fact, support from appropriate agencies across the spectrum of needs and capabilities already exists for many groups within the laboratories, but these are small, short-term, disjointed, and funded at the margin. They will remain so unless and until the heads of the potential funding agencies can be convinced to make major, long-term funding commitments, to include investment in infrastructure, in their particular areas of responsibility. Because such a commitment reduces the flexibility of their agency, and because the present arrangements meet their near-term needs at minimal cost, there is little incentive for them to change the mode of operation. Thus, a higher authority will be required and is discussed below.

What is not needed and, in fact, must be avoided is an attempt to mimic the entrepreneurial style of private companies that provide analyses and services to the federal government on a wide variety of subjects and whose modus operandi is assembling a large number of small contracts often based on personal familiarity with mid-level federal officials. While there is nothing inherently wrong with this approach, it is not consistent with the role of a national laboratory, nor would the laboratories be particularly competitive, having high overhead, bureaucratic complexity, and lacking proximity to Washington. In short, the laboratories are unique and must succeed or fail in the broader areas of national interest only to the extent that they can demonstrate the usefulness of their uniqueness.[7] Accordingly, the directors of the weapons laboratories have established the following criteria for seeking support from a broader range of agencies; viz., projects should be:

- "synergistic with the Laboratory mission
- of national importance; and
- done with excellence using unique Laboratory capabilities."[8]

While the Expert Working Group endorses these criteria, it recognizes that enforcement is not an easy matter.

Proper Allocation of Costs

In the era of WFO, assessment of costs to the "others" could be characterized as "collegial." In the new era of broader support, the need for assessment of total costs associated with the expanded responsibilities must be on a more business-like basis.[9]

Agencies cannot be asked—or required—to support major projects at the laboratories unless they can be assured that the funding is properly estimated and allocated. This comes as no surprise to the laboratories. The need is recognized, and procedures are being put in place, but changing long-held cultures takes time, and time is now of the essence.

Reduction of Overhead

Assessment of a fair share to non-NNSA work could not come at a worse time. Overhead rates, which are already high in comparison to the defense industries, will be driven even higher; thus making it more difficult for sponsors to justify to Congress a large and long-term commitment to support laboratory work. Simply put, the current overhead rates must come down, which can be done, but only if there is a sea-change in the managerial culture. In particular, safety and security at any price will have to give way to criteria that includes productivity, a truly difficult task, given the intense public and congressional scrutiny under which the laboratories operate.[10] Fortunately, all three laboratories now have industrial partners. All are experienced in other defense areas in providing safety and security in hazardous environments that seem to be acceptable in the public domain. The partners, with NNSA support, should, therefore, take the lead in reducing the overhead and be willing to defend more balanced security procedures publicly. Federal and congressional support will be both critical and difficult.[11]

Broader Support within the Federal Government

The Department of Energy and NNSA have sought to facilitate broadening support by designating Los Alamos, Livermore, and Sandia as "national security" rather than nuclear weapons laboratories:

> NNSA, its national security laboratories, and the test site have reached a consensus that their future mission is not limited solely to the historic nuclear weapons core mission, but rather is one encompassing the full spectrum of national security interests. The broad range of research and development activities at the NNSA laboratories, which include sensor and detection technology, high-performance computing, microsystems, chemical and biological technology, and explosives science, will continue to ensure that the nation is equipped to deal with technological surprises and anticipate new national security threats.[12]

In essence, NNSA plans to expand the mission of the laboratories to be broader national security facilities, using additional business to maintain laboratory capacity. Although the concept is reasonable, implementation has been minimal and at low level. Major procedural changes and high level support (both addressed herein) are required,[13] and even so, it is not clear that the necessary infrastructural improvements can be supported by this means. Although substantial funding already comes from outside the weapons program, it should be noted that all major improvements in capacity have been funded from within. As the Commission was briefed by the laboratory directors during their September meeting at Livermore, what is required is not a series of small projects but a few, large, sustained efforts that will support capability building; i.e., infrastructure. Such a change will require strong, high level support, and thus far, there has been no indication within DOE to shift funding, no attempt to use the head of DOE's intelligence office to gain new support from the intelligence community, and no indication of any high level effort to engage other cabinet departments. Today, the concept of "national security laboratories" is a concept—and little more.

Examples of Broader Support of Infrastructure

Two examples are given below. A third, assessment of intelligence related to nuclear weapons, is conspicuously absent—for reasons of classification —not because it lacks importance or already has broad, long-term funding.

High-performance computing

The weapons laboratories lead the world in the development and application of high-performance computers (aka, super-computers), which are essential for maintaining the nuclear arsenal. With their graphical capability to display results of enormously complex calculations, high-performance computers are not limited to the world of nuclear weapons.[14] Indeed, they have been and should continue to be applied to a wide variety of challenging technical problems such as understanding global climate change, alternative energy research and medical research (e.g., HIV-AIDS research and designing new pharmaceuticals.) Over the past four decades, the NNSA laboratories have been at the forefront of conducting the basic research in computational science, developing the computing and networking technology as well as the software and algorithms, and applying high-performance computers to these and other non-weapons "grand challenge" problems. But in an environment where there is no concept of a "depreciating asset," how does one charge other agencies for the development and use of these very expensive high-performance computing environments, or conversely, how will NNSA convince other agencies to help pay for future development?

Nuclear forensics

Because radio-chemistry and related fields were central to measurements required in the testing of nuclear weapons, the laboratories are, by far, the greatest repository of the those skills and equipment. While testing may have come to an end, the need for nuclear forensics has not. If proliferation of fissile material and weapons using fissile material is to be deterred, the United States and its allies must be able to assess the source of interdicted fissile material and the debris from detonated material rapidly and accurately. Furthermore, this capability cannot be minimally funded; it must be well known and exercised if would be proliferators are to be deterred. While there should be no doubt that such work must be supported by those agencies responsible for preventing and containing nuclear proliferation, formal procedures and significant funding for the laboratories have been slow to materialize.

There are alternatives to establishing inter-agency control of funding the weapons laboratories. The first is a series—a very long series—of MOUs between and among NNSA and all the other players. Experience suggests that a workable set of such MOUs is beyond credulity and even if it were possible, would not be in place on a time scale necessary to retaining a vibrant set of weapons laboratories. The Expert Working Group advises against taking this path—as does the Townsend-Kerrick Task Force.[16]

A second alternative is simply to increase the funding for NNSA and to broaden its charter to include the national security health of the laboratories. While the simplicity is admirable, the likelihood of success, given the broad mission areas that extend well beyond NNSA or DOE and given the fiscal turmoil that can expected in the next few years, seems small.

Changes within the Congressional Reporting Structure

It is clear that the appropriation committees that oversee the NNSA budget are focused elsewhere and that the appropriation committees directly concerned with national security should have this task. It is equally clear—even for a congressionally created commission—that a call to reorganize congressional committees, no matter how clarion, will fall on deaf ears. While the call should be made, an alternative should be considered; viz., the transfer of NNSA from DOE to DOD where budgets are overseen by committees directly concerned with national security.[17] Such a suggestion has been studied time and again over the decades and under a variety of rubrics but always with the same result: nuclear weapons should remain with DOE. Nonetheless, times have truly changed, the Cold War is over, and the mission of the weapons laboratories should, by no means, be what it was. Perhaps, the time has come for a change commensurate with the times.

Primary Conclusion

The time is now for a duly constituted congressional commission to redefine the role of nuclear weapons and the complex that supports them. The election of 2008 provides a rare opportunity to recommend changes that could only be implemented in the fluidity that marks the end of an eight-year administration and the beginning of new administration of a different party which will have control of both the executive and congressional branches, and where cabinets and their secretaries, will be looking for new and better ways to manage the responsibilities that they will soon undertake.

There appear to be only two options for maintaining long term investment in the laboratories. One is to assign NNSA responsibility for national security health of the laboratories and to fund NNSA accordingly. A second is NNSA/DOD/DHS/IC formal joint responsibility for laboratory health. This second option needs strong support, coordinated by the NSC, from the senior leadership of DOE, DOD, DHS and Intelligence Community. The latter, while being more complex, offers the better path.

Recommendations

The Expert Working Group believes that the Commission should recommend:

1. That the Executive Branch conduct a rigorous study to determine the minimum size (by discipline), that the national laboratories need to maintain and support the weapons program. Without such an examination, critics may assume the Commission simply wants to expand the laboratory complex.
2. That the Executive Branch establish a formal mechanism for tracking funded sources at the weapons laboratories. It is impossible for the Executive Branch to broaden the base of laboratory support without a mechanism for tracking progress.

3. That the Executive Branch oversee rigorous development of a strategic plan for the "national security laboratories" that defines and costs those areas, including capital investment, where the laboratories can make a unique contribution to the challenges facing the security of the country.
4. That management of projects adhere closely to the concept of GOCO (Government Owned, Contractor Operated).
5. That the indirect costs, including those imposed by NNSA, be carefully examined by the industrial partners and that, in particular, they be assigned the lead in establishing balanced procedures regarding security.
6. That the White House establish an interagency process as discussed above and that the President formally assign the Secretaries of Defense, Energy and Homeland Security and the Director of National Intelligence with joint responsibility for the health of the existing weapons laboratories, re-characterized as national security laboratories. This assignment should be made by Executive Order.

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1. Admittedly, other agencies support work at the laboratories, but such work is small by comparison, disjointed, and supported only at the margin.
2. Examination of the necessary minimal staff is covered in a separate paper.
3. At the first presidential debate of the 2004 campaign, President Bush declared that "the biggest threat facing this country is weapons of mass destruction in the hands of a terrorist network." Schroeder and Stohl in the *San Diego Union,* 11 November 2004.
4. One such is nuclear power. Because there is necessarily a close relationship between the technology of nuclear power and that of nuclear weapons, the three laboratories are uniquely positioned to contribute to certain aspects of the former. For example, some fuel cycles are more resistant to weapon proliferation than others, but only the weapons laboratories are equipped to make such assessments. Funding, in this case, should be provided directly by DOE and remain outside of the NNSA budget.
5. *The Money Game* by Adam Smith (George Goodwin).
6. This point of view is supported by the preliminary remarks of Frances Townsend, co-chair of the Townsend Kerrick Task Force, "Long-term investments from other agencies cannot be achieved if their priorities are always second or third on the list. This finding requires creating a structure for multi-agency decision making (or sponsorship) and eliminating a predetermined "primary" versus "secondary" relationship regarding access to the labs' capabilities." Frances Fragos Townsend, NUCLEAR DETERRENCE SUMMIT, "Ensuring the Science Component of the Weapons Labs is Maintained" December 4, 2008.
7. This point of view is also consistent with Townsend (ibid). See for example:

   > "The Labs mission has grown dramatically over the past several decades with too little strategic guidance. Mission creep under the guise of "multidisciplinary big science" has led to lack of clarity regarding unique capabilities. Neither NNSA nor the Labs have been disciplined in ensuring that they focus solely on missions or challenges where they have unique capabilities."

   The Labs' approach is often bottom-up. Lab representatives in DC analyze the environment, determining where the Labs should ask for money. The current process is very opportunistic, not strategic.
8. Report of the February 11-12, 2008, meeting of the Mission Committees of the LANS/LLNS Board of Governors; William J. Perry and Sidney D. Drell, May 19, 2008.
9. Again, the EWG and Townsend (ibid.) are in agreement, "The objective is an "integrated, interdependent enterprise that employs best business practices [italics added] to maximize

efficiency and minimize costs." The existing complex doesn't come anywhere close and will have to be significantly rationalized to survive."

10. See, for example, the article by David Kramer, "DOE officials detail security concerns at labs" *Physics Today*, November 2008, in which congressional statements such as "so 'shocking and so serious' that they couldn't be heard in an open hearing" have to be contrasted with statements by the laboratory directors "that classified information isn't at risk."
11. Some believe that the culture of the Department of Energy overemphasizes regulation and that this overemphasis is so deeply ingrained that the laboratories and the weapons program should be removed from DOE. The Experts Working Group analyzes options for doing so in a separate paper.
12. NNSA Press Release, June 26, 2008.
13. For example, NNSA has no approved way of determining the funding at each laboratory that comes from non-DOE sources and thus is unable to determine either a baseline or progress toward diversification.
14. See, for example, the NNSA Press Release, "NNSA Assisted in Shooting down of Satellite in February." September 30 2008.
15. NNSA Press Release, December 17, 2008.
16. "Work for others or MOUs are likely too limited and too ad hoc to allow for the ideal long-range strategic planning for the S&T enterprise" Townsend (ibid).
17. This question is analyzed in more detail in a separate paper and is noted here only for completeness.

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Security Concerns at NNSA Sites

Troy E. Wade II

Issue

Security costs at NNSA sites are consuming one out of every five dollars appropriated for NNSA. Costs for protecting nuclear weapons and category 1 nuclear material have dramatically increased over the past few years.

Problem

What has caused this situation; will it continue; what are NNSA security costs in relation to DOD security costs for similar levels of protection; what is the recommendation(s) to the commission?

Discussion

Figure 1 is a curve that captures the escalation of security costs within NNSA since 9/11. The chart comes from an official briefing of the security office in NNSA concerning the out-year budgets. Note the significant escalation in costs in 2003 associated with compliance with the 2003 design basis threat (DBT). The DBT is a classified standard threat, which defines an attacker's capabilities. The significant escalation in costs is associated with compliance with the 2005 version of the design basis threat. I have indications that at Savannah River, the costs associated with upgrading and improving the Wackenhut Services Inc. security force at that location in order to comply with the plan for compliance with the 2005 DBT this year (the first NNSA site to do so) cost an additional $63m over and above costs for the preceding year. I have long believed that the requirement for all NNSA sites to meet an arbitrary, and yet "one-size-fits-all" threat was unrealistic in that it did not allow any site to take any advantage of the unique characteristics of that site. I have argued, for example, that it was not realistic to not allow the Nevada Test Site security force to take advantage of the fact that it was surrounded by the Nellis AFB bombing and gunnery range which is full of sensors of all kinds. I am advised that, effective in August of this year, a new policy for protection of nuclear weapons and materials, officially called the "graded security protection policy," which replaces the DBT, has been approved, and that all sites have been asked to provide vulnerability assessments based on that new policy. Out-year budget projections will now be based on the adaptation of that policy, which is a giant step forward in developing realistic threats and designing protection against those threats.

Table 1 depicts security costs across the complex in 2008 measured against requirements for 2009, as well as the differences between the program request and the president's budget for each location. This chart and these costs came from a briefing given by the Office of Defense Nuclear Security (the NNSA security office) to Bill Ostendorf in October. All of these costs are in the budget category in the security portion of the overall NNSA budget. These costs all were developed before the decision was made to move from a generic design basis threat to graded security protection. None-the-less, it captures the continued escalation of security costs and the increasing delta between the program request and the president's budget. Think of the difference there clearly will be in money appropriated versus what shows as the president's budget.

Figure 2 is a pie chart showing the results of a comparability study done to look at where all the money appropriated goes. Note that this chart shows an average for all NNSA sites. What it shows is that only about .50 of each dollar (base labor plus overtime) goes to actual security. The balance goes to all of the other categories identified in the pie chart. One of the obvious problems is that all NNSA sites have different cost structures and contracts; some security contractors are prime contracts to the government while others are sub-contracts to the operating contractor or to the laboratory. These different contracting methods result in different cost models that vary site to site, in some cases quite dramatically. Another very important fact is that, in most cases, a large percentage of the budget tied to labor costs is subject to collective bargaining agreements wherein the labor rates exceed established escalation rates.

Members of the infrastructure EWG as well as members of the commission have asked about comparing NNSA costs with DOD costs. There are so many differences; DOD protects nuclear weapons but not any categories of nuclear material; DOD security forces are all active-duty military, etc., quickly lead one to the conclusion that not only is one trying to compare apples to oranges but is closer to comparing apples to bricks. It is clear that the recent NNSA decision to use "graded security protection" does bring NNSA more in line with the policies for protection of nuclear weapons used by the DOD and also by the United Kingdom.

Comparability of security costs at NNSA sites probably can only be accomplished by moving toward a single security contractor at each NNSA site, and adapting the same cost model (as much as site labor agreements would allow) at each site. Moving to a single security contractor would be consistent with moving toward a single M&O contractor at all NNSA sites, but probably neither can be done independent of the other. In other words, if a decision is made to select a single M&O contractor to operate a smaller, consolidated group of NNSA sites, a decision to move to a single security contractor at those sites could be made at that time.

Summary

Costs for security of nuclear weapons and nuclear materials (particularly category 1) have escalated at all NNSA sites since the 9/11/2001 terrorist event. Recent efforts to develop a more reasonable threat model present the opportunity to reduce security costs at each affected site. Attention to development of more uniform cost models across the NNSA complex would clearly add to further reductions in cost.

A detailed examination of differences in security costs from site to site, i.e. looking at union agreements and benefits, might lead to identification of additional cost reduction possibilities.

Recommendation

Any significant reduction of security cost within NNSA will clearly be a function of exactly what NNSA looks like in the next decade. Since the definition of NNSA's future is a major consideration of the commission, I recommend that this working group report to the commission that it has examined security costs, but will make no specific recommendations pending the commission's decision(s) on how the weapons program itself should be organized and implemented over the next decade or so.

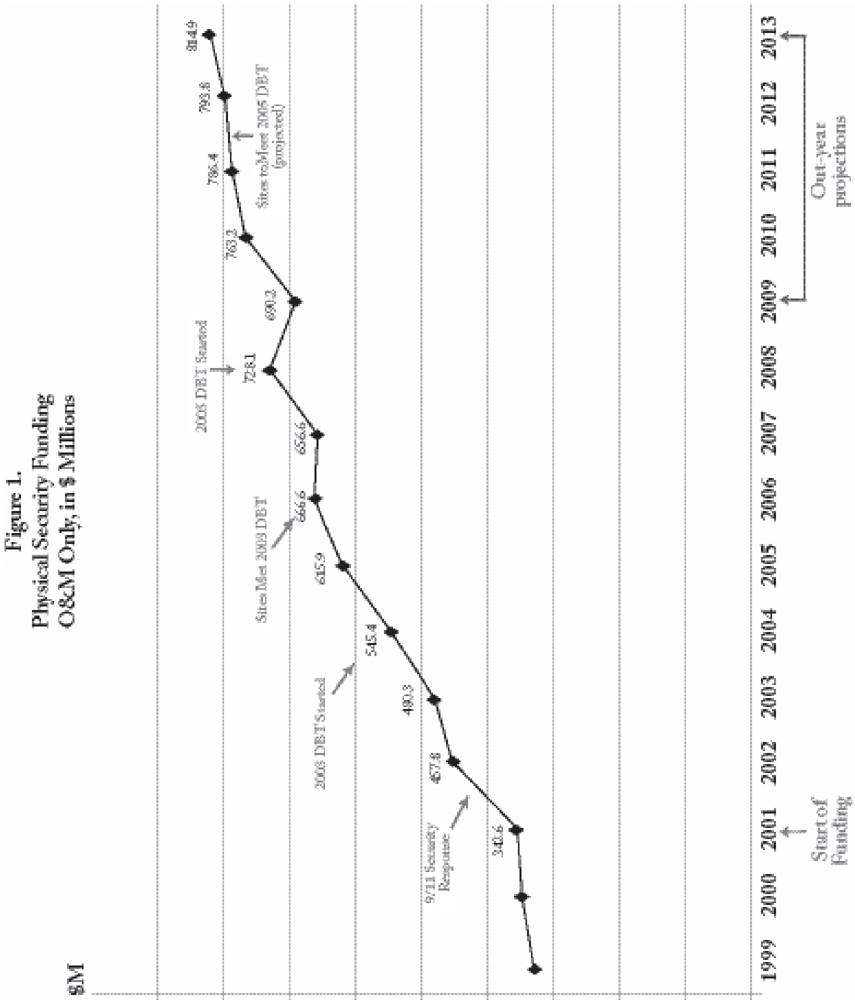


Figure 1.
Physical Security Funding
O&M Only, in $ Millions
$M
900
800
700
600
500
400
300
200
100
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
340.6
457.8
480.3
545.4
615.9
666.6
656.6
728.1
690.2
763.2
786.4
793.8
814.9
9/11 Security Response
2003 DBT Started
Sites Met 2003 DBT
2005 DBT Started
Sites to Meet 2005 DBT (projected)
Start of Funding
Out-year projections

Source: NNSA

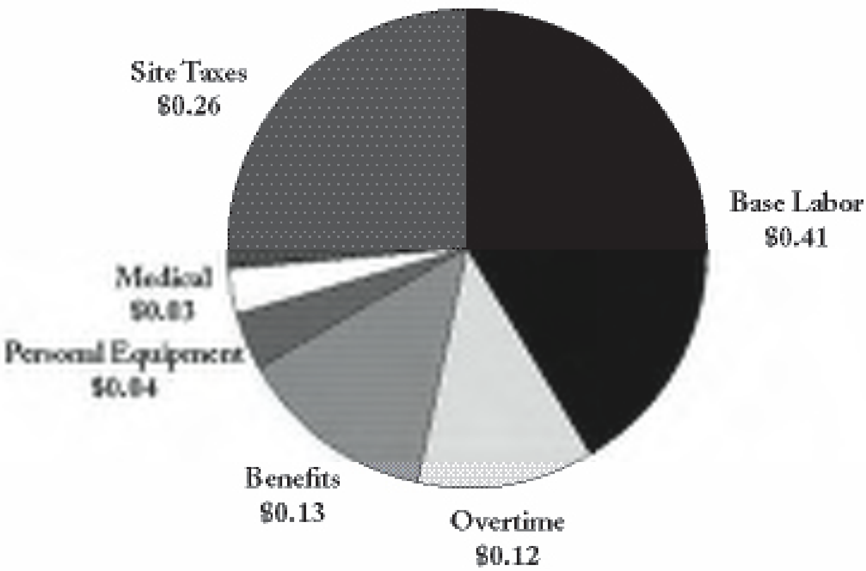
Table 1. FY2009 Funding Challenges

Defense Nuclear Security FY 2009 Funding (O&M) ($ in thousands)				
Site	**FY08 Approp.**	**Base Program Requests**	**President's Budget**	**Delta**
Headquarters	38,471	24,923	23,484	(1,439)
Kansas City	10,748	12,069	10,843	(1,226)
Los Alamos	107,866	117,518	105,203	(12,315)
Lawrence Livermore	95,475	91,300	91,031	(269)
Service Center	7,731	8,859	7,759	(1,100)
Nevada Test Site	78,814	112,734	96,434	(16,300)
Pantex	150,679	149,709	125,397	(24,312)
Sandia	67,883	73,841	68,244	(5,597)
Savannah River	10,842	13,180	12,420	(760)
Y-12	159,614	190,202	149,402	(40,800)
Subtotal, Operating	728,123	794,335	690,217	(104,118)
Construction	71,110	84,973	47,111	(37,862)
TOTAL	799,233	879,308	737,328	(141,980)

Source: NNSA

- Full FY2009 site requests included infrastructure investment and additional security staff shortfalls
- Site budget FY2009 requests reflected what resources they believed were needed to implement 2005 DBT and maintain effective program —$104M delta
- Suspending 2005 DBT implementation and critically reviewing work scope helped sites remain within President's FY09 Budget

Figure 2
2006 Comparability Study
SecurityDollar - All NNSA Sites Average



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Issues and Questions Associated with New Major NNSA Nuclear Facilities

Earl Whiteman

Introduction

NNSA is considering four new nuclear facilities to support the nuclear weapons complex. Three of these facilities are major initiatives covered in the NNSA Complex Transformation program, and are a portion of the Preferred Alternative for the recently completed Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement. These four facilities are:

- A plutonium facility at Los Alamos (the Chemistry and Metallurgical Research Replacement—Nuclear Facility (CMRR-NF)) that supports LANL plutonium activities, including pit production,
- A uranium processing facility (UPF) at Y-12 that replaces the old Manhattan Project era uranium facilities that supports all enriched uranium component fabrication, processing, and assembly,
- An underground storage facility at Pantex that would allow all weapon and SNM storage at Pantex to be consolidated within the Zone 12 weapons assembly zone, and allow the closure of the Zone 4 weapons and material storage area, and
- A Pit Disassembly and Conversion Facility (PDCF) at Savannah River (not covered as part of the Complex Transformation program) for disassembling excess plutonium pits (currently stored at Pantex) and converting the plutonium into an oxide as feed material for the Mixed Oxide Fuel Fabrication Facility currently being constructed at Savannah River.

The purpose of this paper is to describe the NNSA plans for the proposed projects, alternatives to the NNSA plans, questions that the Commission should consider relative to the projects, and recommendations that should be presented to the Commission for their consideration.

According to the FY2009 NNSA budget request, the funding requests for these projects are both large and uncertain. For the CMRR-NF, no total project estimate is provided[1] (budget amounts for FY2014 and beyond are labeled as "TBD"), but the amounts shown through FY2013 total greater than $1 billion. The UPF is shown to have a "Preliminary Cost Range" of $1.4–3.5 billion. The PDCF appears to have a more complete design, and its current estimate is $2.4–3.2 billion. There is no cost estimate available for the underground storage facility at Pantex, and due to the perceived uncertainty and unlikelihood of NNSA moving forward on this facility in the near term, it will not be discussed further in this report.

The annual amounts (in millions of dollars) for these projects shown in the FY2009 NNSA budget request are:

	FY2008	FY2009	FY2010	FY2011	FY2012
PDCF	$68.7	$119.0	$243.1	$323.1	$317.4
UPF	38.6	96.2	117.0	188.0	281.0
CMRR-NF	81.1	108.2	172.0	225.0	250.0

The share of the NNSA Weapons Activities budget devoted to the three projects grows from 3.0% in FY2008 to 11.6% in FY2012.[2] Given NNSA's historical problems in the management of nuclear facility construction to meet cost and schedule commitments, these cost estimates (even with the large uncertainty ranges) should be considered extremely uncertain. At their present estimated costs, they would be among the largest construction projects attempted by the nuclear weapons program in the past 25 years (the National Ignition Facility being the other greater than $1 billion facility during this time period).

The Los Alamos CMRR-NF Background and Justification

The U.S. does not today have modern plutonium facilities sufficient to support all aspects of its nuclear weapons R&D and production programs. The CMRR-NF would fill this gap, and provide the U.S. a full set of plutonium capabilities, including plutonium chemistry, materials science, and metallurgy, as well as pit surveillance and plutonium process development. Pit production (at low rates) occurs in an existing facility, the PF-4 at TA-55. Though CMRR-NF supports plutonium pit production, its primary purpose is to replace an aging laboratory facility (the CMR facility) and to enable closure of the Livermore plutonium facility to provide modern laboratory space for the nuclear weapons laboratories to support all plutonium programs, including pit production. This new plutonium facility is highly controversial, and has been publicly tied to plutonium pit production for stockpile augmentation or modernization.

According to 2008 NNSA Complex Transformation documentation,

> Los Alamos National Laboratory would provide a consolidated plutonium research, development, and manufacturing capability within TA-55 enabled by construction and operation of the Chemistry and Metallurgy Research Replacement—Nuclear Facility (CMRR-NF). … Until completion of a new Nuclear Posture Review in 2009 or later, the capacity at Los Alamos would be limited to a maximum of 20 pits per year.[3]

With the decision to close the Rocky Flats Plant in 1992, DOE was left with no capability to produce, disassemble, or assess plutonium pits in the U.S. stockpile. DOE established at Los Alamos during the 1990's a pit surveillance capability, a limited (up to about 20 per year) pit production capability, and a limited capability to dismantle and disposition old plutonium pits. DOE addressed this mission in a 1996 Stockpile Stewardship and Management Programmatic Environmental Impact Statement. The Record of Decision for that statement said that:

> DOE's decision is to reestablish the pit fabrication capability, at a small capacity, at LANL. …Should a larger pit fabrication capacity be required in the future, appropriate environmental and siting analysis would be performed at that time.[4]

The LANL plutonium program has several major program objectives:

- To conduct actinide R&D by Los Alamos and (after closure of its facility in 2012) Livermore scientists,
- To fabricate plutonium-238 heat sources for NASA and other national programs,
- To produce stockpile pits to replace pits lost in destructive surveillance testing to avoid drawing down the stockpile for programs where there are no replacement pits in storage (principally the W88 warhead),
- To assess plutonium pits from all stockpile weapon systems to assure continued reliable and safe performance,
- To maintain production competence for nuclear weapons plutonium pits,
- To provide a small production capacity to meet unforeseen production requirements, and
- To serve as a test bed for new production and process technologies that might be used in a new plutonium facility.

Los Alamos is today meeting all of these major objectives in its existing facilities (including the aging CMR).

The information needed to justify proceeding with a new production facility relates to the projected operational life of plutonium pits, and the stockpile size that a new plutonium facility should support. Pit lifetime is important because it is technically possible to "reuse" plutonium pits in refurbished and (to a limited extent) redesigned nuclear weapons in order to avoid the manufacture of new plutonium pits if there is sufficient life expectancy remaining for the older pits. This ability contributes to both stockpile refurbishment and a stockpile reconstitution capability. An aggressive program of pit reuse could significantly reduce the demand for new plutonium pits, and could reduce the size of needed pit production facilities without compromising national security objectives.

The weapons laboratories have made considerable progress in the past ten years in answering the question of pit life expectancy. In a November, 2006 statement, NNSA announced that weapons laboratories studies assessed that plutonium pits for most nuclear weapons have minimum lifetimes of at least 85 years. NNSA further noted that the scientific process used in the assessment had been peer reviewed by the JASON panel, which concluded that most plutonium pit types have credible lifetimes of at least 100 years.[5]

Stockpile size is the other major uncertainty affecting plutonium facility plans. With an assumption that pits would need to be "remanufactured" on average every 30-50 years because of pit aging or weapon replacement (such as an RRW), a production capacity of 20-30 per year is needed for every one thousand units in the U.S. stockpile (also assuming that additional "reconstitution capacity" is not desired). The present facilities at Los Alamos can produce about 20 pits per year (relying on the aging CMR facility). Modest upgrades to the existing PF-4/TA-55 facility combined with a new CMRR-NF to replace CMR could fabricate up to about 80 pits per year.

In its 2008 decision, NNSA continues to reflect considerable uncertainty about the future demand for plutonium pits. In fact, it defers making a final decision about pit production capacity (beyond the 20 unit per year capacity in place today) until better guidance (in the form of a 2009 Nuclear Posture Review) is available about stockpile size and mix.

Despite the uncertainties about future production requirements, NNSA has committed to move forward with the new CMRR-NF at Los Alamos, and it "believes that the plutonium R&D and surveillance capabilities provided by a new CMRR-NF at Los Alamos are required whether or not the United States ever builds another plutonium pit."[6] This commitment contains considerable uncertainty about budgetary decisions, however. NNSA is reflecting in its current decision that the projected demand for plutonium pits should not be the driving factor for proceeding with a new plutonium facility at Los Alamos. Plutonium work at Los Alamos is currently performed in two facilities, an all purpose plutonium facility initially occupied in 1978 (the PF-4 in TA-55) that is in good physical condition, and the much older facility (the CMR, circa 1952) that is not constructed or operable to current safety standards.

NNSA cannot accomplish its plutonium R&D and production programs without the capabilities currently residing in the CMR. The Defense Nuclear Facility Safety Board has criticized NNSA for continuing to perform plutonium work in the aging CMR, and, because of pressure from the DNFSB (and because NNSA thought it was the right thing to do), NNSA committed in 1999 to "manage the existing CMR Building to a planned end of life in or around 2010."[7] The CMR had been temporarily closed during the 1990's at least twice because of safety concerns. Though significant upgrades were made to CMR safety systems at that time, there were limits to the amount of upgrades possible with the 50-year-old facility. With funding and schedule delays for CMRR-NF, the CMR must now remain operational well into the next decade.

Before deciding to proceed with the Los Alamos CMRR-NF, NNSA considered relocating its plutonium missions from Los Alamos (including the work performed at the Livermore plutonium facility) to other possible locations including Savannah River, Y-12, Pantex, and the Nevada Test Site. NNSA looked at the costs and risks for each of these sites. Remaining at Los Alamos was the lowest cost and risk approach.

NNSA also considered consolidating all of its plutonium and highly enriched uranium work at a single site, or combining these two missions with the Pantex weapons assembly mission at a single site. Savannah River, Y-12, Pantex, the Nevada Test Site, and Los Alamos were considered for this single consolidated nuclear site (called the Consolidated Nuclear Production Center). This level of consolidation had been previously recommended by a panel of the Secretary of Energy Advisory Board in 2006 because of perceived cost and security benefits.

Both the relocation and consolidation of nuclear operations were considered in the recently completed Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement (SPEIS). The preferred alternative for the final SPEIS indicates that neither relocation nor consolidation is the desired approach.

The estimated cost of the CMRR-NF is large and uncertain (no total project estimate is provided in the NNSA FY2009 budget request; budget amounts for FY2014 and beyond are labeled as "TBD"). The budget requests shown through FY2013 total greater than $1 billion. NNSA has indicated in comments to a draft version of this report that the current estimate for CMRR-NF is $1.7-2.7 billion. On the present schedule, funding would increase significantly in FY2010 to support project construction. This project, the UPF, and the PDCF (both discussed below) would need significant construction funding beginning in FY2010.

The Uranium Processing Facility Background and Justification

The Y-12 Plant near Oak Ridge, Tennessee, is one of the original facilities constructed to support the Manhattan Project. Y-12 facilities, originally constructed to house uranium separation capabilities, were converted in the early 1950's into facilities for the manufacture of highly enriched uranium secondaries and related components. Complete nuclear weapons secondaries and cases are assembled at Y-12 from these components. Y-12 continues to perform its production and assembly missions in these World War II era facilities.

As with the CMR facility at Los Alamos, the Defense Nuclear Facility Safety Board has been very critical of the continued use of these aging facilities for the highly enriched uranium mission. In fact, NNSA management has indicated that it might prioritize the UPF ahead of the CMRR-NF because of these safety concerns.[8] In addition, as security requirements for nuclear weapons program facilities have been made more stringent (in particular after 9-11), the ability to economically secure the sprawling complex of Y-12 enriched uranium facilities has become increasingly difficult and expensive.

For all of these reasons, NNSA has decided in the Preferred Alternative to the SPEIS that:

> Y-12 National Security Complex would continue as the uranium center producing components and canned subassemblies, and conducting surveillance and dismantlement. NNSA has completed construction of the Highly Enriched Uranium Materials Facility (HEUMF) and will consolidate highly enriched uranium storage in that facility. NNSA would build a Uranium Processing Facility (UPF) at Y-12 in order to provide a smaller and modern highly-enriched uranium production capability to replace existing 50-year old facilities.[9]

NNSA says that constructing the UPF at Y-12 would result in a:

- 90% reduction in the Y-12 high security area,
- 60% reduction in the Y-12 nuclear operations footprint, and
- 50% reduction in the total Y-12 building footprint.[10]

In addition, there continues to be a support mission for the U.S. naval reactors program at Y-12 as HEU is taken from dismantled nuclear weapons and processed to an appropriate form for use by the naval reactors fuel fabrication facilities. HEU is also stored for the naval reactors program at Y-12 (a new

$500 million facility for the storage of all weapons program and naval reactors HEU is nearing completion at Y-12). The UPF will also support storage and down blending of HEU from international nonproliferation programs.

The estimated cost of the UPF is large and uncertain (preliminary cost range of $1.4—3.5 billion). NNSA is pursuing design-only for this project with FY2008 funding of about $40 million. On the present schedule, funding would increase significantly in FY2010 to support project completion by the end of FY2018. This project, the CMRR-NF, and the PDCF (discussed below) would all need significant construction funding beginning in FY2010. NNSA has stated that the UPF would reduce the annual operating costs of Y-12 by approximately 37%.[11] Presumably, a large fraction of these savings are due to reduced security costs. NNSA has not stated how these projected savings were independently verified. Assuming this level of savings is possible, for the requested FY2009 Y-12 budget of about $860 million, annual savings of about $320 million would result, whether the UPF is built at Y-12 or another site. The old facilities vacated at Y-12 due to UPF construction will require significant D&D funding; this funding will be required whether UPF is built at Y-12 or another site.

The issues for NNSA to face relative to new uranium processing facilities are: where should it be built, and how big should it be? It could be an easy decision to build new uranium facilities at Oak Ridge because of the long history of uranium work in the region, the strong technical base in the regional workforce, and the (unambiguously) strong political support for the work. In addition, multiple analyses by NNSA have determined that retaining uranium operations at Oak Ridge is the lowest cost and risk alternative. Relocating the uranium mission also requires that a downsized version of the recently completed uranium storage facility (HEUMF) be duplicated at the new site. Mission relocation also has significant "transition" costs. However, questions remain about the long term viability of maintaining uranium operations competency at very low workload levels (which are likely for the long term) at a site geographically distant from other portions of the nuclear weapons complex (the West Texas–New Mexico locus). Building the several billion dollar UPF at Y-12 essentially commits the nuclear weapons program to that site for the foreseeable future. NNSA has chosen to remain in Oak Ridge.

NNSA has said in the past that complex consolidation is an important objective, and significant consolidation has been accomplished over the past 15 years (several sites have been closed). A long term vision that involves consolidation of nuclear weapons complex missions to one or a few sites as the program decreases in size would be inconsistent with building a multi-billion dollar long term facility at Oak Ridge. However, consolidating uranium operations with one of the other long term nuclear weapons sites is more expensive over the next decade. An independent assessment by the Institute for Defense Analysis concluded that the cost savings from relocating the Y-12 Plant missions would not cancel the added costs of relocation until about 2040 due to the long construction and transition time. IDA concluded that collocation of the Y-12 mission with another NNSA site would save an additional $142 million per year (in addition to the $320 million from facility downsizing).[12]

In contrast to the CMRR-NF at Los Alamos, the justification for the UPF at Y-12 is tied primarily to the need for production capability and capacity. In the Preferred Alternative, NNSA considered a UPF sized to manufacture 125 secondaries per year with the ability to increase this output to 200 per year through multiple shifts or an extended work week. NNSA has indicated in its comments to a draft version of this report that its current planning assumes a UPF capacity of about 80 units per year.

The UPF is configured as a standalone production facility based on the historical approach to nuclear weapons component production. An alternative approach to stockpile management based on principles more relevant to a smaller U.S. nuclear weapons stockpile might result in a smaller and less expensive facility. For example, the historical approach to component production is to configure and qualify a production process for individual nuclear weapons components, and to control quality of the manufactured parts through control of this process. Process qualification and control were an integral part of overall weapons quality, and contributed significantly to the size and cost of production facilities. For very small production rates (as planned for the nuclear weapons program), an alternative approach that did not rely on dedicated and controlled production processes might allow for a significantly smaller production facility (that is also more flexible to changing requirements).

The life expectancy of nuclear weapons secondaries is somewhat less than that for plutonium pits, and varies depending on the special materials assembled into the so-called canned subassemblies. With an assumption that secondaries (and the full canned subassemblies) would need to be "remanufactured" on average every 20-30 years because of weapon aging or weapon replacement (such as an RRW), a production capacity of 30-50 per year is needed for every one thousand units in the U.S. stockpile (again, assuming that additional "reconstitution capacity" is not desired). A strategy of secondary reuse analogous to that discussed for pit reuse might significantly reduce the necessary capacity for the UPF without compromising national security objectives. The present aging facilities at Y-12 were originally sized to manufacture well over 1000 units per year, though new safety- and security-driven operating practices limit their capacity today to a few hundred per year.

The Pit Disassembly and Conversion Facility Background and Justification

Well over 10,000 nuclear weapons have been dismantled at Pantex over the past 15 years. The plutonium pits from these weapons remain in storage at Pantex. During the Cold War, the pits from these weapons would have been returned to the Rocky Flats Plant where the plutonium would have been extracted and reprocessed for use in new nuclear weapons production. At least 1000 pits per year were processed in this manner at Rocky Flats during the decade of the 1980's. With Rocky Flats ceasing operations at about the same time that major stockpile reductions began through weapons dismantlement at Pantex, the Zone 4 storage area at Pantex became the only feasible storage site for plutonium pits from this dismantlement until a new facility was available to disposition the pits.

The pits currently stored at Pantex are destined to be shipped to Savannah River to be processed in a new Pit Disassembly and Conversion Facility (PDCF). When the PDCF begins operations, at least 1000 pits per year are planned to be shipped from Pantex to Savannah River for disposition. The PDCF would complete its current operational mission in 10-15 years, although its mission would be extended if additional plutonium is declared excess to national security needs. PDCF construction and startup is currently uncertain due to funding uncertainties, but the startup date is likely no earlier than 2020.

During the 1990's, DOE separated the plutonium disposition activities from the nuclear weapons program with a separate program and budget within what is now NNSA. At the time, there was considerable work with Russia in developing joint programs for the disposition of excess plutonium and highly enriched uranium, and there was a desire to maintain separation between the U.S. nuclear weapons program and the new disposition program. Thirty-four thousand kilograms of plutonium were officially declared excess to the U.S. nuclear weapons program (a like amount was declared by Russia), and U.S. facilities were planned to disposition the U.S. material.

Significant program delays occurred because of delays in reaching a final agreement between the U.S. and Russia. Finally,

> In 2007, the U.S. and Russian governments agreed on a framework for a technically and financially credible Russian plutonium disposition program based on the irradiation of plutonium as MOX fuel in fast reactors. When implemented, it will enable the U.S. and Russia to meet their commitments under a 2000 agreement to dispose of a combined total of 68 metric tons of surplus weapon-grade plutonium—enough material for approximately 17,000 nuclear weapons.[13]

In the U.S., two major facilities are currently planned, the Pit Disassembly and Conversion Facility (PDCF) and the Mixed Oxide Fuel Fabrication

Facility (MFFF), both to be constructed at Savannah River. The MFFF is under construction, and not funded by the nuclear weapons program. Pits from Pantex would be shipped to the PDCF where they would be disassembled and the extracted plutonium converted into a plutonium oxide feed material. The plutonium oxide feed would be converted into mixed oxide (MOX) fuel suitable for burning in U.S. light water reactors at the MFFF. Contracts and schedules have been negotiated with U.S. commercial nuclear power operators for use of the MOX fuel.

The current cost estimate for the PDCF is a "preliminary cost range of \$2.4–3.2 billion. According to the FY2009 NNSA budget request, the PDCF design was 65% complete as of February, 2008.

For various reasons, including the late approval of the agreement with Russia, the two projects do not today have compatible schedules. The MFFF is on schedule to begin receiving plutonium oxide feed materials in 2016. However, the PDCF has been delayed several times, and is now projected to begin providing feed materials in the 2019-2022 timeframe.

Congressional action on the FY2008 budget moved the PDCF out of the NNSA nonproliferation budget and into the NNSA nuclear weapons program budget. The result of the Congressional action was to put the PDCF in competition with other nuclear weapons program budget items and to push NNSA to pursue other technical approaches for providing the plutonium oxide feed material, thus eliminating the need for the PDCF.

To date, NNSA has moved to close the gap in feed material availability by committing Los Alamos to provide initial feed material to the MFFF from its ARIES process, a development capability at PF-4/TA-55 that initially developed and demonstrated the technology for the PDCF process. In addition, NNSA has gained commitments from another DOE program at Savannah River (the DOE Environmental Management [EM] program) to provide material from EM facilities at Savannah River. Through these measures, most of the gap between MFFF need and PDCF ability has been closed.

These measures, however, beg the question that if these other approaches can provide material for a few years, why can they not provide all of the feed material needs and negate the need for building the PDCF? This is particularly the case since the PDCF mission could be only 10-15 years in duration. The Los Alamos facility could be asked to continue operating its development equipment a few more years, the Savannah River EM facilities could be configured to continue providing the material, and/or equipment could be installed at a facility at the Nevada Test Site. NNSA appears to be looking at all of these options, singly or in combination, and could propose elimination of the PDCF.

Conclusions and Questions

NNSA has a severe problem in trying to fund all of these major construction projects at a time when the overall downward pressures on the total NNSA budget are expected to increase, and, as noted earlier, these facilities increase their share of the Weapons Activities budget from 3% to 11.6% (without further project cost increases). In addition, if NNSA does fund one or more of these projects, the internal tradeoffs that must occur will necessarily involve reductions in other aspects of the NNSA program that are themselves facing shortfalls. In particular, there is concern that cuts would occur in those NNSA programs that support the intellectual infrastructure of the nuclear weapons program (both at the laboratories for scientific expertise, and at the laboratories and plants for development and production engineering expertise).

There are a number of questions to consider when making recommendations regarding the proposed NNSA projects.

First, does the project directly contribute to support of the stockpile? Both CMRR-NF and the UPF directly contribute to stockpile support, and both are needed irrespective of future stockpile levels. Stockpile levels do, however, influence the needed size and capabilities of the two facilities, in particular the UPF. The PDCF does not contribute to stockpile support other than by allowing the eventual closure of the Zone 4 storage area at Pantex.

Does the project contribute to the support of the long term intellectual infrastructure of the nuclear weapons program? Since all of these projects would compete with programs that maintain the intellectual infrastructure, it would be beneficial if the project itself (when completed) also contributed to the intellectual infrastructure. Of the projects, the CMRR-NF most clearly makes a direct contribution. It assures that there is a complete long term capability for Los Alamos and Livermore to conduct R&D involving SNM (in addition to contributing to the pit production mission), and provides the U.S. a complete set of required plutonium capabilities.

Are the size, scope, and cost of the projects influenced by the future size of the nuclear weapons stockpile? Because of the uncertainties in the size of the nuclear weapons stockpile for the coming decades, projects that are relatively independent of stockpile size might be prioritized over projects that are strongly dependent on stockpile size. The UPF at Y-12 is the only project whose size, scope, and cost is influenced by stockpile size, i.e. the greater the size of the stockpile, the larger the needed production capacity of UPF. This is true in spite of the fact that at very low production rates (80 per year for the UPF), facility size becomes less dependent on production rate. An alternative approach to stockpile management and associated production process qualification might also yield a smaller more flexible UPF.

Are pit and secondary component reuse viable options for support of the stockpile, and for influencing the needed capacity for pit and secondary production? Nuclear tests and subsequent development work has shown pit reuse to be feasible for some weapon applications. Preliminary studies indicate that secondary reuse could also be feasible for some weapon applications. The new computer simulation tools have given the NNSA laboratories enhanced methods for assessing the feasibility of nuclear component reuse. In addition, enhanced nondestructive evaluation techniques show great promise to provide the NNSA with viable tools to select the best nuclear components for reuse applications.

Is consolidation of the nuclear weapons complex an important or necessary NNSA objective? NNSA has said in the past that complex consolidation is an important objective, and significant consolidation has been accomplished over the past 15 years (several sites have been closed). Today, NNSA has determined that the downsizing of existing sites rather than closure of sites is the preferred approach, though the CMRR-NF contributes to consolidation by allowing the plutonium facility at Livermore to be closed. The UPF at Y-12 would be counter to complex consolidation and would commit the U.S. to remaining at Y-12 over the next several decades.

Facility and mission consolidation and resulting site closures introduce greater near term costs and risks to the nuclear weapons program, however long term program vitality requires continued consolidation as the stockpile and program continue to decrease. Spreading a smaller and smaller program over geographically dispersed sites creates concerns about the ability to maintain nuclear weapons competence. A multi-billion dollar investment at Y-12 is counter to consolidation of work.

How should NNSA prioritize safety of its nuclear facilities against other program objectives? The CMRR-NF and the UPF are needed to replace old nuclear facilities. Both NNSA and the Defense Nuclear Facilities Safety Board have said that it is unacceptable to continue nuclear operations in these older facilities because of safety concerns, and that new replacement facilities must be constructed. The high cost of these facilities requires very difficult decisions in a time of severe budget limitations. NNSA has not decided which facility it would prioritize to be first from a safety standpoint, but has indicated it may support the UPF as the first project.

How should NNSA prioritize security construction projects that help control the high cost of securing and operating nuclear facilities[14] *against other program objectives?* The UPF is expected to significantly reduce the security and other costs of operating the Y-12 Plant. However, achieving these cost savings at Y-12 requires the expenditure of significant construction funds at a time of severe budget limitations (a trade-off between scientists and concrete). Also, security cost savings are difficult because they are primarily in the form of manpower reductions, which are always hard to capture; and, the requirements associated with the Design Basis Threat have tended to increase regularly with time and thereby to call for more and better security arrangements, and to override projected savings.

Are there other alternative approaches that might significantly reduce the size, or negate the need for the new facility? For the PDCF, it appears to be possible to avoid the large facility construction expenditure through the modification and use of existing facilities at Los Alamos and/or Savannah River. There does not appear to be a realistic alternative to the CMRR-NF if long term plutonium capabilities are to be maintained. The UPF also appears to be a necessary facility to replace the aging Y-12 facilities, though there remain questions of the size (and cost) of the facility to be constructed (dependent on stockpile size and required "reconstitution capacity"), and the location of the facility (should consolidation objectives be continued).

Is reconstitution or surge capacity needed in future nuclear production facility plans? In the past, an added capacity factor was generally added to nuclear weapons production facilities to provide an ability to rapidly respond to unanticipated problems or increased requirements. Today, non-deployed stockpile systems and plutonium pits from dismantled weapons, i.e. pit reuse, are major components of a reconstitution strategy, and allow most production sites to avoid excess facilities and equipment for reconstitution or surge. However, excess capacity as reconstitution or problem resolution insurance may be built into plans for uranium facilities. This excess capacity would increase security and maintenance costs of the resulting facilities. It is not clear what the added capacity factor for reconstitution is for the UPF. If a clear policy required no surge or reconstitution capacity, it might be possible to further reduce the size and costs of the UPF.

Recommendations

Recommendation 1: Because the maintenance of nuclear weapons competency and the restoration of plutonium capabilities must take precedence over other competing interests, it is recommended that the CMRR-NF be the number one priority NNSA nuclear construction project.

Recommendation 2: A smaller sized, reconfigured, and less costly UPF should be constructed, but the schedule should be delayed.

- Even with UPF on its present schedule, Y-12 facilities will need to operate for an additional 10-15 years. Delay of the UPF could extend Y-12 facility operations by an additional 5-10 years.
- Before committing to the construction of the UPF, more detailed and independent engineering studies should be performed in order to minimize its size and cost. External and independent resources should be provided to enable accomplishment of this objective. An independent

assessment of projected cost savings through the construction of UPF at Y-12 or another site should also be performed.
- Major maintenance projects for existing Y-12 facilities should be funded to alleviate UPF schedule delays.
- A UPF schedule delay allows major decisions on the size and nature of the U.S. nuclear weapons stockpile to occur before committing to a location for the UPF.
- A UPF schedule delay also allows continued work to demonstrate the feasibility of secondary reuse, and to allow a reuse strategy to influence needed secondary production capacity.
- CMR facility safety concerns are at least as serious as Y-12 uranium facility safety concerns, and a short term loss of plutonium capabilities due to safety problems may be more serious to program objectives than a short term loss of enriched uranium capabilities.
- The UPF should proceed after these steps have been accomplished in order to realize security and operating cost savings.

Recommendation 3: A strategy of continued site and facility consolidation should be adopted by NNSA as the nuclear weapons stockpile continues to decrease:

- Enables the maintenance of critical skills and competencies.
- Enables efficiencies through work consolidation.
- Allows indirect and support costs to be reduced.

Recommendation 4: NNSA should exclude contingency facility and process capacity for reconstitution or other purposes from the UPF and other nuclear construction projects. In doing this, the nuclear weapons program would be accepting the added risk of production capacity limiting the ability to respond to future problems. In seeking a minimum sized and lowest cost facility, process capacity and equipment contingencies should be minimized.

Recommendation 5: The PDCF should not proceed and alternative approaches should be pursued using existing nuclear facilities at Savannah River and Los Alamos.

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1. Per FY2009 NNSA Budget Request, page 298, "Initial estimates place the revised TPC above $2,000,000,000. A final cost estimate will be established when the Nuclear Facilities performance baseline is established at C-2 [a milestone in the DOE project approval system], which is estimated to occur during FY 2010."
2. The numerator for the percentages is taken from the various project data sheets in the FY2009 NNSA Budget Request. The denominator for the percentages is taken from pages 71-72 of the NNSA FY2009 Budget Request.
3. NNSA Final Complex Transformation Supplemental Programmatic Environmental Impact Statement, Summary, dated October, 2008, page S-72.
4. Record of Decision: PEIS for Stockpile Stewardship and Management (DOE/EIS-0236), December, 1996, pages 33-34.

5. "Studies Show Plutonium Degradation in U.S. Nuclear Weapons Will Not Affect Reliability Soon," NNSA Press Release, dated November 29, 2006.
6. The quotation comes from comments provided by NNSA to an initial draft version of this report.
7. Department of Energy FY2009 Congressional Budget Request, National Nuclear Security Administration, dated February, 2008, page 300.
8. Based on comments provided by NNSA at the Nuclear Infrastructure Working Group September 9, 2008 meeting.
9. NNSA Final Complex Transformation Supplemental Programmatic Environmental Impact Statement, Summary, dated October, 2008, page S-72.
10. Y-12 Plant fact sheet provided as public information at public hearings for Complex Transformation Supplemental Programmatic Environmental Impact Statement.
11. Department of Energy FY2009 Congressional Budget Request, National Nuclear Security Administration, dated February, 2008, page 288.
12. From a briefing provided by David Hunter of IDA to the Nuclear Infrastructure Working Group at its September 9, 2008 meeting.
13. Department of Energy FY2009 Congressional Budget Request, National Nuclear Security Administration, dated February, 2008, page 22.
14. It appears that the security projects are for the sole purpose of reducing costs. The level of necessary security is being satisfied today in existing facilities, albeit at higher costs.

26

The Weapons Laboratories

Linton F. Brooks

The intellectual infrastructure is the most critical part of the nuclear weapons infrastructure and the three weapons laboratories—Los Alamos, Lawrence Livermore, and Sandia—are the most critical element of the intellectual infrastructure. These laboratories are vital to the United States in three ways. First, they are crucial to maintaining the safety, security, reliability and effectiveness of the stockpile over the long term. Although nuclear weapons have existed for over sixty years, weapons science was an empirical science for much of that period. Nuclear weapons are exceptionally complex, involving temperatures higher than the sun and times measured in nanoseconds. Understanding these weapons from first principles requires a broad, diverse and deep set of scientific skills, along with complex experimental tools and some of the fastest and most powerful computers in the world.

Second, because of their unique staff and remarkable experimental and computational tools, the laboratories contribute to other national security challenges, such as nonproliferation research, nuclear threat reduction, nuclear forensics, countering bioterrorism, ballistic missile defense, countering improvised explosive devices, research on nuclear energy and alternative energy sources, and assisting the intelligence community with advanced technology and analysis of foreign programs. Virtually all of this work grows out of expertise developed in nuclear weapons programs. At the same time, these new challenges enrich the laboratories' ability to continue to advance that program.

Finally, the weapons laboratories play an important role in maintaining U.S. scientific leadership. Laboratory scientific excellence is widely recognized, as evidenced by the large number of R&D100 awards received annually. The multi-disciplinary nature of laboratory research, combined with large scale research tools such as the National Ignition Facility and with supercomputers that have advanced ten-million fold over the past 15 years, allows research that is unmatched in the United States. Academic research cannot operate on the scale comparable to the weapons laboratories and industry has largely abandoned basic research in the physical sciences.

Maintaining this excellence requires the continued ability to attract top science and engineering talent by providing challenging research on important national problems. It also requires sustained investment in maintaining laboratory capability, especially in the unique experimental tools and facilities that are a hallmark of the weapons laboratories. Finally, it requires projects that exercise the full range of laboratory skills on important real-world problems. In the weapons area, this includes projects that exercise design skills, for example by enhancing surety and safety under a more robust life extension program while further reducing the likelihood of needing to conduct underground nuclear testing. The Reliable Replacement Warhead would be one way of exercising these skills.

27

Future Disruptive Technologies: Meeting with DOE/NNSA on the Future of Disruptive Technologies

Elbridge Colby

I visited DOE/NNSA this afternoon to meet with Dimitri Kusnezov, Director of the Office of Research and Development for National Security Science and Technology, and several of his deputies to discuss transformational developments in science and technology that may have an impact on U.S. national security. The session yielded several recommendations and I plan to return for a subsequent briefing that includes greater detail on some of the technological possibilities.

The common view among the NNSA personnel was that the coming decades will likely see transformational developments in science and technology, especially in the fields of materials science, fusion energy, sensor technology, the handling of large data sets, and new organizing principles for understanding physical phenomena (along the lines seen in the introduction of quark theory, for instance).

- Dr. Kusnezov and his team particularly emphasized the possibilities latent in the combination of increasing computing power (even factoring in the exhaustion of Moore's Law) with the increasing ability to manipulate materials—yielding the capability to model and design materials from the atomic level up with maximal efficiency. This will likely have significant consequences for the military field.
- Fusion technologies, the feasibility of which the participants expected to be clear within several years, were also discussed; the ease with which such fusion capabilities could be put to nuclear use was a particular focus.

- Sensor technology, including pervasive sensor technologies, was also discussed as a possible breakthrough area, with emphasis on its possibilities for use undersea and as a nuclear detector.

Though the NNSA personnel emphasized that the specific contours of these developments cannot be predicted with any real confidence, there was general agreement that rapid and discontinuous developments were highly likely in several key fields, and that the proliferation of massively destructive technologies in particular is effectively inevitable. One participant quipped that there "are no secrets any longer" in the nuclear field. The ramifications of this reality are apparently the subject of some research at the National Labs.

A major focus of all the participants was serious dissatisfaction with a perceived decline in the commitment of the U.S. Government to sustaining a top-quality national security science and technology base. This pertains particularly to the National Labs, where stockpile stewardship and related tasks are perceived to be too mundane either to prompt the kinds of research and innovation the Labs produced in previous decades or to draw new generations of top-flight talent. (Congressional prohibition of any work related to "new" nuclear weapons was cited as a particularly deadening policy on innovation.) Participants emphasized that the very non-linearity, ambiguity, and unpredictability of the future national security technological landscape requires having a peerless national security science and technology base—and that support for this is currently lacking, in large part because of a combination of neglect and distaste for nuclear weapons work at the political level.

The participants urged incorporation of the principle of "technological responsiveness"—the ability of the United States to stay ahead of and respond effectively to its competitors in the national security S&T fields—as part of the U.S. strategic posture. A crucial component of the U.S. deterrent, in other words, is our unmatched national security S&T capability—both as a deterrent/dissuasive/cost-imposing tool and as a responsive one.

Recommendations

In light of this testimony, the Commission might consider:

- *Emphasizing the principles of "technological responsiveness" and "peerless national security science and technological capabilities" into our formal strategic posture.* This might take the form of highlighting the importance of our S&T prowess in meeting our strategic goals to deter, dissuade, and impose costs on other countries considering hostile courses, as well as in responding effectively to such behavior.

- *Encouraging the Congress to provide sustained, substantial funding for the National Labs to undertake basic research and analysis on a broad array of national security-related science and technology problems,* rather than an overweening focus on stewardship and maintenance alone.
- *Encouraging the Congress to loosen restrictions on innovative nuclear-related national security research.*

28

Strategic Ballistic Missile Infrastructure

Robert B. Barker

The infrastructure that supports two thirds of the strategic deterrent triad, the Navy's Submarine Launched Ballistic Missile (SLBM) and the Air Force's Intercontinental Ballistic missile (ICBM), is in trouble. There are now no new missile development programs planned for more than a decade. There is no comprehensive, funded, program plan designed to preserve this infrastructure. While both Navy and Air Force systems are now undergoing life extension programs, these efforts do not significantly exercise the design and system engineering infrastructure and while they do involve some production, keeping that capability alive for now, this too, with the possible exception of missile motor production, will soon come to a close.

Industry is uniformly emphatic that expertise can only be maintained by funded programs for which the skills are necessary. The skills that are being exercised today for nuclear-capable deterrent forces are almost exclusively related to the less demanding sustainment of the systems first deployed many years ago.

In the not too distant future, the infrastructure unique to strategic missiles will not be available for any new programs or to respond to major problems, should they develop, in deployed systems. Any reconstitution of capability will take years and will inevitably be accompanied by schedule slips and cost overruns. As strategic forces are drawn down in numbers, it has been hypothesized that a responsive infrastructure would provide a hedge against surprise. No one could use responsive to describe the capability that will result from the path upon which strategic missile infrastructure now finds itself.

The need for special efforts to sustain key components of the large diameter ballistic missile infrastructure was recognized as early as 1990 in a Defense Science Board report. Periodically since, and as recently as 2008, Defense advisory committees have continued to warn of the inevitability of the demise of large diameter ballistic missile system infrastructure absent a carefully planned and funded program to prevent it. No infrastructure preservation plan has been developed. Very recently the Navy and Air Force have identified their concerns regarding infrastructure health. These documents are the basis of what follows.

This paper is a companion piece to Hank Chiles' paper entitled "Nuclear Weapons Personnel Expertise" that addresses nuclear weapon system personnel expertise, since personnel competence may arguably be the most critical element of infrastructure. The brick and mortar of laboratories and production facilities and the hardware and software that are necessary for design, engineering, and production are ultimately useless without the skilled people needed for them to function reliably. Without staff competent to operate these facilities and capabilities they will become inoperable. Because of this interrelationship some repetition of the message of "Nuclear Weapons Personnel Expertise" is inevitable.

The 1990 Defense Science Board study, in recognition of the then anticipated, unprecedented, more than decade-long cessation in modernization of strategic missile systems, recommended in their report Research & Development Strategy for the 1990s "pre-prototype" development in 13 areas, four of which related directly to strategic ballistic missile infrastructure: reentry systems, propulsion, guidance, and hardened electronics. These efforts were recognized as unique to strategic applications and would not likely be supported by tactical force programs, and would not be supported by the commercial sector.

The Strategic Air Command endorsed the program in the early 1990s. Both the Air Force and the Navy were requested to provide \$25M/yr for each of reentry systems, guidance, and hardened electronics development, and \$40M/yr for propulsion development (the larger amount was judged to be necessary because of the significant costs associated with large-scale rocket motor facilities). Collectively, these efforts became known as "Application Programs" and have continued to receive endorsement from U.S. Strategic Command (STRATCOM) and approval from OSD. However, these programs have hardly ever been fully funded by the Services (even in then-year dollars let alone 1992 buying power) in the years since and their funding is now in rapid decline.

The consequences of neglect can be found in the 2008 Service reports mentioned earlier.

The Department of the Air Force submitted a Congressionally-mandated report on ICBM infrastructure to the Appropriations Committees of the Congress on October 14, 2008. It states, in part (emphasis added):

> The 2006 ICBM Industrial Base Study conducted by the ICBM Long-Range Requirements Planning Steering Group **forecasts a decline in development, production, and sustainment skills** as current life extension efforts conclude. The findings of the study were threefold: First, at completion of the current ICBM modernization efforts, the first of which concludes in 2009, **large portions of the workforce will retire, be moved to other work within companies, or go to new jobs elsewhere resulting in a risk those skills will not be recoverable.** Second, to maintain, sustain, and modernize the ICBM system to 2030, sufficient resources are required to preserve the production and development capabilities for unique ICBM capabilities. Furthermore, significant risk exists, which is quantifiable in terms of cost, schedule, and capability, relative to having capabilities available to develop and produce a follow-on land based strategic deterrent unless the skills and capabilities are preserved during the period between the current production efforts coming to a close and the development of a new system. **Lastly a risk exists that companies with specific skill sets may choose to exit the ICBM industry due to lack of business.**

The following conclusion of Navy Strategic Systems Programs was part of its recent submittal to the ongoing Office of the Secretary of Defense Solid Rocket Motor Study.

> **The large solid rocket motor manufacturing capability of the United States has been on the decline for nearly two decades. Further decline is anticipated as a majority of the current production for other government customers is ending.**

Possibly the most dramatic portrayal of the state of infrastructure is the information included in a briefing prepared by the ICBM SPO, Col. Allan Netzer in 2005. The presentation, entitled "ICBM Industrial Base Skills Assessment," prepared in conjunction with the ICBM industrial base contractors, presents a dire picture of skills in the areas of propulsion, guidance, and re-entry, exactly the areas in which the 1990 DSB study called for special efforts to retain unique infrastructure capabilities. While charts from the briefing explicitly address the loss of personnel skills, they fully reflect the negative impact upon the facilities and equipment infrastructure that these personnel maintained and exercised. The data were gathered in 2004–2005. Each chart displays the then expected annual funding level of each of the Application Programs mentioned previously that were notably less than the $40 Million per year recommended for Propulsion and the $25 Million each for Guidance and Reentry. The charts also identified other Strategic Programs that were also expected to contribute to necessary competence. The charts' bottom line is the resulting "stop light" assessment of competence by skill area, essentially all going rapidly from yellow to red during the period FY'05 to FY'18. These charts were included in the paper provided to the Commission but were unable to be reproduced in this volume for technical reasons. They can be seen in a March 2006 DSB Report titled "Future Strategic Strike Skills" on pages 24, 25, and 26. The DSB Report can be found at http://www.acq.osd.mil/dsb/reports/2006-03-Skills_Report.pdf.

Since 2005 some relevant new programs have come into existence. In other areas funding has disappeared. Strategic Rocket Propulsion has benefitted by some recent renewed interest and funding in the ICBM Dem/Val line. Contributing to the challenge is the fact that there is no current funding to support the Technology for Sustainment of Strategic Systems (TSSS) effort. In addition, the Navy's Strategic Propulsion Applications Program (SPAP) is currently not funded.

Guidance, navigation and control (GN&C) application technologies and skills are important to supporting sustainment/life extension efforts of both ICBM and SLBM systems. There is a moderate level of work in these areas and promising technologies are being evaluated. Scalability of common technologies and cost reduction are major thrusts. However, some difficulty has been encountered in sustaining a viable path to strategic radiation hardening, as demonstrated by the lack of funding in the Navy's Radiation Hardened Electronics application line.

There is some work in the Conventional Prompt Global Strike (CPGS) arena that can be applied to legacy strategic systems, but it does not replace the necessary level of effort in this area.

Even taking into account these programs the net result is captured starkly in additional quotes from the Air Force Report to Congress:

- "The Air Force FY2009 Unfunded Requirements List (URL) quantifies near–term sustainability issues. The current, planned ICBM funding is insufficient to sustain the Minuteman III to 2030 and to sustain an industrial base qualified to develop a follow-on system."
- "Within the FYDP the Guidance, Propulsion, and Safety Enhanced Re-Entry Vehicle production programs will end, resulting in a loss of production skills."
- "An increased production capability risk will be assumed for future modernization or for sustainment issues when they arise. Therefore, confidence is low to medium that these capabilities will be available."
- Specifically, for Propulsion, the Report summarizes: "The overall risk based on data collected from the ICBM community indicates a significantly growing reconstitution concern in the next 3 to 5 years (Post Propulsion Replacement Program (PRP) production)."
- For Guidance the Report summarizes: "With completion of the GRP (Guidance Replacement Program) in 2009 the skill sets and associated risk in production, materials component suppliers, and production facilities is assessed as moderate to high."

For Reentry Vehicles the Report summarizes: "However, no program is developing and producing a complete ballistic reentry vehicle or contributing substantially to the domestic industrial base. Furthermore, domestic static testing capability of the extreme environments experienced by RVs is limited. While numerically sufficient, the current inventory of RVs will require some sustainment activity and development of technologies limited primarily to materials to support through 2030, therefore the overall risk is assessed as moderate to high."

The Report's overall summary: "The risk of retaining the skills base for development, production, materials, component suppliers, and facilities is moderate to high."

Subsequent to the release of the Air Force Report, the Air Force has decided to seek funding for low-rate production of MMIII solid rocket motors in its FY 2010-2015 FYDP. If funded, as their Report indicates, the risk for motor production skills may be reduced to moderate.

While the Air Force Report explicitly addresses only ICBM infrastructure, the assessment is drawn from essentially the same industrial base that supports the Navy, and must be assumed to apply equally. Similar to the Air Force, the Navy has funded continuing limited TRIDENT II (D5) motor production through the FY10-15 FYDP.

The remedy for the situation has been articulated in several recent reports.

As the Air Force Report to Congress makes clear, the recommendations from earlier assessments have not been adequately implemented.

The recently completed Defense Science Report on Nuclear Deterrent Skills (http://www.acq.osd.mil/dsb/reports/2008-09-NDS.pdf) includes the recommendation:

> The Secretary of the Air Force and Secretary of the Navy should fund advanced development programs to technically evaluate potential replacement systems to maintain and renew necessary skills in anticipation of the end-of-life of U.S. nuclear-capable delivery systems.

The 2006 Report of the Threat Reduction Advisory Committee, "An Evaluation of DoD's Responsive Infrastructure for Strategic Strike" concluded:

> The strategic forces infrastructure can only be healthy, and its health can only be assessed realistically, if it is actually doing something—doing actual work in some profile along the continuum of exploratory development engineering development, prototype fabrication, and perhaps limited serial production. The current low level of effort on new or modified strategic strike systems is insufficient both to maintain the health of the infrastructure and to provide strategic options for the nation.

The 2006 Defense Science Board Report on Future Strategic Strike Skills noted:

Finding #3

The strategic strike area most at risk today is ballistic missiles:

- Current skills may not be able to cope with unanticipated failures requiring analysis, testing, and redesign;
- A large number of skilled military, civil service, and contractor personnel are nearing retirement;
- Design skills are rapidly disappearing, both for major redesigns of current systems and for the design of new strategic systems; and
- Applications programs are necessary, but not sufficient to maintain skills; moreover, they have never been funded at the required levels.

Recommendations

- Ballistic missile program offices should devote resources to the transfer of critical knowledge and skills to early career personnel in industry.
- The Secretary of Defense should direct the Navy and the Air Force—absent near-term systems development—to fund advanced development (subsystem design, system prototype development, and testing) to support next-generation system development (which will also restore and maintain the skills base).
- The Secretary of Defense should ensure that the Navy and Air Force Applications Programs are fully funded at the STRATCOM SAGs originally-recommended levels to address critical areas not supported fully by advanced development.

The Infrastructure EWG strongly endorses these recommendations. We believe that the President and the Congress must not allow the large diameter ballistic missile infrastructure to simply fade away without a clear and concrete decision. A decision to allow the infrastructure to die and depend upon possible resurrection at some future date, with the attendant risks and costs is one option. A decision to preserve the unique technologies critical to infrastructure sustainment, will, according to the best advice available, require the funding of development programs, without necessarily a commitment to full scale production, but certainly including the industrial base in full evaluation of production issues and the evaluation of reliability via a testing program. As an initial step the Air Force and Navy should be tasked to redo the Air Force assessment excerpted in the above charts in order to identify and prioritize those areas of infrastructure in greatest need of programmatic effort.

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F-35—Preserving Nuclear Air-delivery Infrastructure

Robert B. Barker

The current funding structure, contrary to earlier expectations, for a nuclear capable F-35 Block IV raises serious questions about the nation's commitment to preserve extended deterrence in the form of forward based non-strategic nuclear capable aircraft in the US and allied inventories.

The US nuclear deterrent has always included air delivered nuclear capability and today incorporates strategic aircraft, the B-52 and B-2; non-strategic aircraft, the F-16 and F-15 (and includes some European nations' Tornado aircraft as part of extended deterrence); and cruise missiles, the TLAM-N and ALCM.

With the exception of the B-2, all of these systems are several decades old and, except for the ageless B-52, are scheduled for retirement in the next decade. The Next Generation Bomber (NGB) purportedly will incorporate nuclear delivery capability in its basic design and is not discussed here.

The F-35, Joint Strike Fighter, has been advertised for a decade as preserving the option for nuclear delivery that would include nuclear capability in Block IV design and production for aircraft scheduled for delivery in 2016. This schedule would preserve non-strategic nuclear air-delivery as the F-16 and F-15 are retired, and very importantly preserve the option for extended deterrence via forward basing in NATO. Some NATO nations have expressed interest in F-35 procurement as their nuclear capable Tornados face retirement as early as 2013.

However the DoD FY 2010 budget includes no funding for nuclear capability for the F-35 Block IV. The Air Force now states that it expects nuclear capability funding to be initiated in FY12 POM, with the expectation of a 2016 IOC. The basis for the Air Force's claim that a 2016 IOC can be met with funding only being initiated in the FY12 POM is unknown. A serious consequence of the decision is that F-35 contractors now are not funded to engage in technical discussions with NNSA's Laboratories to even evaluate the technical impact on F-35 design of adding nuclear capability. The current B61 nuclear bomb Life Extension Program Phase 6.2/6.2A study will go forward with less than ideal communications with the designers of the only non-strategic aircraft that would remain to carry it.

The non-strategic aircraft infrastructure in general is very healthy, unlike the industrial base that is required to support large diameter ballistic missiles (See paper #10). Commercial and tactical aircraft demand has kept the industry vibrant and technologically current. The only missing infrastructure factors when one considers nuclear capable non-strategic aircraft are the exercise of incorporating nuclear survivability (survival against nuclear weapon effects) and incorporating nuclear surety (ensuring that the safety, security, and control requirements for nuclear weapon carriage are met at all times). The F-35 will not incorporate a nuclear survivability requirement similar to that of the F-15 and F-16 so this issue is not discussed in what follows.

Historically, adding nuclear survivability and surety after basic design of a delivery system has incurred much larger costs than would have been required if nuclear requirements had been considered initially. In fact, at times, the cost differential was big enough that policy plans for nuclear capability were abandoned. Some have even suggested that program office actions to defer a decision to incorporate nuclear capability, and thus inevitably incurring high cost, was a back door path to dictating policy.

Today, the situation may be different. Modern digital technology may allow nuclear surety to be "added" to an otherwise non-nuclear capable aircraft platform at reasonable cost. While aircraft pose some different challenges, a late 1990's Navy study developed a system that could enable an otherwise non-nuclear capable submarine to be made capable of TLAM-N delivery using man-portable equipment and meet all nuclear surety requirements.

Explicit in the concept of "added" aircraft nuclear capability is that design features of the nuclear weapon carried may assume some of the surety burden previously imposed on the delivery platform. The concepts behind this vision are, however, so far conceptual and cannot be established with adequate confidence without technical experts from NNSA and DoD contractors exploring implementation on a real system. Such a prospect was in the offing with the prospect for simultaneous undertaking of engineering nuclear capability for the F-35 Block IV and the B61 nuclear bomb Life Extension Program Phase 6.2/6.2A study.

The Air Force decision to delay nuclear capability funding for the F-35 has been a major setback. The delay is worrisome not only because of the limitation on time to explore the technical aspects of nuclear surety, but because any changes from historic Air Force nuclear surety procedures will involve time-consuming scrutiny by experts from all sides to assure that confidence in surety has not been compromised by new technology. Current Air Force nuclear surety requirements are based on the limitations of 1950's technology and have been ingrained in 50 years since. In many ways, the philosophical re-evaluation of the adequacy of surety, involving new nuclear design concepts and new approaches to hardware and software implementation in the delivery platform, may be even more time-consuming than the evaluation of the technical aspects.

The Infrastructure EWG recommends that the Air Force be directed to reprogram funding to initiate F-35 contractor participation with NNSA in the evaluation of nuclear surety concepts for a nuclear capable F-35 Block IV.

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Stockpile Alternatives from Life Extension Program (LEP) to Reliable Replacement Warhead (RRW)

Everet Beckner

This paper explores the value trade-offs in two current approaches for maintaining a safe, secure, and reliable nuclear weapon stockpile into the future. The two approaches are: (a) to extend the life of an existing weapon by selective parts replacement and recertification (the LEP approach); or (b) to replace an existing weapon with a new design, with improved design features and predictability (the RRW approach). In addition to examining the technological advantages of the two approaches, we will also consider the challenges of providing and maintaining the production infrastructure to support either approach, as well as the way in which the nuclear design community is impacted (positively or negatively) in terms of maintaining the critical technical skills of the designers and the stockpile stewards.

The Present Situation with the Stockpile

Under current plans, the United States plans to maintain seven warhead types in the active stockpile:

- Two submarine-carried SLBM warheads, the W76 and the higher yield W88. Because production of the W88 was terminated earlier than originally planned, there are relatively few of them compared to the number of W76's originally manufactured.

- Two ICBM warheads, the W78 (initially deployed on the Minuteman III missile) and the W87 (developed for Peacekeeper but now deployed on the Minuteman III). The warheads have similar military characteristics.
- Two bombs, the B61 and B83. The B61 is actually a family of bombs, some designed for tactical use and deployed in Europe. The Secretary of Defense has told NATO that the tactical B61s will undergo life extension and improvements.
- One cruise missile warhead, the W80.

Details of the Two Approaches to Stockpile Maintenance

- LEP is the approach whereby the life of an existing weapon system is extended by remanufacturing the original design using duplicated parts, wherever possible, while making modest changes to accommodate the realities of manufacturing limitations imposed by changes in environmental laws, availability of materials, etc. As a part of such a program, the weapon also undergoes a renewal of its certification that it satisfies the DoD military system requirements. An ongoing example of this approach to stockpile life extension is the LEP which has just reached FPU (first production unit) on the W76 Trident warhead, designated the W76-1. Other weapons presently being considered for possible LEP remanufacturing are: the B61 bomb and the W78 ICBM warhead. Both have been identified as having aging problems which are developing with either the nuclear package or with one or more electrical components.
- RRW is the approach whereby an existing weapon is replaced in the stockpile by a newly designed, newly manufactured weapon, that exploits the opportunity to optimize the design around performance margins, predictability, and specialized security features rather than "yield-to-weight," which was the primary consideration in the designs in the present stockpile. Although it is not inherent in the concept, as a matter of policy the current Administration mandated that these replacement designs would not have new military characteristics. RRW designs were recently developed for consideration as a possible 2nd block replacement for the W76, but Congress has so far not appropriated funds to do detailed design and cost estimating.

Critical Differences, Advantages, and Disadvantages of the Two Approaches

- LEP solutions to extending the life of an existing weapon are straightforward and feasible for every weapon design in the present stockpile, unless for some reason the pit needs to be replaced. In that case, two solutions are possible: 1. Pit re-use, in which pits from a retired weapon system are substituted into the LEP design, when possible; or, 2. Manufacture of new pits, with the expectation that production rates will be limited by the rates obtainable from the limited capacity of the plutonium manufacturing facility at LANL. All the other parts for an LEP program can generally be expected to be "manufacturable," including the manufacture of new secondaries at the Y12 Plant, new electronic components at the Kansas City Plant, new neutron generators at Sandia, and new gas reservoirs at the Savannah River Plant. LEP production rates will probably be determined by the assembly rates which can be achieved at the Pantex Plant, since it is also executing a large dismantlement program over the next 10–15 years. The exception to this rule would occur if a new pit had to be manufactured for the primary, in which case the output rate for the full system would be determined by the rate of production of pits at LANL.

- RRW solutions to maintaining the stockpile tend to be very weapon specific and, in every case, very dependent on the design of the new primary. If the approach is to design and manufacture a new pit, the production rate will necessarily be slow and the cost will be high, but the design can thereby be truly optimized for higher margins against uncertainties and for higher designed-in security features. If the approach is to re-use an existing pit (from a previously retired weapon), then the total program is less expensive, probably can result in a higher production rate, and will probably be at least marginally sub-optimized. To date, for a variety of reasons, Congress has been unwilling to authorize any RRW work beyond preliminary design studies.
- Recently, the concept of "secondary re-use" (replacing a set of troubled secondaries on one weapon system with excess secondaries from another weapon system, retired or otherwise available) has been advanced as an option deserving consideration. Secondary re-use offers as a way of limiting the cost of manufacturing LEPs or RRWs, as well as limiting the size and scope of HEU manufacturing facilities that need to be replaced at the Y12 Plant. It is not likely that this approach could be broadly applied, but it might be a useful strategy in certain weapon systems. For now, it is simply too soon to tell what the impact of this strategy will be.

In Terms of Providing Early Answers to the Value Trade-off Questions Raised in the First Paragraph of This Paper, We Can Say the Following

- RRW designs can be expected to yield more complete warhead solutions to technical questions than LEP solutions, though they will be more expensive; and
- RRW designs offer a better way of sustaining the intellectual vigor of the design community than LEP solutions; but
- RRW designs, especially those involving a new pit, will require a more extensive and expensive manufacturing complex than LEP solutions.

More specifically, the concerns of the nuclear design community are very strong regarding intellectual vigor and the difficulties of maintaining a competent design community over the long term if, in fact, there is little or no work for them to do other than maintain a stockpile of old weapons.

Near-Term Stockpile Activities Underway or Contemplated

- The W76 LEP (W76-1) is underway and is expected to be completed on at least 600 weapons in the next 4-5 years, with many hundred additional unmodified W76-0s available for spares for perhaps 20 years. Later in this paper, the time required to manufacture the secondaries for the W76-1 is found to be important, since that requirement is at least partially responsible for keeping operations ongoing in Y12's nuclear facilities, which are generally considered to be too old for continued use.
- In addition to strategic forces requirements, the tactical forces requirements will dictate that the B61 remain in the stockpile to satisfy NATO commitments, until a B61-LEP or an RRW/bomb is completed to replace the present B61. Several aging problems are dictating that this weapon system undergo refurbishment or replacement in the next 10 or so years if it is to remain in the stockpile.
- Aging problems known to be developing in the W78 will soon require: (a) an LEP; or (b) an RRW designed for a reentry vehicle[1]; or (c) retirement of the W78 with the W87 taking its place. Later in this paper, we assume the solution can probably be (c).
- The W88 and the W87 can probably remain in the stockpile, if desired, without modification for at least another 15 years.

- Unless the Air Force eliminates the B-2 as a nuclear carrier, the B83 can probably remain in the stockpile without modification for at least another 15 years, if desired.

One concludes from these statements that for at least the next 15 years the critical nuclear weapons issue is: what must be done (LEP or RRW) to keep the B61 (or a replacement) in service well into the 21st century. This is the obvious LEP vs RRW trade-off that needs a more thorough examination than it has received to date. Since there is not enough known at this time about the technical arguments of LEP vs RRW for this weapon, we will explore below only the manufacturing considerations.

Ramifications of These Conclusions on the NNSA Strategy on the Two Big Nuclear Construction Projects Requiring Decisions Soon: CMRR-NF and UPF

Chemistry and Metallurgy Research Replacement—Nuclear Facility (CMRR-NF). CMRR-NF is a proposed new nuclear facility at LANL, primarily devoted to plutonium and intended to replace an existing facility, the Chemical and Metallurgy Research (CMR) facility, which is roughly 50 years old and a serious safety concern for both NNSA and the Defense Nuclear Facility Safety Board (DNFSB). It would be used to support manufacturing of plutonium components (pits), but in a support role rather than as the manufacturing site itself. Production of pits would continue in PF-4 at LANL, but rates would be raised from around 20 pits per year from present facilities to 50-80 per year if CMRR-NF is available. Thus, production, *per se*, is not the driving need for construction of CMRR-NF. Rather, it is the need to replace CMR, which is judged by all to be well past the time when it should have been closed. The cost to complete design and to construct CMRR-NF is believed to be between $1.5 billion and $3 billion, with 8 years +/- required after design is completed. The cost issue is complicated by the fact that not only is the cost very hard to fit into the flat or declining NNSA budget, it is highly unlikely that the NNSA can be confident that the cost of such a large and complex nuclear facility can be controlled against the unrelenting pressures of safety and security regulations and orders.

Uranium Processing Facility (UPF). UPF is a proposed new nuclear facility at the Y12 Plant, intended to replace existing facilities used to manufacture HEU parts and to assemble/disassemble nuclear secondaries. The major facility to be replaced is building 9212, which dates back to the Manhattan project. Both NNSA and the DNFSB are committed to closing the old HEU manufacturing facilities at Y12 as soon as replacement facilities can be built. Unfortunately, this project suffers from the same uncertainty as CMRR-NF in terms of cost and schedule control. It appears that UPF will cost somewhere between $2.5 billion and $3.5 billion, and therefore will seriously impact other elements of the budget which will have to be reduced in order to make way for this project.

UPF carries another uncertainty, that being the required scope of the project. As is obvious to all, the stockpile that requires support by the Y12 Plant is now expected to be much smaller than when the UPF design was started. Whereas the project must still be able to do all the manufacturing processes originally envisioned, it is not required to support the original production rates and NNSA assumes much of its workload will be related to dismantlement. It appears that NNSA is having a lot of difficulty getting this "scope" definition under control.

Timing Is Everything

In the previous section, we described the two most pressing needs in the NNSA weapons complex for critical facilities to support LEP or RRW manufacturing activities for the stockpile for the next 20-40 years, namely CMRR-NF and UPF. However, since they are large and very expensive nuclear facilities, and since neither has yet entered final design, let alone construction, a significant doubt exists that they will be designed and built at the proper size and scope to support the smaller stockpile that will probably exist by the time the construction projects are completed. Simply stated, the Infrastructure EWG is concerned that the significant costs entailed in the completion of these two facilities will come at the cost of critical technical personnel and support programs when, in fact, many of the LEP (or RRW) manufacturing requirements will have been met before the big facilities can be completed and brought into operation.

Here is the picture that emerges from our present understanding of the manufacturing needs of the stockpile for the next 10+ years:

- If the W76 LEP (which has just achieved FPU) can be manufactured at the rate of at least 100/yr, the first 600 units can be completed by the end of FY2014. Present expectations are for higher rates of production.
- If the decision is made to manufacture a B61 LEP (being informally referred to as the B61-12), and if that development program can be completed by 2014 (certainly a reasonable amount of time), then a few hundred B61-12's could also be manufactured by the end of FY2020.
- Since the secondaries for both the W76-1 and the B61 LEP will have to be manufactured in existing facilities in this scenario (since UPF cannot be expected to be completed and brought into operation much

before 2020), UPF is not required to support either of these LEP's unless the schedule for one or both of them is delayed.

- Similarly, since neither the W76 nor the B61 LEP require new pits, CMRR-NF is not obviously required before 2020.
- This means that a major portion of the presently identified stockpile manufacturing activities will be completed before either CMRR-NF or UPF can be completed. This is true, however, only if both CMR at LANL and the 9212 complex at Y12 can be kept in operation until 2020.
- It follows from these arguments that, from the standpoint of the stockpile, NNSA should be able to delay both CMRR-NF and UPF long enough to get the scope of both projects adjusted for the smaller stockpile manufacturing needs that will likely require support after 2020.

On the other hand, if the safety/security concerns regarding the B61 LEP are viewed as substantial and as requiring development of an RRW replacement for the B61, then the story changes considerably.

- If the decision to move forward with an RRW replacement for the B61 was made within the next two years, the significant change from the prior analysis would be the requirement to manufacture a few hundred new pits before approximately 2020. If we could complete the development program for the RRW within 5 years of starting it (assumed to start in 2011 and to be ready for manufacture in 2016 in this scenario), then we could reasonably plan to manufacture 25-40 pits per year at LANL in PF-4 (without CMRR-NF completed) or 60-80 per year (with CMRR-NF operational). This would specify completion of 100-200 RRW B61s by the end of 2020, rather than as many as 600 B61 LEPs estimated earlier.
- There is no reason in this scenario not to complete manufacture of all the secondaries required for the B61/RRW prior to 2020 in existing facilities at Y12, since it would be possible in the same way that it appeared to be possible in the all-LEP scenario described previously.

Finally, one additional development could significantly alter the analysis in this paper. When the concept of an RRW was first devised, the Nuclear Weapons Council approved proceeding with an RRW as a complement to the existing W76/LEP. The W76 is the most numerous warhead in the stockpile. It dominates the sea-based leg of the U.S. deterrent and thus represents a very high fraction of survivable U.S. warheads deployed on a day to day basis. It is also the only U.S. strategic warhead for which there is no backup. These considerations led the Nuclear Weapons Council to advocate a future sea-based force that was a mixture of W76 LEP (now in progress), W88 (existing but a relatively small fraction of the sea based deterrent) and the proposed W76/RRW. Were the upcoming Nuclear Posture Review to reaffirm this decision, and were the Congress to approve resumption of the W76/RRW design effort, then the considerations noted above for the B61/RRW would apply to the W76/RRW. It would not be possible to simultaneously manufacture new pits for both the B81 and W76, except by stretching out both programs for an unacceptably long period.

Conclusions Regarding LEP and/or RRW Manufacturing Requirements

- For the stockpile modifications envisioned for the next 15 years, only the B61 poses a significant new program requirement. This relies on the present stockpile assessment that the W88, W87 and B83 do not require modifications or upgrading until the mid-2020s. Also, it assumes that the W80 is retired, rather than being modified or repaired, and that the W78 is retired and replaced by W87's. However, if the decision was made to retain either the W80 or the W78 in the stockpile for many years, a few hundred could be manufactured as LEPs in the next 15 years without making a significant demand on nuclear manufacturing facilities.
- If the B61 plan is executed soon as an LEP (the B61-12), then neither CMRR-NF nor UPF can be available, and the program would be completed by 2020 in existing facilities at Y12, if they can continue to operate until then.
- If the B61 plan is executed as an RRW, and if it could be authorized by 2011, then: (a) UPF is not required for the program; while (b) CMRR-NF could help provide for completion of the program by approximately 2023, rather than by 2026 if CMRR-NF is not available.
- This analysis does not contemplate a serious attempt to use an existing pit for the B61 RRW, rather than a new pit. That option would seem to be open for consideration, and if selected for the program would eliminate all the manufacturing arguments for CMRR-NF unless the Congress reconsiders and approves an RRW in lieu of some portion of the W76 LEP.

Other Considerations

- It is likely that an LEP or an RRW for both the W88 and the W87 will be required by the mid-2020s. At this time, it is not obvious that the same statement would be made for the B83. Furthermore, considering the details of the weapon designs for the W88 and the W87, it is not at all obvious that either would need a new pit in order to stay in the stockpile. The W87 is not likely to need a new secondary, while the W88 probably will.

- So, looking out as far as 2030, at this time it appears that the B61 RRW option is the only weapon which could require manufacture of new pits. Several weapon modifications (LEPs) will require new secondaries, but UPF is not available, and thus not required until after 2020. If, in fact, the present manufacturing facilities at Y12 are declared prior to 2020 to be unfit for further use, the B61-12 (or B61/RRW) could not be completed until UPF was completed and brought into operation.
- A significant issue is now obvious: a serious effort needs to be devoted by NNSA to assuring operation of present manufacturing facilities (Bldg. 9912, etc.) at Y12 until all the secondaries are manufactured to satisfy the W76-1 and the B61-12 (or B61/RRW) needs. It would appear that the W76-1 program needs are not the issue. Rather, the B61-12 (or B61/RRW) program needs to be defined and the secondary design finalized so that secondaries for that program can be manufactured as soon as possible. If NNSA decides that this program cannot be supported in existing facilities, since they would likely require operations until at least 2020, then UPF construction should proceed as first priority with the expectation that operations there might be underway by 2017-2018.

Final Conclusions

- The main justification for NNSA to urgently seek to complete both CMRR-NF and UPF follows from the broadly held view that the U.S. nuclear weapon program should not continue to rely on old, out-of-date, and out-of-compliance nuclear facilities at LANL and Y12. In the case of the LANL facilities, they primarily limit the weapon surveillance and R&D programs. In the case of Y12, they limit the HEU manufacturing capability as well as assembly/disassembly of secondaries. In both cases, they limit the vitality of the weapons support program and the associated technical staff.
- However, upon scrutinizing the manufacturing requirements associated with future LEP or RRW programs, it appears to the Infrastructure EWG that NNSA should not rush to complete both the UPF and the CMRR -NF facilities at the earliest possible date, as they are now planning to do, but should take the time to re-scope them for the reduced stockpile requirements that are now becoming obvious. This will surely save some construction money and will also make it possible to protect a larger budget for the Stockpile Stewardship

Program and thereby retain a more competent staff for all elements of the weapon program.

- There is a strong concern on the part of the design community, which the Infrastructure EWG endorses, that irrespective of the details of the nuclear facilities required to maintain the stockpile there is an even greater problem that must be addressed. That problem is the widely held view that there must be important and useful work for nuclear designers to do if that community is to remain technically viable over the next several decades and thereby maintain for the country its "second to none" nuclear weapon capability. The Infrastructure Experts Working Group is preparing a separate paper on this subject.

Recommendations for Actions by the Commission

- Suggest to NNSA that they re-examine the urgency to construct replacement facilities for both CMR at LANL and the 9212 HEU Complex at the Y12 Plant. This re-examination should take into consideration the likely reduction in stockpile size now being developed by DoD as well as the fact that the W76 LEP will be, and the B61 LEP probably can be, completed in existing facilities before the new nuclear facilities can be expected to be completed. We would expect this re-examination to show that the replacement facilities (CMRR-NF and UPF) can be smaller than presently planned and can be scheduled to be constructed sequentially rather than simultaneously, which will free up funds to more adequately support critical human capital requirements of the NNSA Nuclear Weapons Program.
- Following the above review, provide input to Congress supporting these two construction projects, though with scope, schedule, and costs adjusted to reflect the probable U.S. stockpile needs of the 21st century.
- By combining input from the Nuclear Infrastructure Working Group with input from other working groups, develop a firm position on the relationship between the technical health of the weapon design community and the stockpile requirements, particularly within the context of RRW vs LEP as the long-term strategy for maintaining the nation's nuclear capabilities as well as the stockpile.

1. The RRW proposed as a replacement for the W76 was designed to be suitable as a replacement for the W78. As noted above, Congress recently denied funds to continue working on this design.

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What's New?—Use and Misuse of the Term "New"

Thomas Scheber

The adjective "new" is often used imprecisely in debates over nuclear weapon issues. "New" can be used to communicate many different aspects of the noun it modifies (e.g., something recently produced, different than previous versions, or having no precedent). When the precise usage is not specified, the various meanings of "new" can cloud an issue rather than help clarify it.

Take, for example, a situation that occurred in 1995 when administration officials initiated a modification to an existing nuclear gravity bomb (the B61-7) to serve as an interim earth-penetrating weapon. (The resultant modified nuclear weapon is the current B61 Mod 11 nuclear earth penetrator that can be carried on B-2 aircraft.)

A national debate ensued over the proposed modification as journalists and technical experts heatedly debated whether the modification to the B61-7 represented a "new" warhead. Some critics of developing the B61 Mod 11 earth penetrating weapon argued that it would be a *new* warhead. These critics held the view that pursuing any *new* nuclear weapon would be inconsistent with the spirit of U.S. obligations under Article VI of the Nuclear Nonproliferation Treaty. Thus, critics attempted to frame the debate within the semantics of the term *new*.[1]

In the case of the B61 modification, the U.S. took an existing (*not new*) warhead, put it in a different (*new*) configuration as an earth penetrating weapon, deployed it on the same (*not new*) delivery systems (B-2 aircraft), to achieve weapon effects on deep underground targets comparable (but *not new*) to effects from an older, higher yield gravity bomb that was to be retired. The comparable (*not new*) effects on the same (not new) targets were achieved in a somewhat different (*new?*) manner. Is there any wonder why there was confusion over whether the term new was appropriate for this program?

The proposed modification to the B61-7 was implemented. Fielding the B-61 Mod 11 enabled the U.S. to retire all B53 warheads—old multi-megaton warheads that lacked modern safety and security features—without degrading military effectiveness.

Is the Reliable Replacement Warhead (RRW) New?

One question that is often asked is whether RRW concepts will lead to a "new" nuclear warhead. For RRW concepts, the discussion over a term as imprecise as new can be as unhelpful as during the debate over the B61 Mod 11.

Specificity Helps

Perhaps a more straightforward approach is to clarify which aspects of RRW should be considered *new* (and in what way) and which do not meet any of the definitions of *new*.

For the RRW, the category, *not new,* seems to apply to the following:

- The U.S. is developing replacement warheads that are to be carried on existing (*not new*) weapon delivery systems.
- RRW warheads for existing weapon delivery systems are being developed to accomplish the same (*not new*) missions as the warheads they will replace.
- Existing weapons armed with RRW warheads will provide comparable (*not new*) weapon effects on targets.

The category, *new,* seems appropriate for the following:

- *All* components required for RRWs will be *newly produced.* (Of course, *some* newly produced components are required for warhead refurbishment programs.)
- The precise configuration of RRW warheads will be *different* from any previous nuclear warheads in the U.S. stockpile. For example, RRWs will not contain some hazardous materials currently in the warheads that they will replace.
- RRWs will be inherently *safer and more secure* in the event that unauthorized intruders gain access to a weapon or that the weapons are involved in accidents.

Congress Creates Its Own Definition

Congress has legislated a definition of *new* as the term applies to nuclear weapon activities. The congressional definition of *new* may be useful in calling attention to specific kinds of activities. However, it is not useful for distinguishing the potential benefits and drawbacks between things that may or may not be *new*. For example, according to the criteria in the law, the RRW would be considered a "new nuclear weapon." However, the law allows exemptions from being called *new* which seem to apply to the purpose of the RRW program.[2] (Attachment 1 provides an excerpt from the Public Law 107-314 that defines *new*.)

A Final Caution

In the drafting of the commission's final report, writers should be aware of the loaded meaning of *new* and the potential for obfuscation of issues. A blanket rejection of anything *new* could block future modifications and technology advancements that help make the stockpile smaller, safer, more secure, and more adaptable to meet emerging needs.

Attachment 1

Excerpt from: PUBLIC LAW 107–314—DEC. 2, 2002, THE BOB STUMP NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2003 (pages 277-278 of 306)

SEC. 3143. REQUIREMENTS FOR SPECIFIC REQUEST FOR NEW OR MODIFIED NUCLEAR WEAPONS.

(a) REQUIREMENT FOR REQUEST FOR FUNDS FOR DEVELOPMENT.—

(1) In any fiscal year after fiscal year 2002 in which the Secretary of Energy plans to carry out activities described in paragraph

(2) relating to the development of a new nuclear weapon or modified nuclear weapon, the Secretary shall specifically request funds for such activities in the budget of the President for that fiscal year under section 1105(a) of title 31, United States Code.

(2) The activities described in this paragraph are as follows:

(A) The conduct, or provision for conduct, of research and development which could lead to the production of a new nuclear weapon by the United States.

(B) The conduct, or provision for conduct, of engineering or manufacturing to carry out the production of a new nuclear weapon by the United States.

(C) The conduct, or provision for conduct, of research and development which could lead to the production of a modified nuclear weapon by the United States.

(D) The conduct, or provision for conduct, of engineering or manufacturing to carry out the production of a modified nuclear weapon by the United States.

(b) BUDGET REQUEST FORMAT.—The Secretary shall include in a request for funds under subsection (a) the following:

(1) In the case of funds for activities described in subparagraph

(A) or (C) of subsection (a)(2), a single dedicated line item for all such activities for new nuclear weapons or modified nuclear weapons that are in phase 1, 2, or 2A or phase 6.1, 6.2, or 6.2A (as the case may be), or any concept work prior to phase 1 or 6.1 (as the case may be), of the nuclear weapons acquisition process.

(2) In the case of funds for activities described in subparagraph

(B) or (D) of subsection (a)(2), a dedicated line item for each such activity for a new nuclear weapon or modified nuclear weapon that is in phase 3 or higher or phase 6.3 or higher (as the case may be) of the nuclear weapons acquisition process.

(c) EXCEPTION.—Subsection (a) shall not apply to funds for purposes of conducting, or providing for the conduct of, research and development, or manufacturing and engineering, determined by the Secretary to be necessary—

(1) for the nuclear weapons life extension program;

(2) to modify an existing nuclear weapon solely to address safety or reliability concerns; or

(3) to address proliferation concerns.

(d) DEFINITIONS.—In this section:

(1) The term "life extension program" means the program to repair or replace non-nuclear components, or to modify the pit or canned subassembly, of nuclear weapons that are in the nuclear weapons stockpile on the date of the enactment of this Act in order to assure that such nuclear weapons retain the ability to meet the military requirements applicable to such nuclear weapons when first placed in the nuclear weapons stockpile.

(2) The term "modified nuclear weapon" means a nuclear weapon that contains a pit or canned subassembly, either of which—

(A) is in the nuclear weapons stockpile as of the date of the enactment of this Act; and

(B) is being modified in order to meet a military requirement that is other than the military requirements applicable to such nuclear weapon when first placed in the nuclear weapons stockpile.

(3) The term "new nuclear weapon" means a nuclear weapon that contains a pit or canned subassembly, either of which is neither—

(A) in the nuclear weapons stockpile on the date of the enactment of this Act; nor

(B) in production as of that date.

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1. In the October 1997 Congressional Research Service report, "Nuclear Weapons Production Capability Issues," CRS analyst, Jon Medalia, documented this controversy in the following way: "No definition is possible for two terms that appear throughout this [CRS] report, *new weapon* and weapons maintenance, because the terms are themselves weapons in a struggle over the role and future of nuclear weapons. The debate over the definitions, which masquerades as a matter of semantics, cloaks this larger struggle. … a spectrum of activities might or might not, depending on one's point of view, produce a *new weapon* … those who would de-legitimize the use of nuclear weapons, shrink the stockpile, and abolish these weapons as soon as possible, … use n*ew weapon* inclusively in hopes that broadening the list of new weapon activities will narrow the scope of U.S. weapons activities." [emphasis added]
2. Public law calls for budget submissions to distinguish between what is new and not new for nuclear warhead activities. Public Law 107-314, section 3143, requires budget requests for warhead activities for "new" or "modified" nuclear warheads to be explicitly called out. The definition of new in the law clearly applies to the RRW. However, Section 3143 allows for exceptions and that reporting "shall not apply to funds for purposes of conducting, or providing for the conduct of, research and development, or manufacturing and engineering, determined by the Secretary [of Energy] to be necessary—(1) for the nuclear weapon life extension program; (2) to modify an existing nuclear weapon solely to address safety or reliability concerns; or (3) to address proliferation concerns."

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Miscellaneous Issues for the Commission

Linton F. Brooks

Summary. Several issues have been raised by Commissioners or identified by the Infrastructure Experts Working Group (EWG) that do not require additional analysis but that may deserve brief mention in the Commission's final report. This paper summarizes a number of these issues as an aid to the Commission in determining what to include in that report. It is designed to allow rapid decision on issues to include in the report. There is no significance to the order in which issues are presented.

NNSA Funding Levels

Background. A major concern of the Infrastructure Experts Working Group is that the NNSA plan to fund complex transformation through management efficiencies may fail for two reasons. First, the savings may not materialize. Second, most current plans for management improvements and shifting weapons laboratory costs to non-weapons accounts, while commendable, involve only relatively small sums; there have been no proposals that would lead to major cost savings. NNSA's plans are further complicated by the near certainty that the costs of complex transformation and especially of construction of major nuclear facilities will rise. The history of DOE/NNSA nuclear facility construction shows major cost growth, often exacerbated by Congressional funding decisions. NNSA has worked hard to understand this issue but may not be able to solve it. The EWG fears that cost growth of new nuclear facilities and insufficient savings from efficiency improvements could (and probably will) lead to underfunding the weapons labs, especially in basic science.

Options. The Infrastructure EWG is preparing papers looking at phasing the construction of major nuclear facilities in an effort to fund transformation within projected budgets. Such phasing carries production and safety risks. The Commission could, therefore, call for an increase in NNSA funding to allow complex transformation to proceed as soon as possible. Current (FY07) weapons program funding is only 43% of the Reagan peak and 58% of the average funding from 1962-1993. On the other hand, it is unclear whether Congress will support increased funding even if the Commission recommends it. Indeed, recommending more funding for nuclear weapons could discredit the Commission's report. The following options are available:

- Remain silent on the issue.
- Call for increased funding of $200-300 million/year for complex transformation.
- Stress the importance of predictable funding (much cost growth is the result of Congressional inconsistency in funding).
- Note the consequences of attempting complex transformation within steady budgets but make no explicit recommendation.

Acceptability to Congress of Complex Transformation if There Are No Major Savings

Background. Some in Congress assume that reductions in the nuclear weapons stockpile should lead to comparable reductions in the weapons complex. They fail to recognize that much of the complex is necessary regardless of stockpile size. Without major cost savings or the closure of a major facility, some in Congress may oppose complex transformation. The Commission may wish to use its prestige to head off this outcome.

Options. The Commission could (1) remain silent on the issue or (2) include words similar to the following at an appropriate place in the report:

> The Commission firmly believes that the U.S. nuclear weapons stockpile should shrink and that the nuclear weapons complex should be sized for this smaller stockpile. The Commission has spent considerable time seeking to determine the most cost-effective way to approach complex maintenance and transformation and to minimize the retention of unnecessary capabilities. In this regard, we applaud the ongoing NNSA efforts to eliminate and consolidate duplicate capabilities. We note, however, that the expectation that complex transformation will lead to major cost savings or the closure of a major facility is unrealistic.

Nuclear Test Readiness

Background. Although the Administration sought to establish a standard of retaining the ability to resume underground nuclear testing within 18 months, Congress has been unwilling to fund this level of readiness. NNSA now says it can resume testing in 24 months, but test readiness tends to be a low priority for both NNSA and the laboratories. Test readiness costs are small but tend to be underfunded by NNSA and cut on the Hill. There is no consensus (in the Administration or in Congress) on the importance of test readiness. A Commission endorsement of the importance of maintaining readiness to resume underground nuclear testing, if such a step became necessary, might increase support.

Options. The Commission could:

- Remain silent on the issue.
- Call for maintaining test readiness as a safeguard if the Comprehensive Test Ban Treaty is ratified (test readiness was one of the safeguards proposed by the Clinton administration when it submitted the CTBT for ratification).
- Stress the importance of maintaining test readiness in any case.[1]

Base Closure Commission Approach

Background. There are periodic calls, including in Congress, for establishing the NNSA analogue of the Department of Defense Base Realignment and Closure Commission (BRAC). A BRAC approach is inappropriate for NNSA because all NNSA sites are one of a kind. The one exception is the two physics laboratories, Los Alamos and Livermore. These facilities, however, provide indispensable peer review and each contains unique, major, and expensive diagnostic facilities (NIF, DAHRT).

Options. The Commission could (1) remain silent on the issue or (2) include words similar to the following at an appropriate place in the report:

> The Commission is aware of periodic suggestions for establishing a DOE/NNSA analogue of the Department of Defense Base Realignment and Closure Commission (BRAC). We believe that a BRAC approach is inappropriate for NNSA because all NNSA sites are one of a kind. The one exception is the two physics laboratories, Los Alamos and Livermore. These facilities, however, provide indispensable peer review and each contains unique, major, and expensive diagnostic facilities (NIF, DAHRT).

One Physics Lab or Two?

Background. Livermore and Los Alamos both focus on the physics package of nuclear weapons (Sandia is the engineering laboratory and concentrates on components outside the physics package). Periodically, questions are raised about the need for two physics laboratories (Senator Nelson of the SASC Strategic Forces subcommittee raised this briefly when he met with the Commission). Two separate laboratories provide peer review in the one area—the physics package—that we cannot test and where our theoretical understanding remains incomplete. Further, there are unique facilities at both Los Alamos (plutonium, DAHRT) and Livermore (NIF) that the weapons program requires and that would be prohibitively expensive to duplicate.

Options. The Commission could (1) remain silent on the issue or (2) include words similar to the following at an appropriate place in the report:

> The Commission is aware of periodic questions about the need for maintaining both Lawrence Livermore and Los Alamos National Laboratories, since both focus on the physics package of nuclear weapons. In our view, keeping both laboratories is essential. Two separate laboratories provide peer review in the one area—the physics package—that we cannot test and where our theoretical understanding remains incomplete. Further, there are unique facilities at both Los Alamos (plutonium, DAHRT) and Livermore (NIF) that the program requires and that would be prohibitively expensive to duplicate.

Annual Certification of the Stockpile

Background. It is generally acknowledged that no responsibility of the Directors of the weapons laboratories is as important as their involvement in the annual certification process. At their meeting in Livermore, the Commission heard the Directors express concern that concluded that the present fee and evaluation structure took no notice of certification or its importance. The Directors fear that, over time, the parent corporations operating the laboratories could form the erroneous impression that certification is not important to the government.

It would be inappropriate to assign any variable fee to the certification process. The Directors' independent assessment is crucial (indeed, Congress mandates that their letters be transmitted to Congress unaltered to help ensure independence). Assigning a fee could appear to be a government evaluation of the Directors' certification, which would compromise the crucial independence of the process. At the same time, formal recognition of the continuing importance of certification may be important enough to warrant inclusion in the Commission's report.

Options. The Commission could (1) remain silent on the issue or (2) include words similar to the following at an appropriate place in the report:

> No responsibility of the Directors of the weapons laboratories is as important as their involvement in the annual certification process. Despite this, the existing laboratory fee and evaluation structure takes no notice of certification or its importance. Over time, this could lead to the erroneous impression that certification is not important to the government. NNSA should find an appropriate, formal way to recognize the importance of the process. This should not involve assigning a fee to certification, however. Doing so could appear to be a government evaluation of the Directors' certification, which would compromise the crucial independence of the process.

Verification of Elimination of Nuclear Weapons

Background. In the Interim report, the Commission made the following finding:

Four senior statesmen have urged that the nation work towards the global elimination of nuclear weapons. It is clear that the goal of zero nuclear weapons is extremely difficult to attain and would require a fundamental transformation of the world political order. If, however, the new administration accepts their proposal as a long-term goal, there are steps that could be taken in the next few years that would be consistent with such a goal and, at the same time, consistent with maintaining and even increasing our security. Some of our recommendations will deal with such steps.

One area in which additional work is required to evaluate the feasibility of elimination of nuclear weapons is verification. The NNSA weapons laboratories are uniquely qualified to carry out research in this area.

Options. The Commission could (1) remain silent on the issue or (2) in their discussion of near term steps relating to elimination, recommend significant new R&D funding on verification. Any amount is arbitrary, but dedicated funding of perhaps $100 million might send an appropriate signal.

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1. In choosing among these alternatives, the Commission should recall the view of Livermore Director George Miller that a formal test readiness program is unnecessary. His argument that, given that the holes for emplacing devices already exist, we can test if we need to. Neither the EWG nor NNSA fully agree with this conclusion.

Part III: Nonproliferation

Preventing the spread of nuclear weapons and associated technology has proven to be a partly attainable yet frustratingly elusive goal. Since the detonation of the first atomic bomb in 1945, acquiring a nuclear weapons capability has been a powerfully seductive option for states seeking greater security and the prestige and power some perceive it brings. While several states now have established nuclear weapons programs, there have also been other states in the past that have abandoned this path for political, security, and possibly moral reasons. Currently, there is great worldwide impetus to curb the further proliferation of nuclear-related technology and know-how to other states. To this end, the Commission asked its experts to examine a number of nonproliferation subjects and issues, including the Non-Proliferation Treaty (NPT), declaratory policy, and regional proliferation concerns and encouraged them to address any other nonproliferation issues the experts deemed important.

In his opening paper, Joseph Cirincione describes the timeline of nonproliferation landmarks over the past half-century, including the establishment of the NPT, the relinquishment of nuclear weapons by some countries, and the factors, such as the NPT, that led some countries to abandon nuclear programs before they reached fruition. As a suggestion for the Commission, Cirincione provides his perspectives on the connection between the spread of nuclear weapons and U.S. nuclear posture, concluding that the surest way for the U.S. to promote nonproliferation is to lead by example—that is, to reduce our own stockpile as a way to deemphasize the role of and need for nuclear weapons. In a shorter piece on the subject, Philip Zelikow provides a state-by-state analysis of how U.S. nuclear posture has affected foreign acquisition choices in the past. Zelikow surmises, as Cirincione suggests, that superpower behavior could affect the purported value and utility of nuclear weapons in the eyes of other states.

In considering the prospects for preventing nuclear proliferation, Henry Sokolski examines several emerging issues that may threaten to derail the trend towards arms reductions and nonproliferation. The most timely issue is perhaps the spreading of nuclear energy technology. Currently, several states have established programs and several others are clamoring to develop or otherwise obtain this technology. Sokolski points out the heightened chances of nuclear weapons development once a state has acquired nuclear energy technology, even for ostensibly peaceful purposes, and criticizes the limits of the IAEA in its policing and enforcement role. Sokolski urges the Commission to balance arms reductions with solutions that discourage proliferation, specifically ways to render nuclear energy a less attractive energy alternative.

To further the nation's nonproliferation goals, the experts concluded that the United States must strengthen the NPT and use declaratory policy as a way to signal our commitment to curbing the spread of nuclear weapons. Robert Litwak highlights three NPT issues that the U.S. should address: how to strengthen our commitment to the goal of nonproliferation and disarmament; how to allow non-nuclear weapons states to develop nuclear energy technology without permitting them to develop weapons; and how to enforce compliance with NPT commitments. As another way to signal our commitment, James Goodby sees the crafting of appropriate declaratory policy as an instrument that can be used to convince others of our dedication. However, as Goodby points out in an illustrative list of potential declaratory policies, the chosen policy path must be consistent with, and complementary to, other U.S. declared national security policies.

Experts examined several geographical areas of increasing interest, including Europe and the Middle East, to provide a context for regional nonproliferation dynamics. Robert Einhorn and Rebecca Hersman focus on the role of U.S. strategic posture on proliferation in NATO and non-NATO states. In their work, Einhorn and Hersman analyze member states and non-member states through a regional lens: "old NATO"; "new NATO"; potential members including Turkey, Ukraine, et al.; and other non-NATO states. Both authors conclude that a consultative approach to the region and a credible extended deterrent pledge, among other suggestions, will help maintain the relatively stable proliferation dynamics in Europe.

In contrast to this European stability, several experts point out that the Middle East, is an unfortunately fertile place for nuclear proliferation. Robert Litwak explores the connection between U.S. force structure and proliferation in the Middle East, with a special emphasis on Iran. He describes the history of nuclear weapons in the region, where there are no declared nuclear weapons states, and offers insights into reassurance of our allies and approaches for addressing possible Iranian nuclear acquisition. In a complementary paper, Elbridge Colby points out the danger in not planning for a nuclear-armed Iran; by formulating a plan for this worst-case scenario, Colby suggests that the U.S. could make the nuclear option less attractive to Iran by exposing the limits of acquisition. To prevent a "cascade of proliferation," Colby argues that the U.S. should also strengthen its security commitments in the region to assure others that a nuclear-armed Iran can be constrained.

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The Impact of Nuclear Posture on Non-Proliferation

Joseph Cirincione

The nuclear posture and strategic decisions of nuclear-armed nations have a significant, often immediate impact on the nuclear acquisition decisions of other nations. A decision by a state to acquire nuclear weapons can trigger a similar decision in a rival state. Conversely, the commitment not to acquire or maintain nuclear weapons by one state or group of states can foster similar commitments regionally or globally.

This relationship was recognized in U.S. national intelligence assessment in the 1950s and 1960s and informed the U.S. decision to negotiate the Non-Proliferation Treaty. The new international norm established by the NPT and related agreements—that the world was moving toward the elimination of nuclear weapons—helped prevent, and in some cases reverse, the acquisition of nuclear weapons by new states.

Even as the nuclear-armed nations increased and improved their nuclear weapons in the 1970s and early 1980s the process of negotiation of new arms control treaties maintained the deterrent effect of the NPT. Nations and publics saw the arms race as a violation of the disarmament commitments and sought to bring the violating states back to the established norm. Negotiated reductions in U.S. and Russian nuclear arsenals begun in the late 1980s appeared to reaffirm this norm and substantially enhanced non-proliferation efforts, including the successful extension of the NPT in 1995 and the decisions by Ukraine, Belarus, and Kazakhstan to give up the nuclear weapons inherited from the break-up of the Soviet Union in 1991.

The United States ended the negotiated reduction process in the early 2000s, and both the United States and Russia again emphasized the importance of modernizing and maintaining nuclear weapons and expanded their use to additional non-nuclear missions. As some nations concluded that the nuclear-weapon states had no intention of eliminating their nuclear weapons, and as India and Pakistan seemed to win acceptance as new nuclear nations, the anti-proliferation impact of the NPT waned. When new states began to develop nuclear weapon technologies, the international cooperation needed to prevent this development became harder to muster.

Re-establishing the commitment to the elimination of nuclear weapons by the United States and other nuclear-armed states coupled with practical steps towards that goal would be a powerful barrier to the spread of nuclear weapons to other states. The interim report of the Commission correctly notes: "If the U.S. by its actions indicates to other nations that we are moving seriously to decrease the importance and role of nuclear weapons, we increase our chance of getting the kind of cooperation we need to deal effectively with the dangers of proliferation." As the Commission finds:

> "What we do in our own nuclear weapon program has a significant effect on (but does not guarantee) our ability to get that cooperation. In particular, this cooperation will be affected by what we do in our weapons laboratories, what we do in our deployed nuclear forces, what kind of nuclear policies we articulate, and what we do regarding arms control treaties (e.g., START and CTBT)."

The historical record supports this conclusion.

Historic Linkage Between U.S. Nuclear Posture and Proliferation

Non-proliferation has been a declared part of U.S. national security strategy since 1945. From the beginning, officials recognized the linkage between U.S. nuclear posture and proliferation and detailed this linkage in successive official assessments.

In 1958, when only three countries had nuclear weapons, a now declassified National Intelligence Estimate (NIE), the first exclusively devoted to proliferation, noted:

> "A U.S.-USSR agreement provisionally banning or limiting nuclear tests would have a restraining effect on independent production of nuclear weapons by fourth countries. However, the inhibiting effects of a test moratorium would be transitory unless further progress in disarmament—aimed at effective controls and reduction of stockpiles—were evident."[1]

Specifically, the agencies concluded:

> "In the interest of encouraging progress in disarmament among the major powers, there is popular support throughout most of the world for a ban on tests. Hence, a U.S.-USSR agreement provisionally banning or limiting tests would bring into play strong public pressures against testing by fourth countries, even though such countries might not initially be parties to the agreement."[2]

The test ban might not stop some countries from testing, such as France, said the report, "Nevertheless, popular pressure, among other reasons, would probably force the Government to postpone further tests." In the longer run, France would likely restrict its right to make weapons "only as part of an arrangement which required reduction of the stockpiles of the major nuclear powers."

Similarly, international agreements would help deter Japan from acquiring weapons, even if it were close to nuclear capability, as "not only the public but the government as well would welcome any agreement which promised to be effective…although they would be reluctant to accept restriction greater than those accepted by other fourth countries, notably Communist China."[3]

International agreements had their limits, the NIE noted, "The Chinese Communists probably would not be deterred from nuclear weapons production by a limited disarmament agreement, except insofar as they might be prevented by Soviet adherence and Soviet withholding of assistance from China for development of a weapons program."[4]

Subsequent NIEs reaffirmed this linkage. The first assessment done during John F. Kennedy's presidency, in September 1961, reviewed the capabilities of 14 countries believed capable of developing an operational nuclear weapon but noted that having the capability "does not answer the question whether they will actually do so."[5] The decision to go ahead with a program "will depend on a complex of considerations both domestic and international."[6]

Domestic considerations in addition to technical capabilities include cost, security requirements, the desire to increase prestige, and domestic opposition to a program. International factors include the nature of relations with other states and the international security climate. Significantly, the estimate found:

> "The prospect of an agreement among the major powers for a nuclear test ban, for example, especially if it were viewed as a forerunner to broader disarmament steps, would undoubtedly strengthen force opposed to the spread of nuclear capabilities. Growing pessimism as to the likelihood of any realistic disarmament agreement could in some cases (e.g., Sweden, India) tend to undermine opposition to the acquisition of a national nuclear capability."[7]

These early NIEs were as concerned with the nuclear weapon decisions of U.S. friends and allies as they were about potential adversaries. They remind us that the proliferation problem has never been confined to hostile states. The considerations many allies had then apply to considerations U.S. allies have today.

The 1961 NIE examined each specific case, judged France and Israel as likely to develop weapons (France had tested in 1960, Israel would have a bomb by 1968), and found other likely cases were significantly dependent on international disarmament efforts.

Specifically, Sweden would be technically capable of making a nuclear weapon by 1963.

> "If at that time the international climate appeared to be calm, especially if positive steps toward disarmament had been agreed upon by the major powers—or there were reasonable hopes that one would materialize—it is unlikely that the Swedes would decide to undertake a nuclear weapons program. In the absence of such reassuring factors and especially if other countries had already decided to produce nuclear weapons, the pressure to initiate a nuclear weapons program would probably grow sharply."[8]

India, the estimate said, would be under great pressure to develop a nuclear weapon if China exploded a nuclear device, "even so, we believe India would not decide to devote its nuclear facilities to a weapons program unless its leaders were firmly convinced that no broad disarmament agreements were possible…"[9]

Overall, the agencies judged seven nations capable of developing nuclear weapons as unlikely to do so in the next few years, but warned, "These attitudes and views could change in the coming years with changing circumstances, e.g., if it became increasingly clear that progress on international disarmament was unlikely…"[10]

Gilpatric Committee Concludes Weapon States Must Lead by Example

In January 1965, President Johnson's Gilpatric Committee on Nuclear Proliferation report concurred with the sentiment of the earlier NIEs: "It is unlikely that others can be induced to abstain indefinitely from acquiring nuclear weapons if the Soviet Union and the United States continue in a nuclear arms race."[11]

The first page of the report recommended:

> "The Committee is now unanimous in its view that preventing the further spread of nuclear weapons is clearly in the national interest…[T]he United States must, as a matter of great urgency, substantially increase the scope and intensity of our efforts if we are to have any hope of success. Necessarily, these efforts must be of three kinds:

> (a) negotiation of formal multilateral agreements;
> (b) the application of influence on individual nations considering nuclear weapons acquisition, by ourselves and in conjunction with others; and
> (c) example by our own policies and actions."[12]

The Committee detailed necessary steps, including tougher export controls, stricter safeguards on civilian nuclear programs and increased budgets for the IAEA, and acknowledged the importance of the participation by the Soviet Union in efforts to stop proliferation.

It warned: "Lessened emphasis by the United States and the Soviet Union on nuclear weapons, and agreements on broader arms control measures must be recognized as important components in the overall program to prevent nuclear proliferation."[13]

Its number one recommendation stressed the importance of multilateral agreements:

> "Measures to prevent particular countries from acquiring nuclear weapons are unlikely to succeed unless they are taken in support of a broad international prohibition applicable to many countries."[14]

These agreements should include a global non-proliferation agreement (President Johnson concluded the Non-Proliferation Treaty in 1968 and President Richard Nixon secured its ratification in 1970); nuclear free zones, particularly in Latin America and Africa (both have such treaties in effect today); and a comprehensive test ban (concluded in 1996, but yet to enter into force).

After specific recommendation for policies towards individual nations and increased safeguards, the Committee concluded:

> "If we are to minimize the incentives for others to acquire nuclear weapons, it is important that we avoid giving an exaggerated impression of their importance and utility and that we stress the current and future important role of conventional armaments."[15]

Disarmament Part of a Web of Restraints

While progress toward disarmament is an important factor, no assessment ever found that it was the only factor. NIEs usually included a web of issues influencing individual national decisions on nuclear weapon programs. A December 1975 estimate summarized:

> "Threshold-crossers' decisions will be strongly affected by what happens in the whole complex web of international relations—North-South disputes, East-West relations, economic, technological and military developments."[16]

As noted above, the main reasons that states acquire nuclear weapons are: security, prestige, domestic politics, and to a lesser degree, technology and economics. The reasons states do not develop nuclear weapons can be grouped into the same set of factors: security, prestige, domestic politics, technology, and economics.

Each driver for acquiring nuclear weapons has a matching barrier. That is, states decide not to build nuclear weapons—or, in some cases, give up weapons they have acquired or programs that they have started—because they decide that the security benefits are greater without nuclear weapons, that prestige is enhanced by non-nuclear-weapon status, because domestic politics convince leaders not to pursue these programs, or because the technological and economic barriers are too significant to overcome.

An effective non-proliferation policy will minimize the drivers and maximize the barriers. A recent example of this approach is found in the 2007 NIE on Iran. The assessment concluded, "Tehran's decisions are guided by a cost-benefit approach rather than a rush to a weapon irrespective of the political, economic, and military costs." It found that "some combination of threats of intensified international scrutiny and pressures, along with opportunities for Iran to achieve its security, prestige, and goals for regional influence in other ways," might convince Tehran to halt its nuclear program.[17]

The United States on its own or through its alliances could influence some of these factors in the case of Iran or other states. But the global non-proliferation regime has proved a formidable barrier. Since the signing of the NPT, many more countries have given up nuclear weapon programs than have begun them.

In the 1960's, 23 states had nuclear weapons, were conducting weapons-related research, or were actively discussing the pursuit of nuclear weapons. Today, only 10 states have nuclear weapons or are believed to be seeking them.[18] Before the NPT entered into force, only six nations abandoned indigenous nuclear weapon programs that were under way or under consideration: Egypt, Italy, Japan, Norway, Sweden, and West Germany. Since then, Argentina, Australia, Belarus, Brazil, Canada, Iraq, Kazakhstan, Libya, Romania, South Africa, South Korea, Spain, Switzerland, Taiwan, Ukraine, and Yugoslavia have all abandoned nuclear weapon programs or nuclear weapons (or both). Now North Korea, Iran, and Pakistan are the only three states in the world that began acquiring nuclear capabilities after the NPT entered into force and have not ceased their efforts.

This regime will crumble if the consensus built on disarmament and non-proliferation commitments is not restored.

Conclusion

History has borne out U.S. assessments of the essential connection between controlling existing arsenals and preventing new ones. These previous national estimates can assist today's officials in efforts to apply the same logic to current threats.

The Commission's interim report recognizes this connection but does not include a finding on this issue. The report notes in its narrative, "The fact that other states possess nuclear weapons continues to affect decisions about the needed U.S. strategic posture." The reverse is also true: The fact that the U.S. and other states possess nuclear weapons continues to affect other states' decisions about nuclear strategies.

The interim report's Finding 10, that "Other nations are unlikely to eliminate their nuclear weapons just because the United States does so," is true, but they are also unlikely to eliminate their weapons if the United States does not. A negotiated process of nuclear reductions and restraints has proven to be an essential element for convincing states to limit or eliminate their weapons and weapon programs.

The Commission should find that the commitment by the United States and other nuclear-armed nations to eliminate nuclear weapons and to take practical, immediate steps towards that goal will improve U.S. security and substantially enhance prospects for preventing the acquisition of nuclear weapons by new states and by terrorist groups.

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1 Director of Central Intelligence, "National Intelligence Estimate 100-2-58," 1 July 1958 (Approved for release July 2004), p. 2.

2 ibid., p. 17.

3 ibid.

4 ibid.

5 Director of Central Intelligence, "National Intelligence Estimate Number 4-3-61," 21 September 1961, p. 5.

6 ibid, p. 5.

7 ibid, p. 5.

8 ibid, p. 8.

9 ibid, p. 9.

10 ibid, p. 9.

11 President's Task Force on Preventing the Spread of Nuclear Weapons (Gilpatric Report), 21 January 1965, Washington, DC, p. 7.

12 ibid, p. 2.

13 ibid, p. 5

14 ibid, p. 7.

15 ibid, p. 20.

16 Central Intelligence Agency, Directorate of Intelligence, Office of Political Research, "Eight Years Later: New 'Threshold States' Research Study, 'Managing Nuclear Proliferation: The Politics of Limited Choice,' December 1975.

17 National Intelligence Council, "Iran: Nuclear Intentions and Capabilities," November 2007, Washington, DC, p. 7.

18 The 10 countries known to have nuclear weapons or believed to be seeking them are, in order of acquisition: United States, Russia, United Kingdom, France, China, Israel, India, Pakistan, North Korea, and Iran.

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Nuclear Abolition and the Next Arms Race

Henry Sokolski

A decade ago, an analysis of the challenges of transitioning to a world without nuclear weapons would be dismissed as purely academic. No longer. Making total disarmament the touchstone of U.S. nuclear policy is now actively promoted by George Shultz, William Perry, Henry Kissinger and Sam Nunn—four of the most respected American names in security policy.[1] Most of their proposals for reducing nuclear threats, moreover, received the backing of both presidential candidates in 2008 and, now, with President Obama's arms control pronouncements in April in Prague, they have become U.S. policy.[2] These recommendations include getting the U.S. and Russia to make significant nuclear weapons reductions; providing developing states with "reliable supplies of nuclear fuel, reserves of enriched uranium, infrastructure assistance, financing, and spent fuel management" for peaceful nuclear power; and ratifying a verified Fissile Material Cut-off Treaty (FMCT) and a Comprehensive Test Ban Treaty (CTBT).

This newfound enthusiasm for nuclear weapons reductions has been heralded as a clear break from the past. Politically, this may be so. Technically, however, the U.S. and Russian military establishments have steadily reduced the numbers of operational, tactical, and strategic nuclear weapons since the late 1960s sevenfold (i.e., from 77,000 warheads to less than 11,000). By 2012, this total is expected to decline by yet another 50 percent. When policymakers call for more nuclear weapons reductions and increased nuclear restraint, then, they are hardly pushing against historical or technological trends. Unfortunately, this desired harmony with history and science is far less evident when it comes to the specific proposals being made to reduce future nuclear threats. Here, it is unclear if the proposal will reduce or increase the nuclear threats we face.

Consider the suggestion made in the 2008 Nunn-Shultz-Perry-Kissinger *Wall Street Journal* op-ed (a follow-up piece to one they had written a year earlier) that advocated spreading "civilian" nuclear power technology and large reactors to states that promise to forgo nuclear fuel making—a spread that would bring countries within weeks or months of acquiring nuclear weapons. The U.S. and most other states currently claim that all nations have an "inalienable" right to make nuclear fuel.[3] As a result, any state that promises to forgo exercising this right today could legally—once it has mastered how to make weapons-usable plutonium or uranium—change its mind and chemically separate weapons-grade material from its reactor's spent fuel or enrich the fresh fuel it has on hand without breaking any currently enforced legal requirement. In essence, this is what North Korea did despite pledging in a 1992 North-South denuclearization agreement not to reprocess spent fuel or enrich uranium.[4]

Also, nuclear fuel-making efforts can be hidden. A small covert plutonium chemical separation line, for example, might be built in a matter of months and, after a week of operation, produce a crude bomb's worth of weapons-usable plutonium per day. And there are ways that fresh and spent nuclear reactor fuel might be diverted to accelerate a bomb-making program without necessarily setting off any inspection alarms.[5] All of this suggests that giving states everything they need to build and operate a large reactor, in exchange for pledges not to divert the technology or reactor fuel to make bombs, risks increasing the nuclear threats we already face.

Two other nuclear threat reduction proposals now championed by arms control proponents include agreeing to a verified FMCT and CTBT. Proponents insist that such agreements are sufficiently verifiable to prevent violators from securing any significant military advantage. Such contentions are debatable.[6] In the case of a CTBT, critics claim that useful small test explosions could be conducted to validate advanced nuclear weapons designs without necessarily giving off a clear seismic signal and that without such a signal, other nuclear test monitoring improvements fall far short of sufficiency. Worse, they suggest that other nations might gain strategic advantage over the U.S. either by cheating or by interpreting what the ban permits more liberally than the U.S. does. Finally, they note that U.S. ratification is unlikely to bring the treaty into force.[7]

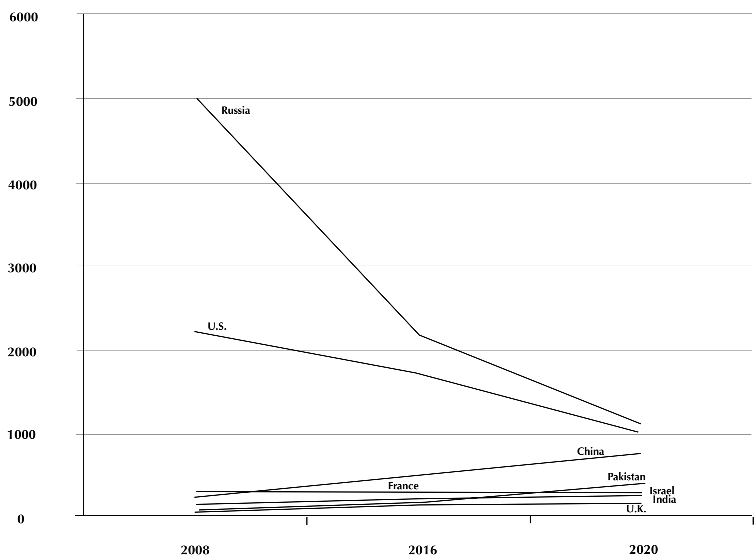
As for verifying a FMCT, a key concern is that it will still allow nuclear weapons states to make nuclear fuel for civilian purposes and that there is no way to reliably detect military diversions from such activities early enough to prevent bomb making. A reasonable rejoinder to this concern is that members of such a treaty would be allowed to keep their existing nuclear weapons stockpiles and so would lack much of a motive to use their civilian nuclear fuel-making plants to cheat. Nonweapons states, such as Iran, however, might well point to such inspections of nuclear fuel-making plants and ask why such casual monitoring cannot be relied upon to prevent military diversions from whatever fuel-making plants they might operate or acquire. Without a good answer to this question, critics note that pushing a FMCT could possibly resolve the headache of growing nuclear arsenals in Pakistan, India, North Korea, and China only to create a much larger set of nuclear proliferation dilemmas in the Middle and Far East.[8] In addition, there are serious political obstacles to bringing such a treaty into force: Egypt and Pakistan would be loath to join until Israel gave up its nuclear weapons or India no longer presented a major military threat. For these reasons, even nominal supporters of the FMCT have suggested that it may make more sense to promote easier, voluntary fissile material control initiatives.[9] Critics, meanwhile, argue that any FMCT verification effort be narrowed to cover only states known to have nuclear weapons.[10]

A Packed Nuclear Crowd?

So far, these verification battles have been waged on the margins of public policy. Each is likely to receive more attention when and if these specific proposals are implemented. Some believe that Washington should unilaterally reduce its operationally deployed nuclear weapons to 1,000 or even 500.[11] What these optimistic analyses rarely consider, however, is Russia's increasing reliance on nuclear weapons for its own security and the nuclear weapons production capacities that continue to grow in Pakistan, India, China, and Israel.[12] They miss how easy it would be for Russia, China, or the U.S. to enlarge their existing nuclear arsenals quickly by exploiting their existing surplus military stockpiles of plutonium and uranium. Nor have they focused on how rapidly Japan or India might acquire nuclear weapons or ramp up the size of their existing nuclear arsenal by dipping into their growing "civilian" stockpiles of weapons-usable plutonium. With such large and growing stockpiles of nuclear-weapons-usable materials, achieving true nuclear arms restraint will become more difficult no matter what the actual number of operationally deployed nuclear weapons might be. Indeed, in 10 to 15 years, the expansion of Chinese, Indian, Pakistani, and Israeli nuclear capabilities could also make further U.S. and allied nuclear weapons reductions politically more difficult and could well encourage other countries to hedge their security bets by developing nuclear weapons options of their own.

The conventional wisdom, of course, is that these dangers are best addressed by getting the U.S. and Russia mutually to reduce their nuclear weapons capabilities.[13] Yet, just as strong is the argument that at some point, the chances for strategic miscalculation and war could increase if China, Pakistan, India, and Israel continue to augment their nuclear capabilities and the U.S. and Russia reduce theirs. Certainly, as the qualitative and quantitative differences between nuclear weapons states decline and are measured in hundreds rather than thousands of bombs and each state has long-range rockets and cruise missiles needed to put them on target, security alliance relations and rivalries could become much more sensitive to a variety of security developments.[14] Assuming the cuts are made in U.S. and Russian stockpiles, the packing of the current nuclear crowd is not farfetched.

Moving toward Life in a Packed Nuclear Crowd?



Fissile for Peace and War

Compounding this worrisome prospect are large amounts of weapons-usable materials in military and growing civilian stockpiles that could be quickly militarized to create or expand existing nuclear bomb arsenals.

Russia, for example, has at least 700 tons of weapons-grade uranium and over 100 tons of separated plutonium in excess of its military requirements, while the U.S. has roughly 50 tons of separated plutonium and roughly 160 tons of highly enriched uranium in excess of its military needs. As noted before, China's surpluses of highly enriched uranium and separated plutonium are already estimated to be large enough to allow Beijing to triple the number of weapons it currently has deployed.[15]

In addition, stockpiles of civilian materials that could be drawn upon to make additional bombs are large or growing. China, for example, is planning to complete two "commercial" reprocessing plants by 2025 that will be able to produce each year enough material to make at least 1,000 crude nuclear weapons.[16] Meanwhile, Japan, a nonnuclear weapons competitor of Beijing, already has roughly 45 tons of separated plutonium (much of which is stored in France), 6.7 tons of which is stockpiled on its own soil—enough to make roughly 1,500 crude nuclear weapons. Japan also will soon be separating enough plutonium at its newest commercial reprocessing plant to make between 1,000 and 2,000 crude-weapons-worth of plutonium a year. Nearly all of this plutonium will be in surplus of Japan's civilian requirements and will be stored in the country.[17]

As for India and Pakistan, they have no declared military surpluses. India, however, has stockpiled roughly 11 tons of unsafeguarded "civilian" reactor-grade plutonium—enough to make well over 2,000 crude fission weapons—and can easily generate over 1,200 kilograms of unsafeguarded plutonium annually. Pakistan has no such reserve but, like India, is planning to expand its "civilian" nuclear generating capacity roughly twenty-fold in the next two decades and is stockpiling weapons-grade uranium. Both countries are increasing their nuclear fuel-making capacity (uranium enrichment and plutonium reprocessing) significantly.[18]

Atoms for Peace?

Finally, several new nuclear weapons contenders are also likely to emerge in the next two to three decades. Among these might be Japan, North Korea, South Korea, Taiwan, Iran, Algeria, Brazil (which is developing a nuclear submarine and the uranium to fuel it), Argentina, Saudi Arabia (courtesy of weapons leased to it by Pakistan or China), Egypt, Syria, and Turkey. All of these states have either voiced a desire to acquire nuclear weapons or tried to do so previously and have one or more of the following: a nuclear power program, a large research reactor, or plans to build a large power reactor by 2030.

With a large reactor program inevitably comes a large number of foreign nuclear experts (who are exceedingly difficult to track and identify) and extensive training, which is certain to include nuclear fuel making.[19] Thus, it will be much more difficult to know when and if a state is acquiring nuclear weapons (covertly or overtly) and far more dangerous nuclear technology and materials will be available to terrorists than would otherwise be. Bottom line: As more states bring large reactors on line more will become nuclear-weapons-ready—i.e., they could come within months of acquiring nuclear weapons if they chose to do so.[20] As for nuclear safeguards keeping apace, neither the IAEA's nuclear inspection system (even under the most optimal conditions) nor technical trends in nuclear fuel making (e.g., SILEX laser enrichment, centrifuges, new South African APS enrichment techniques, filtering technology, and crude radiochemistry plants, which are making successful, small, affordable, covert fuel manufacturing even more likely)[21] afford much cause for optimism.

This brave, new, nuclear world will stir existing security alliance relations more than it will settle them. In the case of states such as Japan, South Korea, and Turkey, it could prompt key allies to go ballistic or nuclear on their own.[22]

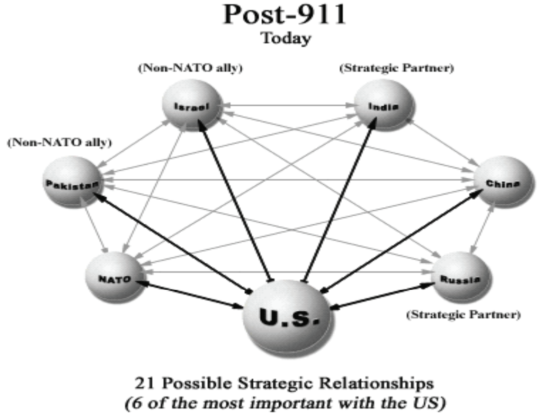
Nuclear 1914

At a minimum, such developments will be a departure from whatever stability existed during the Cold War. After World War II, there was a clear subordination of nations to one or another of the two superpowers' strong alliance systems—the U.S.-led free world and the Russian-Chinese-led Communist Bloc. The net effect was relative peace with only small, nonindustrial wars. This alliance tension and system, however, no longer exists. Instead, we now have one superpower, the United States, that is capable of overthrowing small nations unilaterally with coventional arms alone, associated with a relatively weak alliance system (NATO) that includes two European nuclear powers (France and the U.K.). NATO is increasingly integrating their nuclear targeting policies. The U.S. also has retained its security allies in Asia (Japan, Australia, and South Korea) but has seen the emergence of an increasing number of nuclear-weapon-armed or-ready states.

So far, the U.S. has tried to cope with independent nuclear powers by making them "strategic partners" (e.g., India and Russia), NATO nuclear allies (France and the U.K.), "non-NATO allies" (e.g., Israel and Pakistan), and strategic stakeholders (China); or by fudging if a nation actually has attained full nuclear status (e.g., North Korean or Iran, which, we insist, will either not get nuclear weapons or will give them up). In this world, every nuclear power center (our European nuclear NATO allies), the U.S., Russia, China, Israel, India, and Pakistan could have significant diplomatic security relations or ties with one another but none of these ties is viewed by Washington (and, one hopes, by no one else) as being as important as the ties between Washington and each of these nuclear-armed entities (see chart):

There are limits, however, to what this approach can accomplish. Such a weak alliance system, with its expanding set of loose affiliations, risks becoming analogous to the international system that failed to contain offensive actions prior to World War I. Unlike 1914, there is no power today that can rival the projection of U.S. conventional forces anywhere on the globe. But in a world with an increasing number of nuclear-armed or nuclear-ready states, this may not matter as much as we think. In such a world, the actions of just one or two states or groups that might threaten to distrupt or overthrow a

Current Proliferation Seems Manageable
(With DPRK Disarming and Iran Nonnuclear)



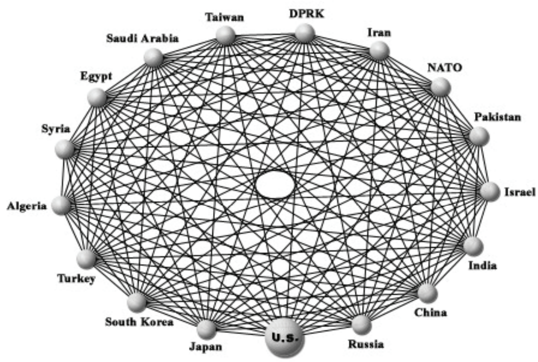
Note: NATO is artificially defined as the nuclear forces of the U.K. and France as these governments closely coordinate their targeting policies with each other and with the U.S.

nuclear weapons state could check U.S. influence or ignite a war Washington could have difficulty containing. No amount of military science or tactics could assure that the U.S. could disarm or neutralize such threatening or unstable nuclear states.[23] Nor could diplomats or our intelligence services be relied upon to keep up to date on what each of these governments would be likely to do in such a crisis (see graphic).

Combine these proliferation trends with the others noted above and one could easily create the perfect nuclear storm: small differences between nuclear competitors that would put all actors on edge; an overhang of nuclear materials that could be called upon to break out or significantly ramp up existing nuclear deployments; and a variety of potential new nuclear actors developing weapons options in the wings. In such a setting, the military and nuclear rivalries between states could easily be much more intense than before. Certainly each nuclear state's military would place an even higher premium than before on being able to weaponize its military and civilian surpluses quickly, to deploy forces that are survivable, and to have forces that can get to their targets and destroy them with highly levels of probability. The advanced military states will also be even more inclined to develop and deploy enhanced air and missile defenses and long-range, precision guidance munitions, and a variety of preventative and preemptive war options.

With More Nuclear-Ready States: Ramp Up to a Nuclear 1914?

Possible Proliferated Future



(136 chances for strategic miscalculation)

Today, plus

Iran DPRK Taiwan Saudi Arabia Egypt
Syria Algeria Turkey South Korea Japan

Certainly, in such a world, relations between states could become far less stable. Relatively small developments—e.g., Russian support for sympathetic near-abroad provinces; Pakistani-inspired terrorist strikes in India, such as those experienced recently in Mumbai; new Indian flanking activities in Iran near Pakistan; Chinese weapons developments or moves regarding Taiwan; state-sponsored assassination attempts of key figures in the Middle East or South West Asia, etc.—could easily prompt nuclear weapons deployments with "strategic" consequences (arms races, strategic miscues, and even nuclear war). As Herman Kahn once noted, in such a world "every quarrel or difference of opinion may lead to violence of a kind quite different from what is possible today."[24] In short, we may soon see a future that neither the proponents of nuclear abolition, nor their critics, would ever want. None of this, however, is inevitable.

Making Something of Zero

The U.S. government is now committed to moving closer to zero nuclear weapons. The challenge, however, is not whether the U.S. can reduce the numbers of nuclear weapons it has deployed or stored. It has been reducing these numbers steadily since 1964. Instead, the question now is how the U.S. might reduce these numbers without simultaneously increasing other states' interest in acquiring nuclear weapons capabilities of their own. Here, it would be helpful to keep four principles in mind:

First, it's critical to avoid making the wrong sorts of military reductions or additions. At a minimum, any push for further nuclear reductions must be as proportionate as possible. To maintain or extend the security alliances that are currently neutralizing states' demands to go nuclear, the U.S. must not only roughly preserve or improve the relative correlation of forces between it and its key nuclear competitors, China and Russia, but do all it can to keep states that might compete in the nuclear arena with these competitors from doing so.

If Washington decides to reduce the operational deployment of additional U.S. nuclear weapons, then it must see to it that additional nuclear restraints—either nuclear deployment reductions or further weapons-usable fuel stockpile or production limits—are imposed on not only Russia, but China, India, and Pakistan as well. As a practical matter, this means other nuclear-weapons-ready states, e.g., Israel, Japan, and Brazil, also should be urged to curtail or end their production of nuclear-weapons-usable materials.

Here, it also would be important for the U.S. to make sure that implementation of its newly struck civilian nuclear cooperative agreement with India does not end up helping New Delhi make more nuclear weapons than it was producing before the deal was finalized late in 2008. Under the NPT, nuclear weapons states are forbidden to help states that did not have nuclear weapons before 1967 acquire them. Also, under the Hyde Act, the executive is required to report to Congress just how much nuclear fuel India is importing, how much of this fuel India is using to run its civilian reactors, how much uranium fuel India is producing domestically, and the extent to which India is expanding its unsafeguarded plutonium stockpiles. If the latter is growing faster per year than it was prior to the U.S.-Indian nuclear cooperative agreement, the U.S. would be implicated in violating the NPT along with Russia and France. If so, the U.S. would be bound to ask these other states to suspend supplying the nuclear fuel they might be selling to India.[25]

As for trying to maintain the relative correlation of forces between nuclear-armed states through military means, considerable care will be required. Missile defenses, for example, could help compensate for eliminated U.S. nuclear weapons systems. Instead of "neutralizing" a possible opponent's nuclear missile by targeting it with a nuclear weapon, it could be possible to do so in a nonnuclear fashion assuming missile defenses become effective and affordable enough. Yet, even if such defenses do grow inexpensive and effective, it would not necessarily improve matters to deploy them in equal amounts everywhere and anywhere.

Consider the case of India and Pakistan. Because Pakistan has not yet fully renounced first use and India will always have conventional superiority over Islamabad, Pakistan would actually have good cause to feel less secure than it already does if equal levels of missile defense capabilities were given to both sides. Similarly, Pakistan would have far more to fear than to gain if the U.S. offers to afford India and Pakistan equal amounts of advanced conventional capabilities since these might conceivably enable New Delhi to knockout Islamabad's nuclear forces without using nuclear weapons. How the U.S. and others enhance each of these states' military capabilities, then, matters at least as much as what each is offered.[26]

Yet another nuclear weapons substitution option now being discussed is to employ long-range precision strike systems in place of eliminated nuclear systems. These systems' effectiveness against hardened or hidden targets is unclear, however. There also may be concerns about how they could be used without unintentionally triggering a nuclear response. What might the numbers and the effectiveness of such nonnuclear systems have to be to substitute for eliminated nuclear weapons systems?

Second, there must be a clear cost for violating existing nuclear control agreements and understandings. The U.S. and other likeminded states have yet to clearly establish that nuclear proliferation does not pay. To the contrary, the cost for the worst nuclear violators—Iran and North Korea—has either been light or nonexistent. It is highly unlikely that North Korea will give up all of its nuclear weapons. It also may be too late to prevent Iran from acquiring nuclear bombs. The prize now is to make sure that North Korea's and Iran's nuclear misbehavior does not become a model for others. Certainly, allowing Tehran to continue to make nuclear fuel under more "intrusive" inspections (even though there is no reliable way to safeguard such activity from being diverted to make bombs) would be self-defeating.

Given that China and Russia cannot be counted on to join the U.S., France, and others to significantly tighten trade sanctions against Tehran, the only choice Washington and its allies have is either to back down or to try to isolate and further stigmatize Iran's nuclear behavior as best they can without additional support from the United Nations Security Council. This would require conducting the type of Cold War the U.S. and its key allies waged against the Warsaw Pact, the apartheid government in South Africa, and Libya.

The U.S. and other like-minded states should try to establish "country-neutral" sanctions in domestic and international law. These sanctions should be directed against states that cannot be found to be in full compliance with their nuclear safeguards obligations, who violate them, or who would withdraw from the NPT before coming back into full compliance. Rather than placing the burden on the IAEA Board of Governors, the Nuclear Suppliers Group, or the UN Security Council to agree on the sanctions for such transgressions, a minimal, predetermined list should be automatically imposed.

Third, it is critical to distinguish between nuclear activities and materials that the IAEA can reliably safeguard against military diversions and those that it cannot. The NPT is clear that all peaceful nuclear activities and materials must be safeguarded—that is, inspected in such a way as to prevent them from being diverted to make nuclear weapons. Most NPT states have fallen into the habit of thinking that if they merely declare their nuclear holdings and allow international inspections, they have met this requirement.

This is a prescription for mischief. After the nuclear inspections gaffes in Iraq, Iran, Syria, and North Korea, we now know that the IAEA cannot reliably detect covert nuclear activities. We also know that the IAEA and EURATOM annually lose track of many bombs' worth of usable plutonium and uranium at declared nuclear fuel-making plants. We also know that the IAEA cannot assure continuity of inspections for spent and fresh fuel rods at more than half of the sites that it inspects. Finally, we know that declared plutonium and enriched uranium can be made into bombs and their related production plants diverted so quickly (in some cases, within hours or days) that no inspection system can afford untimely warning of a bomb-making effort.

All of these points fly directly in the face of the kind of warning nuclear safeguards must provide. Any true safeguard against military nuclear diversions must reliably detect them early enough to allow outside powers to intervene to block a bomb from being built. Anything less is only monitoring that might, at best, detect military diversions after they occur. Given the inherent limits to the kind of warning IAEA nuclear inspections can provide, the IAEA needs to concede that it cannot safeguard all that it inspects.

Such candor would be most useful. It would immediately raise first-order questions about the advisability of producing or stockpiling plutonium, highly enriched uranium, and plutonium-based reactor fuels in any but the nuclear weapons states. At the very least, it would suggest that nonweapons states ought not to acquire these materials or facilities beyond what they already have. Where would one raise these points? A good place to start would be the NPT Review conference that will be held in May of 2010. In advance of the conference, the U.S. and other likeminded nations independently might assess whether or not the IAEA can meet its own inspection goals; under what circumstances (if any) these goals can be met; and, finally, whether these goals are good enough. This work would cost very little and could be undertaken immediately without legislation or any new international agreements.

Fourth, if we want to develop safe, economically competitive forms of energy, we should discourage using additional government financial incentives to promote new civilian nuclear projects. Supporters of nuclear power insist that its expansion is critical to prevent global warming. The proof is to be had in determining what new nuclear power plants will cost in comparison to their alternatives while factoring in the price of carbon. Creating more government financial incentives specifically geared to build more nuclear plants and their associated fuel-making facilities will only make this more difficult to do. Not only do such subsidies mask the true costs of nuclear power, they tilt the market against their alternatives. This is troubling since the most dangerous forms of civilian nuclear energy—nuclear fuel making in most nonweapons states and large power reactor projects in war-torn regions like the Middle East—turn out to be poor investments as compared to much safer alternatives.[27]

There are three ways around these problems. The first would be to get as many governments as possible to offer proposed civilian energy projects that would compete openly against possible, nonnuclear alternatives. This is hardly a radical proposal. France, the U.S., and the IAEA have all quietly noted that nuclear power programs only make sense for nations that have a large electrical grid, a major nuclear regulatory and science infrastructure, and proper financing. U.S. officials have emphasized how uneconomical Iran's nuclear program is in the near- and mid-term as compared to developing Iran's existing natural gas resources. In the U.S., private banks refuse to invest to build new nuclear power plants unless they secure federal loan guarantees and new, additional subsidies. After an extensive analysis in 2006, the British government found, in contrast, that if carbon emissions are properly priced (or taxed), British nuclear power operators should be able to cover nearly all of their own costs without government support.[28]

Economic judgments and criteria, in short, are already being relied upon to judge the merits of proposed nuclear projects. The U.S. and most other nations, however, should go further. Most advanced nations, including the U.S., claim to back the principles contained in the Energy Charter Treaty and the Global Charter on Sustainable Energy Development. These international agreements are designed to encourage all states to open their energy sectors to international bidding and to assure that as many subsidies and externalities are internalized and reflected in the price of any energy option.[29] The U.S. claims it is serious about reducing carbon emissions in the quickest, least costly manner. If so, it also would make sense to reference and enforce the principles of the Energy Charter Treaty and the Global Charter on Sustainable Energy as a part of the follow-on to the Kyoto Protocol.

As a second and complementary effort, the United States should work with developing states to create non-nuclear alternatives to address their energy and environmental needs. In the case of the U.S., this would merely entail following existing law. Title V of the Nuclear Nonproliferation Act of 1978 requires the Executive Branch to do analyses of key countries' energy needs and identify how these needs might be addressed with non-fossil, non-nuclear energy sources. Title V also requires the executive branch to consider the creation of an energy-focused "Peace Corps" to help developing nations explore these alternative options. To date, no president has chosen to implement this law. The U.S. Congress has indicated that it would like to change this by requiring Title V country energy analyses (and outside, non-governmental assessments of these analyses) to be done as a precondition for the U.S. initialing of any new, additional nuclear cooperative agreements. Here, the U.S. can lead by example.[30]

Finally, although it may not be immediately possible to get all nations to agree about what is "peaceful" and protected under the NPT, it would be useful to try by insisting that such projects ought to be safeguardable and beneficial. But it will be impossible to persuade even one state of this proposition if the U.S. continues to insist that all states have an inalienable right to the most dangerous nuclear materials, equipment, and technology so long as they have some conceivable civilian application and are declared and inspected. The U.S. should stop making this case and instead build on the argument it already has made that there is no duty for any nuclear supplier state to supply dangerous technologies or materials under the NPT. In specific, the U.S. should explain that what is peaceful and protected under the NPT can only be determined on the basis of a number of factors, including whether or not the material, equipment, or technology can be reliably safeguarded against possible military diversions and if the project that they are dedicated to is economically justifiable.

Certainly, there is nothing in the NPT that requires member states to read the treaty as if they must encourage countries to come to the very brink of acquiring bombs by developing dangerous, money-losing nuclear ventures. In fact, one would hope that most states would conclude that the NPT was designed to produce just the opposite result. Ultimately, however, the credibility of this point will turn on just how economically competitive civilian nuclear projects are when weighed against their alternatives. The U.S. and those other states eager to prevent nuclear proliferation should do all they can to find out.

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1. See George Shultz, William Perry, Henry Kissinger, and Sam Nunn, "A World Free of Nuclear Weapons," *Wall Street Journal*, opinion, January 4, 2007, p. A15, at http://online.wsj.com/article/SB116787515251566636.html?mod=opinion_main_commentaries; and "Toward a Nuclear-Free World," *Wall Street Journal*, opinion, January 15, 2008, p. A13, at http://online.wsj.com/article/SB120036422673589947.html.

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

3. The Nuclear Nonproliferation Treaty (NPT) actually does not mention any specific nuclear technology or materials that states have a per se right to acquire. On the contentious character of the claim that there is such a right to fuel making see, Victor Gilinsky and William Hoehn, *Nonproliferation Treaty Safeguards and the Spread of Nuclear Technology*, R-501 (Santa Monica, CA: RAND Corporation, May 1970); Albert J. Wohlstetter, et al., "Moving Toward Life in a Nuclear Armed Crowd?" ACDA Report No. PH-76-04-389-14, December 4, 1975

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4. "Joint Declaration on the Denuclearization of the Korean Peninsula," available at http://www.fas.org/news/dprk/1992/920219-D4129.htm.

5. See, e.g., Henry S. Rowen, "This 'Nuclear-Free' Plan Would Effect the Opposite," *Wall Street Journal,* January 17, 2008, p. A-15. For additional technical background, see David Kay, "Denial and Deception Practices of WMD Proliferators: Iraq and Beyond," in Brad Roberts, ed., *Weapons Proliferation in the 1990s* (Cambridge, MA: MIT Press, 1995); Victor Gilinsky, et al., *A Fresh Examination of the Proliferation Dangers of Light Water Reactors* (Washington, D.C.: NPEC, 2004), at http://www.npec-web.org/Essays/20041022-GilinskyEtAl-LWR.pdf; and see Andrew Leask, Russell Leslie, and John Carlson, "Safeguards As a Design Criteria—Guidance for Regulators," Canberra, Australia: Australian Safeguards and Non-proliferation Office, September 2004, pp. 4-9, available at http://www.asno.dfat.gov.au/publications/safeguards_design_criteria.pdf.

6. See, e.g., George Perkovich and James Acton, *Abolishing Nuclear Weapons* (London: IISS, 2008) and Henry Sokolski and Gary Schmitt, "Advice to the Nuclear Abolitionists," *Weekly Standard,* May 12, 2007 (go to http://www.weeklystandard.com/Content/Public/Articles/000/000/015/068ekbiw.asp).

7. See, e.g., The Congressional Commission on the Strategic Posture of the United States, "The Case Made by Opponents of the CTBT," in *America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States*, May 6, 2009, pp. 84-84, available at http://media.usip.org/reports/strat_posture_report.pdf and Kathleen Bailey, *The Comprehensive Test Ban Treaty: An Update on the Debate* (Fairfax, VA: NIPP, March 2001).

8. On these points see, Brian G. Chow and Kenneth A. Solomon, *Limiting the Spread of Weapon-Usable Fissile Materials* (Los Angeles, CA: RAND, MR-346,USDP, 1993); Gilinsky, *A Fresh Examination;* Henry Sokolski and G. Schmitt, "Advice for the Nuclear Abolitionists," *Weekly Standard,* May 12, 2008, http://www.weeklystandard.com/Content/Public/Articles/000/000/015/068ekbiw.asp; and Christopher Ford, "The United States and the Fissile Material Cutoff Treaty," U.S. Department of State, Under Secretary for Arms Control and International Security release, March 17, 2007, available at http://www.state.gov/t/isn/rls/other/81950.htm.

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10. Christopher Ford, "Five Plus Three: How to Have a Meaningful and Helpful Fissile Material Cutoff Treaty," *Arms Control Today,* March 2009, available at http://www.armscontrol.org/act/2009_03/Ford.

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Goodby.pdf; and Graham Allison, *Nuclear Terrorism: The Ultimate Preventable Catastrophe* (NY, NY: Times Books, 2004).

12. On Russia's interest in advanced bombs to threaten NATO and to eliminate U.S. electronic battlefield dominance, see Thomas C. Reed and Danny Stillman, *The Nuclear Express: A Political History of the Bomb and Its Proliferation* (Minneapolis, MN: Zenith Press, 2009), pp. 198-99, and *America's Strategic Posture,* pp. 12-13, 25.

13. See, e.g., Hugh Gusterson, "The New Nuclear Abolitionists," *Bulletin of the Atomic Scientists,* May 13, 2008; Ellen O. Tauscher, "Achieving Nuclear Balance," *Nonproliferation Review,* Vol. 14, No. 3 (November 2008); Jeff Zeleny, "Obama to Urge Elimination of Nuclear Weapons," *New York Times,* October 2, 2007; and Johan Bergenas, "Beyond UNSCR 1540: the Forging of a WMD Terrorism Treaty," *CNS Feature Stories,* October 23, 2008, available on line at http://cns.miis.edu/stories/081022_beyond_1540.htm#fn43.

14. Some might argue that the number of deployed nuclear weapons is only one metric, that a force's readiness, survivability, accuracy, ability to penetrate defenses, and to hit targets in a timely fashion all go into calculating just how "superior" one force is compared to another. Still, ballistic missile-delivered fission warheads against cities in wealthy states in Europe, Asia, or America might be very potent even if they were militarily crude. Also, as American and Russian numbers decline and command systems become less vulnerable due to distribution and tunneling, there may well be a shift to targeting population rather than weapons or command centers. If so, relative numbers would constitute a significant metric.

15. See International Panel on Fissile Materials, *Global Fissile Materials Report 2008,* October 2008, pp. 11 and 16, at http://www.ipfmlibrary.org/gfmr08.pdf; and Andrei Chang, "China's Nuclear Warhead Stockpile Rising," UPIAsia.com, April 5, 2008, at http://www.upiasia.com/Security/2008/04/05/chinas_nuclear_warhead_stockpile_rising/7074/.

16. Areva Press Release, "Areva and CGNPC Sign Biggest Contract Ever," November 26, 2007, at http://www.areva-np.com/scripts/press/publigen/content/templates/show.asp?P=875&L=U.S.; and World Nuclear Association, "Nuclear Power in China," October 2008, at http://www.world-nuclear.org/info/inf63.html. China operates a pilot reprocessing plant capable of processing 50 tons of spent fuel annually. There are plans to expand this plant to process 100 tons. This would enable China to make up to 250 crude bombs' worth of plutonium a year. China also is planning on completing a large commercial scale plant in 2020 based on indigenous technology located in far western China. Finally, China has contracted with Areva to compete a plant by 2025 capable of processing 800 tons of spent fuel annually that is nearly identical in capacity and design to that Areva help Japan complete at Rokkasho, i.e., large enough to make between 1,000 and 2,000 bombs per year assuming operation a full capacity and a bomb's worth being defined as requiring 4 kilograms of plutonium.

17. See Masafumi Takuba, "Wake Up, Stop Dreaming: Reassessing Japan's Reprocessing Program," *Nonproliferation Review,* March 2008, p 71.

18. See, e.g., Zia Mian, A.H. Nayyar, R. Rajaraman, and M.V. Ramana, "Plutonium Production in India and the U.S.-India Nuclear Deal," in Henry Sokolski, ed., *Gauging U.S.-Indian Strategic Cooperation* (Carlisle, PA: Strategic Studies Institute, 2007), pp. 99-128, at http://www.npec-web.org/Books/20070300-NPEC-GaugingUS-IndiaStratCoop.pdf; and Zia Mian, A.H. Nayyar, R. Rajaraman and M.V. Ramana, "Fissile Materials in South Asia" in Henry Sokolski, *Pakistan's Nuclear Future: Worries Beyond War* (Carlisle, PA: Strategic Studies Institute, 2008), pp. 129-67, at http://www.npec-web.org/Books/20080116-PakistanNuclearFuture.pdf.

19. See, e.g., Elaine Sciolino, "Nuclear Aid by Russian to Iranians Suspected," *New York Times,* October 10, 2008, available online at http://www.nytimes.com/2008/10/10/world/10nuke.html; and John Larkin and Jay Solomon, "As Ties Between India and Iran Rise, U.S. Grows Edgy," *Wall Street Journal,* March 24, 2005. Also see "Russia, Iran May Set Up JV [Joint Venture] to Operate Bushehr NPP in 3 Months," RIA Novosti, February 14, 2008, at http://en.rian.ru/business/20080214/99244034.html; and "[Russian] Nuclear Staff in Iran Doubles," Reuters, February 19, 2008, at http://www.sptimes.ru/index.php?story_id=25086&action_id=2.

20. It is worth noting that it took the U.S. only 10 months after it started up its first large reactor to test its first bomb at a time when it was unclear whether or not the U.S. knew how to make a practical weapon. In the USSR, it took only 14 months. Assuming the reactor in question has been up and running, the distance between decision and detonation could be

considerably shorter. On these points, see Reed and Stillman, *The Nuclear Express,* p. 83 and Thomas B. Cochran, "Adequacy of IAEA's Safeguards for Achieving Timely Detection," in *Falling Behind,* pp. 121-58.

21. On these points see, David Kay, "Denial and Deception Practices of WMD Proliferators: Iraq and Beyond," in Brad Roberts, ed., *Weapons Proliferation in the 1990s,* (Cambridge, MA: MIT Press, 1995); Victor Gilinsky, et al., *A Fresh Examination of the Proliferation Dangers of Light Water Reactors* (Washington, D.C.: NPEC, 2004), at http://www.npec-web.org/Essays/20041022-GilinskyEtAl-LWR.pdf; David Kay, "Iraqi Inspections: Lessons Learned," *Lecture for the Program of Nonproliferation Studies,* Monterrey Institute of International Studies, February 10, 1993, p. 7, at http://cns.miis.edu/research/iraq/kay.htm; Henry Sokolski, ed., *Falling Behind: International Scrutiny of the Peaceful Atom* (Carlisle, PA: Strategic Studies Institute, 2008) at http://www.npec-web.org/Books/20080327-FallingBehind.pdf; Mark Clayton, "Will Lasers Brighten Nuclear's Future: New Process Could Replace Centrifuges But Renew Threat of Nuclear Proliferation," *Christian Science Monitor,* August 27, 2008, at http://features.csmonitor.com/innovation/2008/08/27/will-lasers-brighten-nuclears-future/; and World Nuclear Association, "Nuclear Power in South Africa," October 2008, at http://www.world-nuclear.org/info/inf88.html.

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23. Thomas A. Donnelly, "Bad Options: Or How I Stopped Worrying and Learned to Live with Loose Nukes," in *Pakistan's Nuclear Future: Worries Beyond War,* edited by Henry Sokolski (Carlisle, PA: U.S. Army War College's Strategic Studies Institute, January 2008), pp. 347-68, available at http://www.npec-web.org/Books/20080116-PakistanNuclearFuture.pdf.

24. Herman Kahn, *Thinking about the Unthinkable* (New York: Avon Books, 1964), p. 222.

25. See the Henry J. Hyde United States-India Peaceful Atomic Energy Cooperation Act of 2006, "Implementation and Compliance Report," available at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_cong_bills&docid=f:h5682enr.txt.pdf.

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28. See British Department of Trade and Industry, "The Energy Challenge: Energy Review Report 2006," July 11, 2006 available at http://www.dti.gov.uk/energy/review/.

29. For more on these points, see Henry Sokolski, "Market Fortified Non-proliferation," in *Breaking the Nuclear Impasse* (New York, NY: The Century Foundation, 2007), pp. 81-143, available at http://nationalsecurity.oversight.house.gov/documents/20070627150329.pdf. For more on the current membership and investment and trade principles of the Energy Charter Treaty and the Global Energy Charter for Sustainable Development go to http://www.encharter.org and http://www.cmdc.net/echarter.html.

30. See Letter from Congressmen Brad Sherman, Edward Markey and Ileana Ros-Lehtinen to Secretary of State Hillary Clinton, April 6, 2009, available at http://bradsherman.house.gov/pdf/NuclearCooperationPresObama040609.pdf; S1138 Nuclear Safeguards and Supply Act of 2007, available at http://www.govtrack.us/congress/billtext.xpd?bill=s110-1138; and the key nuclear recommendations of the Congressionally appointed bipartisan Commission on the Prevention of Weapons of Mass Destruction Proliferation and Terrorism available at http://www.npec-web.org/Frameset.asp?PageType=Single&PDFFile=20081200-WmdCommission-AdoptedNpecRecommendations&PDFFolder=Reports.

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Can U.S. Strategic Posture Influence Foreign Choices about Nuclear Weapons?

Philip D. Zelikow

A cluster of original decisions by the United States, made mainly in 1941-1946, did influence foreign behavior by confirming that the world would enter an age of nuclear weapons. The later, parallel U.S. and Soviet decisions to proceed with development of thermonuclear weapons flowed from the original decisions, as did the British development of such weapons.

It is hard to identify any particular choice in U.S. strategic posture that could then have altered the course of French and Chinese decisions, or India's move reacting to China.

In very different ways, the clandestine Israeli, South African, and Pakistani programs had nothing to do with U.S. strategic posture. Their only relation was, perhaps, in a negative sense. There was no U.S. strategic posture that seemed reassuring, or even relevant, to the Israeli, South African, and Pakistani governments at the time.

Thus the flip side. Where U.S. strategic posture has been relevant to regional security choices, it has had a marked effect—invariably positive so far.

- U.S. nuclear weapons developments and extensive deployments of these weapons definitely contributed to choices against nuclear weapons by governments in the Federal Republic of Germany, Japan, South Korea, and Taiwan. U.S. nuclear posture may also have helped to tilt the balance in countries like Turkey, while other kinds of U.S. security assurances may have helped persuade countries like Saudi Arabia to forgo nuclear weapons (which they would probably purchase), at least so far.

- Beyond U.S. nuclear weapons developments and deployments, U.S. determination to counter proliferation with offensive action if necessary indirectly contributed to forced termination of nuclear weapons programs in Iraq (at least in 1991) and Libya (2004). It may have had a positive effect on Israeli calculations in that country's preventive strike on Syria in 2007. This U.S. posture has also helped limit the damage from the failure to stop the North Korean weapons program.

On the other hand, reflection on the available information about these more recent clandestine nuclear programs—in North Korea, Iraq, Libya, and Iran—certainly reveal concern about U.S. conventional military capabilities. Rhetoric aside, there is no evidence that U.S. nuclear posture played—or plays—a notable part in the choices of these countries, one way or the other.

The strength of U.S. counterproliferation policy, backed by conventional forces, has had some evident deterrent effect. The effect is only as strong as the supporting conventional forces and the apparent will to use them.

About five years ago, a number of scholars were gathered to survey nuclear weapons choices made by a number of states. Their conclusion is similar and is worth quoting at length:

> U.S. nuclear gluttony—the allegation that the United States has not sufficiently reduced its vast stockpiles of nuclear weapons and therefore failed to live up to its NPT 'bargain'—is also judged to have little immediate relevance in the complex decisionmaking surrounding those choices. Most of the nuclear decisions in our case studies are driven primarily by regional security considerations in which the characteristics of U.S. nuclear capabilities play at most a minor role. To the extent that U.S. nuclear capabilities are a factor—either because a country depends on a U.S. nuclear umbrella or fears U.S. nuclear coercion or attack—it is very unlikely that the country's behavior will be affected by any distinction it may perceive between older and newer U.S. nuclear designs (or by the size of the U.S. nuclear arsenal). In reality, the behavior of most countries will be influenced not by their perceptions of the specific qualities of the U.S. nuclear arsenal (old or new, large or small) but by their judgment of the willingness of the United States to bring its unprecedented *conventional* military superiority to bear—either on their behalf or in opposition to them.[1]

OK. So there is no evident correlation between superpower nuclear force posture and nonproliferation, except for the positive one that correlates nuclear reassurance with some nonproliferation choices.

But what about a different question: Might superpower force posture play a part in decisions to give up weapons among countries that already have them?

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1. Kurt M. Campbell & Robert J. Einhorn, "Concluding Observations," in Campbell, Einhorn, Mitchell B. Reiss, eds., *The Nuclear Tipping Point* (Washington, DC: Brookings, 2004), p. 323.

To this question the answer is more nuanced.

- If the superpowers want to abolish nuclear weapons (and I think this should be their goal), it is true that they do contradict such a message if they visibly redouble their investment in nuclear weapons.
- But it is also false to believe that arsenals of important weapons are likely to be abolished on a deliberate glidepath. Battleships were not gradually reduced in order to make way for aircraft carriers. Signature weapon systems are reduced out of existence—often quite rapidly—*after* they have become superfluous.

Superpower behavior *can* influence foreign states to regard nuclear weapons as superfluous. These efforts would not need to focus much on nuclear force posture, per se. The superpower behavior (both U.S. and Russian) could be more effective by emphasizing two other tracks:

- Introduction of an effective, affirmative system for international management of critical stages in the nuclear fuel cycle. Before their work was mangled in the Baruch plan, the original Acheson-Lilienthal team of early 1946, which included the founding fathers of U.S. nuclear weapons, presciently recognized: a) that the outlaw-inspection model for eliminating nuclear weapons was likely to fail, not least because the inspectors would find their work so stultifying; and b) that an international management model for critical processes was technically feasible and would feel productive to those charged with running it.
- Providing security reassurances against conventional military threats that do not rely on nuclear weapons. Nuclear weapons were originally relied on by the United States as an offset against very large-scale industrial warfare. For our military purposes, these weapons are now superfluous, except to deter their use against us. Since nuclear proliferation has still been substantially contained, it is not too late to embark on other security policies that could help make such weapons appear to be immaterial or counterproductive in a few key regional situations.

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Nuclear Non-Proliferation Treaty (NPT)

Robert Litwak

Objective: Strengthening the NPT as an instrument of U.S. nonproliferation strategy

Interim Report guidance: "The NPT has long provided the essential legal framework for preventing proliferation. But it is not sufficient for this purpose—and was never intended to be. It must be supplemented with other tools of policy. Its effectiveness has been undermined by errors in how it has been interpreted and by failures of enforcement by the UN Security Council. The 2010 Review Conference provides an opportunity to renew international efforts to address these problems with the legal framework. The U.S. ought to begin now to set the stage by engaging with friends and allies on those issues related to desired improvements."

Focus: Strengthening NPT rights and obligations—the Article II pledge by non-nuclear weapon states not to develop or acquire nuclear weapons, the Article VI commitment of the nuclear weapons states to disarm, and the Article IV right of non-nuclear weapon states to access to nuclear energy technology in a way that does not call their Article II commitment into question—and enforcing signatories' compliance with NPT responsibilities.

Challenges

Issue: Strengthening the U.S. commitment to nuclear disarmament under Article VI

Context

- The interim report stated that nuclear disarmament would "require a fundamental transformation of the world political order." But long-term abolition is a treaty commitment and many steps toward achieving that visionary objective have considerable and often bipartisan support, and can benefit U.S. security.
- Representatives of other states have told U.S. officials that the United States is not complying with its Article VI obligations, and that this affects their willingness to cooperate on issues of importance to the nonproliferation, including adherence to the Additional Protocol. The argument that U.S. weapons affected cooperation is designed to influence U.S. behavior and may not reflect the real reasons for limited cooperation.
- The U.S. case for Article VI compliance is strong, including the deep cuts in the nuclear arsenal that have occurred since the end of the Cold War through the START Treaty, the Moscow Treaty, the Presidential Nuclear Initiatives, and other actions.
- Further reductions will eventually lead to levels of arms where the verification challenges increase dramatically.
- For non-nuclear weapon states, the CTBT is perhaps the most tangible symbol of the nuclear weapon states' Article VI commitment. The interim reports states, "The new administration may consider resubmitting the CTBT to the Senate for ratification."

Recommendations

- Reaffirm the U.S. commitment to Article VI. The United States should take the initiative and not be defensive in the lead up to the 2010 RevCon. Engaging with foreign governments is central to defusing the Article VI issue. The strong U.S. case for Article VI compliance should be effectively communicated by senior officials through a public diplomacy campaign, including high-level U.S. representation at the RevCon to signal its importance.
- Initiate P-5 discussions to realize a P-5 statement of intent on Article VI, if possible. A P-5 security dialogue on Article VI would focus on the nature of the international security environment, technical challenges of verification raised by further deep reductions, and enforcement mechanisms to address the security consequences of cheating.
- The U.S. administration should fund technical and analytical studies of the verification challenges that further reductions would pose.

- Action on START is critical and can be done by 2010. This treaty, another key element of Article VI compliance, should be extended or a follow-on agreement negotiated.
- The next Nuclear Posture Review should reflect and support U.S. nonproliferation interests, including the NPT. Creating and publicizing an unclassified version to avoid the public diplomacy problems encountered with the 2001 NPR is essential.
- While views differ on the best approach to ensuring confidence that U.S. warheads remain safe, secure, and reliable, there should be a preference for exercising the option that generates the desired warhead attributes while not casting doubt on the arms control and reduction process.

Issue: Ensuring the Article IV rights of non-nuclear weapon states without facilitating proliferation

Context

- Civil nuclear energy programs, if not properly regulated (most notably, through controlling the spread of fuel cycle technology), can reduce the supply-side obstacles to nuclear weapons acquisition.
- The emerging nuclear "renaissance" is fueled by projected energy demand and climate change concerns. The challenge is to reduce the potential for additional states in the region to acquire hedge options for weaponization in the process.

Recommendations

- Affirm that the inalienable right under Article IV is conditional on compliance with Articles II and III. That is, the NPT does not permit weaponization activities under the guise of a civilian nuclear energy program.
- Reform the nuclear fuel cycle: Develop and win international approval for an effective plan for reliable supply (including front-end and back-end fuel cycle services) that affords non-nuclear weapon states access to civil nuclear energy technology without increasing the risks that weapons-grade materials will fall into the wrong hands.

Issue: Enforcing compliance of NPT responsibilities

Context

- North Korea and Iran have flagrantly violated their IAEA safeguards agreements and hindered inspections.
- Proscribed activities under the guise of Article IV may be difficult to detect in a determined proliferator.
- The flawed U.S. intelligence assessment of Iraq's WMD programs has seriously eroded trust in American competence and credibility. This perception will affect the U.S. ability win support for strong collective action in other cases.

Recommendations

- To avoid devaluing U.S. credibility, policymakers should refrain from rhetorical excesses, such as loose talk about "regime change." Coercive diplomacy is not possible when the adversary believes that the objective is regime change.
- With respect to proscribed activities and capabilities, promote the shift from national to multinational lists in support of more robust export control and interdiction efforts.
- Ensure that the IAEA has the authority, capabilities, and resources to meet current and emerging safeguards challenges. Develop "proliferation-resistant" technologies for nuclear power and associated for "next generation safeguards."
- Provide support and resources for effective implementation of UN Security Council 1540.
- Begin a new dialogue with the P-5 on enforcement, which would eventually be expanded to other key states.

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Nuclear Nonproliferation Implications of U.S. Declaratory Policy

James E. Goodby

The Issue. How to integrate nonproliferation with other aspects of U.S. declared national security policy.

Discussion. "Declaratory policy" refers to public statements by senior U.S. officials regarding all aspects of the U.S. Government's aims, intentions, and plans for nuclear weapons within the overall framework of U.S. national security policy. In theory, U.S. declaratory policy assigns top priority to nonproliferation. In practice, nonproliferation competes for attention with other U.S. national security goals. Several decisions are likely to be made by the incoming administration within the next year that will become part of declaratory policy. Some will relate to conditions under which the U.S. would use nuclear weapons. Others will be concerned with the U.S. defense budget. Many will refer to U.S. relations with other nations, both friends and adversaries. The announcement of these individual decisions, even before their implementation, in some cases, will affect the assessments other nations make about U.S. nuclear nonproliferation policy. The menu of potential decisions is long and needs to be viewed in its entirety so that U.S. declaratory policy can have the maximum effect in achieving U.S. nonproliferation goals.

Goals of publicly-stated policies. Four priority and interrelated goals that the United States seeks to achieve through public statements of policy regarding nuclear weapons are:

- Deter hostile action against U.S. interests

- Respond in a controlled and calibrated fashion to any use of weapons of mass destruction against the United States, U.S. forces or interests, or allied and friendly nations
- Strengthen nuclear nonproliferation regimes and reverse nuclear proliferation
- Reduce reliance on nuclear deterrence, considering that it is decreasingly effective against today's threats and increasingly dangerous.

Categories of nonproliferation-related policies. The main points of U.S. security policy that most closely bear on nonproliferation, leaving aside bilateral issues, include:

- Conditions under which the United States might use nuclear weapons
- Intentions regarding size, characteristics, development, and conditions of deployment of nuclear weapons
- Plans and expectations for defenses against nuclear weapons
- Programs designed to combat nuclear proliferation, including nuclear-armed terrorist organizations
- Steps directed at reducing reliance on nuclear weapons
- Relationship between conventional and nuclear forces
- Civil nuclear power programs.

Illustrative alternative options for future U.S. declaratory policies. Policies designed to achieve these goals can easily conflict with each other. Integrating these policies is presidential business.

What are the purposes of U.S. nuclear weapons?

- Deter nuclear attacks on the United States by states or non-state entities.
- Reassure allies and friendly states that the United States is capable of deterring nuclear attacks on them.
- Dissuade states and non-state entities from acquiring nuclear weapons.

How might the U.S. use nuclear weapons?

- Only in response to first use by another nations or a non-state entity.
- Only as a last resort in a major war.
- Use as necessary to preempt a nuclear attack.
- Use as necessary to defeat armed aggression against an ally or friendly nation.
- Possible use as part of a response to the use of chemical or biological weapons by an adversary nation or non-state entity.

How much is enough?

- As low a number as is consistent with deterrence and commitments to allies.
- A number sufficient to dissuade adversaries from seeking military advantages.
- Zero operationally deployed nuclear weapons if all other states agree under conditions of reliable verification.

Where should nuclear weapons be deployed?

- No deployments of nuclear weapons outside the territorial limits of the United States, except on naval vessels home-ported in the United States.
- Maintain current deployments in Europe.

Should U.S. nuclear weapons be kept in a prompt launch mode?

- All or most land-based ballistic missiles maintained in a ready-to-launch status on short notice.
- All ballistic missiles, in agreement with other major nuclear weapons states, deployed in such a fashion that prompt launch is not possible, that preparations for launch would be visible, and time would be available for diplomacy and decisionmaking.

What is the function of the national nuclear weapons infrastructure?

- A responsive nuclear infrastructure that is capable of maintaining a safe, secure, and reliable nuclear weapons arsenal. Key components of the infrastructure must include (a) expert personnel engaged in a strong and stable program of stockpile stewardship, without which confidence in the U.S. nuclear deterrent will erode, and (b) an active research program exploring a range of stockpile options enabling the U.S. to respond as may be necessary to changing threats and other potential national security requirements.
- Build a new stockpile of nuclear warheads and bombs and do so without explosive testing.
- Modernize nuclear weapons and test as necessary to ensure reliability.

How to construct defenses against nuclear attack?

- Continue to deploy defenses against limited ballistic missile attacks along the lines of those defenses already deployed in the western United States and being planned for Eastern Europe.
- Suspend deployments pending a technical review and consultations with potential partners in cooperative ballistic missile defense programs.
- Develop the capabilities to enforce "no-fly zones" for ballistic missile launches in countries like Iran and North Korea.

- Accelerate deployment of sensors to monitor ships and aircraft entering U.S. territory.
- Strengthen the Proliferation Security Initiative, UN Resolution 1540 and the Global Threat Reduction Initiative.

How best to prevent and roll back nuclear proliferation, while complying with NPT obligations?

- Adopt and implement the Shultz, Kissinger, Perry, Nunn initiatives.
- Give priority to first steps, such as ratifying the Comprehensive Nuclear Test Ban Treaty.
- Use the May 2009 Preparatory Meeting and the May 2010 NPT Review Conference to reaffirm U.S. obligations under Article 4 and 6 of the NPT.
- Offer security assurances to nations that forgo nuclear weapons programs.
- Focus only on rogue states, using force if necessary.

How best to strike a balance between conventional and nuclear forces?

- Maintain a sharp distinction between the two.
- Merge conventional and nuclear forces, at least conceptually, into one strike force, as in the Bush administration's triad.
- Develop a conventionally armed ballistic missile force, as is being done on a small scale in the Global Strike Force.
- Strengthen conventional forces to serve as a credible substitute for extended nuclear deterrence.

How to manage civil nuclear power programs to reduce proliferation risks?

- Curtail cooperation with other countries.
- Internationalize the nuclear fuel cycle.
- Develop new technologies to reduce risks of proliferation.
- Rely on lease-take back arrangements.

Injecting nonproliferation interests into declaratory policies. Although there are nonproliferation implications in each of the declaratory policy options in this illustrative list, proponents of various policies will not necessarily weigh those considerations very highly. That problem could be ameliorated if policy makers were required to take into account the following questions as part of a "nonproliferation impact statement."

- Does it appear to increase or reduce the salience of nuclear weapons in international security affairs?
- Does it emphasize or blur the distinction between the nuclear "haves" and "have nots"?
- Does it strengthen or weaken the position of pro-nuclear weapons advocates in other nations?

- Is it consistent with or incompatible with the overall anti-proliferation stance of the United States?
- Can it be effectively defended in terms of U.S. obligations under the Nonproliferation Treaty?
- Does it appear to be asking for special treatment for the United States and its friends or is it even-handed with respect to all nations in compliance with the NPT?

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Implications of U.S. Strategic Posture for Proliferation Dynamics in NATO and Non-NATO Europe

Robert Einhorn and Rebecca Hersman

This paper assesses the possible effects of U.S. strategic posture on the following U.S. nonproliferation objectives in Europe over the next 20–25 years:

- *Reassuring* allies and friends they can depend on us for their security and do not require their own nuclear weapons
- *Dissuading* others—both state and non-state—from trying or be tempted to acquire nuclear weapons or nuclear weapons capability
- *Preventing* others—both state and non-state— from acquiring nuclear weapons
- *Reversing*/rolling back nuclear proliferation
- *Enhancing* international support for measures to strengthen the nonproliferation regime and prevent nuclear proliferation

Relevance of These Objectives to NATO and Non-NATO Europe

The NATO alliance is the United States' longest standing formal alliance and the most explicit U.S. commitment to nuclear-based extended deterrence (nuclear umbrella). As such, the principal nexus between U.S. strategic posture and nonproliferation lies in the area of "reassurance," namely our ability to continue to convince our friends and allies that they can depend upon us for their security and do not require their own nuclear weapons. Indeed, U.S. nuclear-based security assurances provided in the NATO context are the main reason why many U.S. allies that were capable of acquiring nuclear weapons chose not to do so. However, while reassurance remains an important objective, NATO countries, along with some other non-NATO European countries, may not always share similar views as to the need for and nature of reassurance.

The alliance is also home to a number of key partners in building international support for efforts to prevent nuclear proliferation and strengthen the nonproliferation regime. Many parties to the Nonproliferation Treaty (NPT) regard the Treaty as a bargain in which the non-nuclear weapon states (NNWS) agree to renounce nuclear weapons in exchange for a commitment by the nuclear powers (in Article 6) to reduce and ultimately eliminate their nuclear arsenals. NNWS, especially non-aligned countries, claim that the nuclear powers have not done enough to fulfill that commitment and argue that, unless more rapid progress is made in reducing nuclear weapons and their role in international relations, it will not be possible to take further steps to strengthen barriers to proliferation (e.g., adherence to the IAEA Additional Protocol, constraints on the spread of enrichment and reprocessing capabilities). Although U.S. allies and friends in Europe are not as critical of the nuclear powers' record as the non-aligned, they nonetheless believe that additional steps to implement Article 6 (including deeper reductions in U.S. and Russian nuclear forces and entry into force of the Comprehensive Test Ban Treaty) would significantly strengthen the hand of those seeking to tighten measures that are critical to dissuading, preventing and reversing proliferation among state and non-state actors elsewhere around the world.

Today, the non-proliferation objectives of dissuading, preventing and reversing proliferation are less directly relevant to alliance members. With the possible exception of Turkey, we have no countries known or suspected to be seeking nuclear weapons either within NATO or even within a broader European context, and therefore no real targets for these other objectives. That is not to say that such objectives have not been relevant in the past or will not be in the future. During the Cold War, upwards of seven European countries (Norway, Sweden, Yugoslavia, Romania, Italy, Switzerland and possibly Spain and Germany), including at least two then NATO allies (Norway and Italy), sought to develop nuclear weapons capabilities or at least thought seriously about the option of acquiring them. Later, during the 1990s, three states (Belarus, Kazakhstan and Ukraine) inherited Soviet nuclear weapons capabilities resident on their territories, which they ultimately chose to relinquish. That said, in the future, a significant loss of confidence in U.S. extended deterrence coupled with a deteriorating threat environment (perhaps via a more regionally assertive Russia or a nuclear-armed Iran) could trigger a reassessment of the need to possess national nuclear deterrent forces in Europe. This could happen both within the alliance, or more likely among some European nations along NATO's fringe. At that point, a role for U.S. military capabilities/strategic posture in dissuading, preventing and reversing proliferation could resurface.

The Impact of Different Concepts and Components of Strategic Posture on Reassurance

Given the importance of reassurance in the European/NATO context, it is essential that the U.S. optimize its strategic posture to provide effective reassurance to its allies; ensure operational effectiveness and alliance cohesion; and maximize nonproliferation outcomes. Some of these concepts and components include the type and characteristics of U.S. nuclear weapons; the size of our overall nuclear stockpile; the nature of deployment and delivery (CONUS-based or forward deployed; types of delivery platforms); and the role of missile defenses and conventional strategic forces in the overall U.S. strategic posture. Most analysts believe that effective assurance in NATO depends far more upon notions of "political will," namely the United States' willingness to use nuclear weapons if necessary in defense of a NATO ally, than upon detailed assessments of operational proficiency and warhead specifications. In fact, there is some anxiety that U.S. nuclear modernization is focused less on improving safety and reliability and more upon increasing their utility. Most European countries seem comfortable with significant reductions in strategic stockpiles, but differ as to where those numbers should ultimately fall. Many European countries are increasingly comfortable with and supportive of missile defenses as an important component of the overall strategic posture, although a number of European governments would like to pursue missile defenses in a way that does not antagonize the Russians. Moreover, many European countries view conventional strategic weapons with skepticism; both in terms of the risks associated with misinterpretation of a conventional ballistic missile launch as well as in terms of the far lower deterrence value of such capabilities vis a vis potential adversaries.

Divergent Views on Strategic Posture Across Europe and the Alliance

The twenty-six countries which comprise the NATO alliance (not to mention the non-NATO European countries on the periphery of the alliance, several of which want to join NATO) by no means constitute a unitary actor. In fact, domestic political attitudes toward U.S. strategic capabilities, threat perceptions, propensities for proliferation, requirements for assurance, and status as international nonproliferation partners differ substantially.

"Old NATO"

Most of the pre-1999 expansion members of NATO hold deeply internalized commitments to nonproliferation; and in some cases even sympathize with nonaligned positions on the U.S. need to fulfill article VI. All of them have ratified the CTBT and would like to see the U.S. ratify and help bring the Treaty into force. They believe the credibility of U.S. extended deterrence would not be adversely affected by further significant reductions in U.S. nuclear forces, although they would be much more comfortable if the Russians were making comparable reductions. They therefore favor continued U.S.-Russian bilateral arms control efforts, including a replacement for START, which they believe should be legally binding and contain verification measures to promote greater predictability and stability in the strategic relationship. Aside from supporting such measures on their own merits, the old NATO countries maintain that they would provide leverage to persuade NPT parties to accept additional steps to shore up and strengthen the nonproliferation regime.

This view is enhanced by perceptions of threat within old NATO which emanate from terrorism and out of area concerns rather than from within the region. The resurgence of Russia worries old NATO countries, especially after the Russia-Georgia conflict and Russian efforts to use energy supplies to Europe for political purposes. But they do not see the current challenge from Russia as a return to the Cold War, with Cold War levels of military threat.

Old Europe includes two nuclear powers, France and the U.K. Both share the view that the U.S. can substantially reduce its nuclear forces without harming extended deterrence, and both have reduced their own forces to below 300 nuclear weapons. However, the two don't see eye-to-eye on all nuclear issues. The U.K. has officially embraced the goal of moving toward a world without nuclear weapons, while the French are concerned that adopting the goal and the rhetoric of elimination could de-legitimize nuclear weapons and undercut efforts to modernize their deterrent.

Some old NATO countries are rather schizophrenic about the role of nuclear weapons in Europe—a number of political/military elites value the prestige/reassurance associated with forward deployed weapons; sharing the nuclear mission, role in nuclear planning group, etc., but their populations (and significant elements within their political leadership) hold a significant ambivalence about the role of U.S. nuclear weapons in their security. Many favor the removal of U.S. nuclear weapons from their territory and believe that extended deterrence can be maintained with CONUS-based or other offshore nuclear capabilities.

"New NATO"

"New NATO" includes the 10 former Soviet bloc countries that have joined NATO since 1999—Poland, Hungary, Czech Republic, Estonia, Latvia, Lithuania, Slovakia, Slovenia, Romania, Bulgaria. New NATO countries have a significantly stronger perception of regional (i.e., Russian) threat than old NATO, especially in light of Georgia, although they too seem more concerned about the political challenge of coercion and intimidation from Moscow rather than the prospect of military confrontation. These countries may not have the same level of internalized commitment to non-proliferation as is found among the "old NATO" alliance members. They believe lower levels of U.S. nuclear forces are compatible with extended deterrence but they would probably strongly favor reciprocal Russian reductions. To new NATO countries, the INF and CFE treaties are probably more immediately relevant to their interests than START.

It appears that tangible expressions of U.S. support are more important to these countries than to old NATO. Defense cooperation in the conventional area (e.g., air defense in Poland) as well as political statements of reassurance may be just as important, or even more important, than the quantitative or qualitative characteristics of U.S. nuclear forces. They are probably more supportive of the continued stationing of U.S. nuclear forces in Europe than old NATO, although many of them would face considerable domestic resistance to stationing nuclear weapons on their territory. This desire for tangible expressions may derive in part from their concerns about the willingness of the United States, and especially other alliance members, to "deliver" on its alliance commitment. As a result, over time these countries may desire a stronger role in nuclear mission, operations and planning, which could further complicate alliance relations with Russia.

Turkey

Sitting astride Europe and the Middle East, Turkey is the greatest proliferation risk with the NATO alliance and within the European context more generally. This NATO ally faces growing instability and potential proliferation in its neighborhood. Turkey is deeply affected/conflicted not only by European security conditions but even more so by those in the Middle East. As a result, we cannot separate Turkey from proliferation dynamics in the Middle East—especially vis a vis Iran but also Syria. Turks tend to see Iran as a competitor for regional influence, not as a direct military threat. They believe Iran's acquisition of nuclear weapons would bring instability to the region and therefore oppose it, but apparently don't feel the kind of direct threat that the Gulf Arabs and Israel feel. Turkey depends on Iran for much of its energy supplies and trade and wants to maintain good relations with Tehran. Turkey's most immediate security concern is not Iran but the PKK.

Indeed, the key test of U.S. reliability, as far as Turkey is concerned, is how active we are prepared to be (e.g., intelligence support) in helping Turkey deal with the PKK threat coming from Iraq.

Turkey still wants membership in the EU and feels frustrated and resentful toward Europeans that oppose its entry. Europe's ambivalence toward Turkey has contributed to a sense of alienation in Turkey and to a greater Turkish orientation toward the Middle East. It still attaches great importance to its NATO membership, but harbors doubts that NATO's Article 5 commitment would be triggered on Turkey's behalf. Turks often cite NATO's delay in meeting Turkey's request for air defense support at the time of the first Gulf War as evidence that it cannot rely fully on NATO. Similarly, some Turkish military and political elites are wary about an overreliance on the United States for Turkey's security. This concern is exacerbated by deep public antipathy for the U.S. in general and for the U.S. military—both conventional and nuclear—in particular.

This ambiguity is reflected in Turkish attitudes about U.S. nuclear weapons in the region—making it difficult to assess Turkey's attitude toward removing U.S. nuclear weapons from Turkey or from Europe altogether. Turkish elites probably favor the retention of U.S. nuclear weapons on their soil, especially given Iran's nuclear program and possibly Syria's as well, and may see U.S. deployment as an alternative to Turkey acquiring its own deterrent. The Turkish population as a whole, however, may well prefer to have U.S. nuclear weapons withdrawn. Former senior Turkish officials, including those who see no need for retaining U.S. nuclear weapons in Turkey, are emphatic that, whatever the U.S. and NATO may decide to do, it is critical that Turkey be fully consulted. They remember bitterly when, as a means of resolving the Cuban missile crisis, the U.S. agreed to withdraw Jupiter missiles from Turkey without even mentioning it in advance to the Turkish Government.

Some analysts believe that Turkey is already positioning for possible future nuclear weapons options. Some Turks speak openly of the need to acquire a nuclear deterrent if Iran and others in the region go nuclear. But those are usually people with no authority and little knowledge of the technical demands of acquiring nuclear weapons. Turkey today lacks the infrastructure to produce fissile materials, and it would take considerable time and effort to acquire it. Turkey is only now accepting bids for its first nuclear power reactor. Turkey's nuclear intentions certainly must be watched closely, and special efforts must be made to reassure Ankara. But there are no indications that Turkey has decided to embark on a military nuclear program.

"NATO Wannabe's" and other non-NATO European states

Albania, Croatia, Macedonia, Georgia and Ukraine are all actively seeking membership in the NATO alliance. Could/would failure to incorporate these countries into NATO trigger increased interest/intent for an independent nuclear option? Ukraine seems to be most credible candidate for reconsideration of a nuclear option in the event that its NATO aspirations are not met. While such a possibility does not appear likely or imminent, Ukraine is the second most serious proliferation risk (after Turkey) in Europe. The technical and political hurdles for the remaining "NATO Wannabe's" would appear to be daunting—making such an outcome highly unlikely. Moreover, while granting Ukraine (and Georgia) NATO membership would almost certainly reduce any interest they may have in acquiring nuclear weapons, it could also lead to greater Russian belligerence toward them and to less Russian cooperation with us in addressing a range of proliferation threats, including Iran. When considering the impact of U.S. strategic posture on these countries, our broad political and military posture (including defense cooperation and political statements) will be more relevant to those countries' incentives for going nuclear—whether these steps are taken within the NATO context or through direct bilateral cooperation—than whatever we may do with regard to our nuclear weapons policy.

As for the rest of non-NATO Europe, only Serbia stands out as a proliferation risk of any serious consideration. While not a significant risk at this time, it is possible that an isolated Serbia could consider reigniting its nuclear ambitions. Starting in the late 1940s the Belgrade government (then Yugoslavia) pursued a nuclear weapons program on an intermittent basis until 1987. While that program failed to make significant technical progress despite its longevity, Belgrade could reconsider the option if it feels isolated or threatened by NATO and/or ethnic conflict on its borders reemerges.

Conclusions

- Proliferation dynamics in Europe are relatively stable, especially when compared with the Middle East. No countries are known to be pursuing deterrent capabilities of their own.
- Nonetheless there are worrisome developments, especially resurgence of Russia and prospect of a nuclear-armed Iran and possibly additional proliferation in the Middle East.
- The interests and perceptions as to the role of nuclear weapons and the impact of U.S. strategic posture on proliferation intentions can vary significantly across the NATO alliance and adjacent European coun-

tries. The United States will need to have a general posture that seeks to serve our objectives as well as country-specific elements that can address the particular reassurance needs of individual countries.

- It remains essential to reinforce the credibility of the U.S. extended deterrent, especially with respect to Turkey. Reassurance to non-NATO European states will also be required, but through different means (i.e., we can't offer them a NATO-type pledge, at least until they become members).
- The credibility of the U.S. nuclear umbrella depends more on political factors (declaratory policy, strong bilateral engagement and statements of assurance, etc.) than the quantitative and qualitative characteristics of U.S. nuclear forces.
- Maintaining a credible extended deterrent in Europe is compatible with further reductions in U.S. nuclear forces, especially if they are matched by Russian reductions.
- Most Europeans have become more supportive of integrating missile defense into the U.S. and European strategic posture, although there are differences over the extent to which Russian sensitivities should be taken into account in considering the location and timing of missile defense deployments—with "old NATO" tending to be more concerned about Russian reactions than "new NATO" or NATO Wannabe's.
- Proliferation risks associated with the withdrawal of U.S. nuclear forces are greatest for Turkey, where some believe the basing of weapons is a critical component of extended deterrence and a strong factor in restraining national nuclear ambitions. Concrete evidence of Turkish intentions in this regard, however, is lacking.
- Overall attitudes toward retaining U.S. nuclear weapons in Europe are mixed within Europe, even within NATO and individual NATO countries, greatly complicating an assessment of risks and benefits associated with the benefits of U.S. nuclear weapons on U.S. soil. Some believe that, by sharing the responsibility for the safety, security, and operational requirements and political challenges associated with nuclear weapons, the health of the nuclear-based Alliance and the "coupling" of the U.S. deterrent to its allies can be maintained. Others believe that fundamental changes in the security environment, especially the end of the Soviet-Warsaw Pact threat against which NATO's nuclear posture was directed, would allow the withdrawal of U.S. nuclear forces from Europe without paying a significant price, either in terms of security or alliance unity. To avoid undercutting the extended deterrent, any decision on reducing or withdrawing U.S. nuclear weapons in Europe should only be taken after intensive consultations with key NATO

countries as well as some non-NATO countries. A factor that could affect European attitudes is whether a change in the status of U.S. nuclear weapons in Europe would be reciprocated by Russian actions—for example, the withdrawal of Russian non-strategic nuclear weapons from forward locations to a small number of secure storage sites deep within Russia.

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Proliferation Dynamics in the Middle East/Persian Gulf

Robert Litwak

Issue: How does the U.S. force structure affect nuclear nonproliferation objectives and vice versa?

Context

- The Middle East and Persian Gulf is a geographical region of primary nonproliferation concern. Unlike South Asia, the region has no declared nuclear weapons states. Israel is an undeclared, albeit acknowledged, nuclear weapon state. Its acquisition of that capability triggered nuclear flirtation by Egypt before the 1967 war but did not precipitate catalytic proliferation in the region.
- An assessment of proliferation motivations must distinguish between factors that are regime-specific (e.g., the driving force of Saddam Hussein's megalomania behind the Iraqi program) and those that are regime-generic (i.e., those that would motivate a regime of whatever political character).
- Civil nuclear energy programs, if not properly regulated (most notably, through control of fuel cycle technology), can reduce the supply-side obstacles to nuclear weapons acquisition.
- "Peaceful" nuclear programs (such as past exploratory efforts by Egypt and Algeria) have had a putative energy rationale but also likely reflect interest in a long-term hedge option for weaponization.
- Iraq, Libya, and Iran moved beyond hedging to covert weapons programs. These programs were motivated not by the need to counter/

deter an existential security threat, but by the desire to secure preponderant security status in the region.

- The emerging nuclear "renaissance" is fueled by projected energy demand and climate change concerns. The challenge is to reduce the potential for additional states in the region to acquire hedge options for weaponization in the process.
- Regional states have used force to prevent adversary states from acquiring nuclear capabilities. Cases: Israel against Iraq (Osirak, 1981) and Syria (2007); Iran and Iraq against each other's facilities during their war in the 1980s.
- The United States has supported nonproliferation as a norm, but, in practice, it has focused on keeping nuclear weapons out of the "wrong hands." This attitude has fueled regional criticism of a U.S. double standard. After 9/11, the Bush administration argued that threats of the new era derived from the character of U.S. adversaries—"unpredictable" rogue states and undeterrable terrorist groups. This redefinition of threat (focusing on the potential "nexus" of proliferation and terrorism) prompted a shift in strategy from an emphasis on containment and deterrence to regime change and military preemption (if not prevention).
- Two contrasting precedents were set in 2003 to roll back national programs.
    - Iraq: coercive nonproliferation through a change of regime.
    - Libya: nonproliferation through a change within a regime.
        - The demonstration effect of the Iraq war was a necessary, but not sufficient condition underlying Qaddafi's strategic turn.
        - The crux of the deal was a tacit, but clear, security assurance that the United States would eschew regime change as an objective if Libya agreed to transparent WMD disarmament.

The New Catalyst: Iran's Nuclear Program

- Iran's program is determined and incremental, but not a crash program to get a weapon as quickly as possible in the face of an existential threat. To the extent that Iran perceives a regime-threatening threat, it arises from the United States, which has sent a mixed message over the U.S. objective (regime change versus behavior change).
- Iranian interest in nuclear weapons is not regime-specific as the program began under the Shah. CIA Director George Tenet stated in February 2003: "No Iranian government, regardless of its ideological leanings, is likely to willingly abandon WMD programs that are seen as guaranteeing Iran's security."

- Although North Korea has a more advanced nuclear weapons program, Iran is viewed as a more dynamic threat: While the defensive, inwardly focused Kim Jong Il regime presides over a failed state, Teheran's financial resources from oil and gas fuel its increasingly assertive, ideologically-driven foreign policy.
- Iran has achieved a hedge or breakout option through its uranium enrichment program.
- Iran's nuclear options: bargaining chip, hedge, or weapon?
    - Reversal: Iranian mastery of uranium enrichment technology calls into question the possibility of verifiable disarmament through negotiations. An agreement to cap Iranian U enrichment capabilities to the pilot plant at Natanz would require an intrusive inspection to ensure that proscribed activities are not occurring at undeclared sites.
    - Hedge: In the absence of an urgent threat, Iran may choose to continue a nuclear hedge strategy indefinitely. Given the possible regional reaction to an overt nuclear Iran (discussed below), a hedge strategy might suit Iran's interests. (As former Iranian President Hashemi Rafsanjani put it to the Carnegie Endowment's George Perkovich in 2005: "As long as we can enrich uranium and master the [nuclear] fuel cycle, we don't need anything else. Our neighbors will be able to draw the proper conclusions.")
    - Weaponization: According to the 2007 NIE, work stopped in 2003 but the report did not opine on whether that is because Iran has what it needs. Weaponization could be undeclared (which is possible since testing is less important with the uranium enrichment route) or declared (with a small deployed arsenal on ballistic missiles, eventually aiming for a secure second-strike capability).

U.S. Regional Allies: Perceptions of and Responses to the Iranian Nuclear Program

- The region after Iraq: Iran, now regionally ascendant in the absence of a regional counter-balancer, is viewed increasingly as a threat by its Arab neighbors. Meanwhile, the botched U.S. intervention in Iraq has eroded America's reputation, calling into question both U.S. military capabilities and political judgment.
- Strategic options for regional states
    - Balance: The traditional response of regional states, such as Saudi Arabia, has been to seek reassurance from the United States. The most plausible contingency is not a direct Iranian nuclear threat

against its neighbors, but rather, Tehran's exploitation of the shadow effect of its nuclear capability (whether a hedge or weapon) to further its interests through coercive diplomacy.

- Bandwagon: In the face of an ascendant Iran and doubts about a weakened United States looking for an exit from Iraq, regional states might deviate from past policies and seek reassurance from Iran by cutting deals in Tehran.
- Acquisition of a nuclear weapons capability to have an independent deterrent. Or cultivate relations with an alternative great power for a security guarantee (e.g., recent Russian political inroads with the Persian Gulf states).

- Key countries: The response of regional states would depend on which option Iran chooses. Overt Iranian weaponization (as opposed to hedging or undeclared weaponization) would be an unacceptable change in the status quo.
  - Israel: A closing window on preventive military action, which would set back but not end the Iranian program. An Iranian move beyond a latent hedge capability could precipitate a change in Israel's opaque policy (i.e., becoming a declared nuclear weapons state with an explicit deterrent warning to Iran).
  - Egypt: An Iranian nuclear hedge and even weaponization would not trigger an immediate Eqyptian response as such a move would undercut the government's two (increasingly unpopular) policy pillars—peace with Israel and a close relationship with the United States. However, an Israeli shift toward overt nuclear weaponization in response to an Iranian bomb would compel Egypt to reconsider its non-nuclear status.
  - Saudi Arabia: Overt weaponization could prompt Riyadh to acquire a weapon from Pakistan or station Pakistani forces in the Kingdom.
  - Turkey: Iranian nuclear acquisition could precipitate an internal debate about the continuation of Turkey's non-nuclear status. Ankara would weigh the negative consequences for Turkey of a nuclear Iran against the reliability of the U.S./NATO security guarantee and the perceived costs with the United States and Europe of a decision to acquire an independent deterrent.

Implications for U.S. Force Posture and Nonproliferation Goals

Reassurance

- Reassurance of allies: Preventing U.S. allies from either acquiring independent nuclear capabilities to counter Iran or reaching some accommodation with a regionally-ascendant Tehran is contingent on Washington's ability to provide reassurance that is both militarily and politically credible.
  - For U.S. regional allies, reassurance is less a function of U.S. military capabilities than the political credibility of the U.S. alliance commitment.
  - U.S. conventional forces are central to reassurance: Forward basing of U.S. ground and maritime forces needs to be politically sustainable in the host countries and the United States.
  - Ballistic missile defense: An important element of U.S. reassurance policy with regional allies, notably Israel, given continued advances of Iran's long-range ballistic missile program.
  - Extended deterrence will dictate the size and the composition of the U.S. nuclear force. How low can the United States go if Iran acquires a small nuclear arsenal over the next 5–20 years?
  - Positive security assurances could forestall Israel from going overt, which would likely have catalytic consequences with Egypt and perhaps Saudi Arabia.

Deterrence, prevention or reversal

- Adversaries: Coercive diplomacy is not possible when the adversary believes that the objective is regime change. With Iran, the belief in Tehran that the U.S. objective is regime change is a proliferation driver, which, at minimum, promotes Iranian hedging.
  - Clarifying that U.S. objective is limited to a change in Iranian conduct is the prerequisite for an effective strategy of coercive diplomacy. It also creates a basis upon which the United States and its European Union partners can appeal for meaningful multilateral sanctions if Iranian intransigence persists.
  - Reassurance of an adversary is more difficult than deterrence: Assuring the Iranians that the U.S. objective is not regime change (as a basis for trying to negotiate a change in Iranian nuclear behavior) is more difficult than deterring the Iranians from trying to unilaterally change the regional status quo.
  - The proliferation-terrorism "nexus": U.S. declaratory policy should aim to deter the transfer of nuclear capabilities to non-state terrorist groups, which would have no moral or political compunction

against using them against the United States and its allies. What are the requirements for such a deterrent posture? In contrast to preventing acquisition, where an assurance of regime security may be central, deterring transfer may entail the explicit or ambiguous threat of regime change.

- Allies: While U.S. reassurance of allies is pivotal, dissuasion may be necessary to prevent them from acquiring fuel cycle technology as hedge.

Conclusion

- The U.S. military capabilities that make up the force structure are not per se a proliferation driver. With adversaries, U.S. declaratory policy—specifically, in the case of Iran, that the objective is to change the regime—is a motivating factor. Likewise, with U.S. regional allies, extended deterrence rests more on political reassurance (i.e., the credibility of the U.S. commitment) than on any particular capability.
- Proliferation dynamics in the Middle East and Persian Gulf have implications primarily for the deployment of U.S. conventional forces as a tangible symbol of the U.S. security commitment.

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Extended Deterrence in the Middle East: Possibilities for Deterring a Nuclear Iran, Assuring Allies, and Stemming Proliferation

Elbridge Colby

(NB: Per the original tasking, this memorandum is "a thought piece" on a highly contentious and disputable subject. It is offered as a starting point set of hypotheses in the spirit of constructive suggestions rather than with any pretensions of comprehensiveness or finality.)

What options would the United States and the world have if Iran succeeds in developing nuclear weapons or a so-called "breakout" nuclear capability?[1] Debate thus far has focused largely on the commendable goal of how to halt Iran's ambitions. Yet the consequences of not planning for a nuclear Iran could be grave, as countries and markets may panic if a security structure to manage the situation is not in place if Iran acquires a nuclear capability, possibly leading to dangerous regional instability, a cascade of proliferation, and serious disruptions to the global economy. Indeed, planning how to address such an eventuality might contribute to forestalling an Iranian bomb entirely by showing to Iran's leadership the limits of what they would achieve through obtaining a nuclear capability. Presenting realistic options for managing a nuclear-capable Iran may, therefore, be a productive focus for the Commission, especially given the diplomatic and political need for the Executive Branch not to be seen as contemplating such an outcome.

Objectives: The principal objectives of the United States and its allies in an environment in which Iran has achieved a nuclear capability would include deterring the Iranians from aggression and coercion against U.S. interests and allies in the Middle East and preventing, to the extent possible, a cascade of proliferation.[2] (Saudi Arabia and, to a lesser extent, Egypt and Turkey have signaled that they may seek to obtain nuclear weapons should Iran do so.[3]) U.S. and allied objectives could be achieved by a more developed and credible U.S.-led nuclear-backed security guarantee for key states in the region.[4] Though the U.S. should be extremely careful about extending explicit and formal security guarantees, particularly nuclear ones, it should be open to doing so, especially in concert with others.[5]

Deterrence—Can It Work against Iran? The heatedly contested question whether a nuclear Iran could be deterred cannot be definitively answered in advance, but it is likely that Iran indeed could be. At the most general level, analysis and historical experience suggest that a properly postured, sufficiently strong, and credible deterrent designed to serve defensive or status quo ends is likely to be effective against opponents exhibiting minimal rationality.[6] Conversely, attempts to use nuclear forces to compel such protected states into submission are very unlikely to work if the opposing deterrent structure conforms to these requirements.[7] Since World War II, the U.S. has both deterred opponents' aggression and coercion against and dampened proliferation among its allies by extending its security umbrella over them; a similar strategy might well pay dividends in the Middle East, especially against a state that is by no means a superpower.

More specifically, as the Intelligence Community has reportedly assessed, Iranian behavior suggests that the regime, however distasteful its aims and its methods, does pursue them based on calculations of costs and benefits, and therefore can profitably be made subject to deterrent threats designed to demonstrate that use or threatened use of nuclear weapons against protected allies is perceptibly incommensurate with any rational strategy.[8] Recent statements by experienced experts support this assessment.[9]

In line with these principles, the U.S. posture against a nuclear Iran would likely best be fundamentally defensive or status quo in nature: the protection of the sovereign rights of partnering states from aggression and coercion by Iran and its associates, and in particular the protection of the free flow of oil, related products, and capital into and out of the region. The key for the U.S. and its partners would be to ensure that the deterrent structure is appropriately structured and sufficiently firm and credible, such that it would be clear that Iran would not benefit from achieving a nuclear capability and might well suffer grievously.

Current Structure: Presently, U.S. security arrangements in the region are informal and ambiguous—generally taking the form of statements, exercises, arms sales, and direct military interventions—but are perceived as broadly adequate.[10] Countries in the region seek to balance their need for credible U.S. security assurances with their desire for autonomy and their political need not to appear subject to U.S. dictates. While the U.S. has not made formal security guarantees to GCC countries, the U.S. has consistently made clear its policy that it would not permit the domination of the Middle East region by any power.[11] It has also worked to shore up the credibility of its commitments to the region, including through the Gulf Security Dialogue.[12]

Dealing with a Nuclear Iran: The above assessment suggests that a firmer, augmented deterrent structure (or structures) in the Middle East could effectively blunt many of the negative repercussions of Iran achieving (or nearing achievement of) a nuclear capability.[13] The animating logic for building such a structure could profitably be an ends-oriented flexibility.[14] The objective of such a structure would be to defend critical U.S. and allied interests from Iranian aggression, while offering Iran a plausible, peaceful, and respectable "way out."[15] Given this goal, the structure could take many forms, driven by the need to provide credible deterrence against Iran and its associates and assurance to allies, largely ascertained by consultations with countries in the region and key outside parties.[16] The central balancing act would be, as now, both to assure allies of the reliability and strength of U.S. and associated commitments while also allowing sufficient distance from U.S. and foreign influence to make the structure politically sustainable in the region.[17] Concurrently, the U.S. might also seek to help build up a regional political process designed to address and ameliorate disputes or even seek ways to extend UN Security Council positive security assurances to powers agreeing not to pursue nuclear weapons.[18] Any structure should be designed to provide Iran a "dignified way out" through regional engagement as opposed to outright capitulation or regime change.

A principal challenge for the U.S. and its partners would be the need to establish the credibility of the partnership, both to Iran *and* to key prospective member states, such as Saudi Arabia, that might otherwise seek their own nuclear deterrents.[19] This would principally be a political and perceptional challenge rather than a purely military one, because of the decided supremacy of U.S. forces over any potential challenger(s) in the region. Both Iran and participant members of the structure would need to see not only that the U.S. and its partners would have the theoretical capability to defend and, if necessary, retaliate against Iranian aggression or coercion; they would have to see that such capabilities are likely to be exercised in the event.[20] This would place a premium on evidences of political commitment to the partnership by the U.S. and other key states both within and outside the region. Focuses of such credibility-building activity might appropriately include military, diplomatic, and intelligence contact among the allies; steps to build up theater ballistic missile defense to defend members; training exercises; legally or politically-binding statements of resolve; and procurement and deployment decisions.[21] A special emphasis could profitably be placed on developing, procuring, deploying, and integrating a variety of defensive systems, including ballistic missile defenses; deterrence by defense in addition to retaliation would be preferable. The Gulf Security Dialogue provides a promising starting point for such initiatives, as do existing exercises, training missions, and arms transfer relationships.[22] A particular problem would be posed by insurgency and irregular warfare, both in how the U.S. and other allied parties could meet such challenges and in determining whether instances of insurgency or irregular warfare would appropriately require external allied intervention.[23]

Participation: Given the defensive and nonproliferation purposes of the deterrent partnership, several regional countries likely should be involved: above all Saudi Arabia, the area's principal oil exporter and proliferation concern;[24] Kuwait, the UAE, Qatar, and Bahrain, the key Gulf states most directly threatened by Iran; and, to the extent possible, Egypt, Jordan, Turkey, and other friendly Middle Eastern states as at least supporters. Some countries, especially those not directly bordering or facing Iran, might also be included as adjunct participants, if fuller involvement proves impossible or inadvisable. Yemen might be such a case. Existing institutions could provide a base on which to build, particularly the Gulf Security Dialogue and the Gulf Cooperation Council. Any structure would have to be sensitive to the difficult tension between the countries' desire to have their security guaranteed with the need to maintain distance from an unpopular U.S. The structure should also be at least notionally open to constructive Iranian participation in a way that places the burden of rejection on the Iranian leadership.[25]

The role of Israel will be both a critical and a severe complicating factor in any such structure.[26] Consultations with Israel and other regional states will be necessary to ensure that Israel is adequately assured while making sure Israel's problematic relations with the Arab states do not scuttle any initiative.[27]

In concert with these assurance efforts, the U.S. should also continue and, to the degree viable, intensify its counterproliferation efforts in order to raise the costs and risks of obtaining a nuclear capability to key countries such as Saudi Arabia. Especially if coupled with cooperation from other key nuclear weapons powers, such a policy is likely to be substantially, though not unfailingly, effective.[28]

More broadly, dealing with a nuclear Iran might offer an especially propitious opportunity to build a new security structure that reflects a more multipolar world and allows for more equitable burden-sharing.[29] Iran's nuclear posturing is a direct threat to the Gulf states and to their economies; it is therefore a serious threat to the globe's major economies, all of which have a stake in stability in the Gulf to preserve flows of natural resources and capital. This creates a natural alliance among the United States, the EU, Japan, major developing economies, and key Gulf countries. In addition, Islamic countries such as Egypt and Pakistan and the UN Security Council could play a particularly critical legitimating role. Though the U.S. would likely bear the major military responsibilities, joint efforts would increase international buy-in and legitimacy even as they lessen financial and other costs.[30] Overall, the U.S. should avoid assuming responsibilities markedly disproportionate to its interests in the region; instead, it should seek to find effective ways to divide the labor with like-minded partners, while keeping a hold on the key levers (principally military) of the structure.

Military Posture: According to former CENTCOM commander General Abizaid, the U.S. is likely to be able to meet extended deterrent commitments to key states in the Gulf and Middle East region with basically marginal additions to its current military posture, and to do so in most plausible scenarios solely with conventional forces.[31] In adding to existing capabilities, the U.S. would likely want to focus on increasing missile defense and air defense capabilities while minimizing substantial deployment and basing of forces and other highly visible aspects of U.S. power in the region.[32] These principles would place premia on developing and fielding forces, logistic networks, legal arrangements, and other capabilities designed to facilitate a "light footprint" and swift insertion and removal of forces, thus placing special emphasis on maritime and long-range mobile and aerial forces.[33] Further, Iranian ballistic missile capabilities, including nuclear variants, would imperil large, static concentrations of forces, and make sustained diplomatic support from a host country more precarious.

In general, the U.S. would want to continue to develop and field advanced conventional forces and defenses that would add to the flexibility and strength of a deterrent structure. Defenses, even if not perfect, could substantially complicate Iranian programs to develop their nuclear forces and degrade their capabilities in a crisis or conflict.[34] Indeed, development and deployment of defenses might even contribute to forestalling Iranian progress towards acquiring a nuclear capability.[35]

Role of Nuclear Weapons: The U.S. is likely to be able to meet plausible extended deterrent commitments to Middle Eastern states against Iranian aggression and coercion without needing to resort to nuclear weapons, especially in a multilateral structure designed to share financial and military burdens. Nonetheless, the U.S. would likely benefit from retaining strategic ambiguity regarding criteria for nuclear employment, thus preserving maximal optionality and burdening Iranian decisionmaking; naturally, such a posture would have also to assure allies of the depth of the security commitment. Such a posture might involve military exercises and other moves designed to show U.S. capability and willingness to employ nuclear forces should the need arise, while avoiding incendiary talk or maneuvers.[36]

Options for deployment of nuclear weapons could fall along a spectrum, dependent upon military requirements and allied expectations, ranging from an East Asian-type model with nuclear weapons obscured but present to a more European/NATO model, in which the nuclear commitment is more openly evidenced through dual-capable aircraft and other mechanisms. In this spirit, the U.S. might consider a restrained but suggestive posture towards deploying nuclear weapons in the region; the Cold War provides examples of this technique.[37] Adverse diplomatic pressure against this show of force would likely be lightened because the U.S. would be relieved from its "negative security assurances" to Iran once the latter had achieved a nuclear capability.[38]

Declaratory Policy: The U.S. should seek to minimize any Iranian gains from obtaining a nuclear capability by communicating clearly that the U.S. could and would meet its security commitments against a nuclear-capable Iran, and thus that Iran would not benefit from the use or threatened use of its nuclear capabilities. (This might require dialing down rhetoric on the offensive strategic value of nuclear weapons, a shift that would need to be coordinated with broader nonproliferation rhetoric.[39]) Furthermore, the U.S. should communicate that it would hold Iran to a very high standard of liability with respect to control and security of its nuclear arms, especially concerning possible complicity in or gross negligence towards terrorist use.[40] Broadly, the U.S. would seek to "educate" Iran concerning the limited value of nuclear arms for compellance and other offensive strategic objectives. The U.S. might even consider going so far as to permit the diffusion of or even directly to offer safety and security advice to the Iranians in order to minimize the likelihood of inadvertent loss or use (while maintaining an overarching posture of disapproval for an Iranian nuclear capability). Overall, the U.S. would seek to make clear to Iran that its best interests would be served by not possessing nuclear arms, since Iran would stand to gain very little and could suffer grievously in the event of use or even carelessness. This might eventually contribute to Iran rolling back or at least scaling back its program.

Communications and Publicity: Given broad animosity to the U.S. in the region, such a structure or structures could confront widespread opposition and could catalyze hostile reactions negative to U.S. interests. This would weigh in favor of minimizing the publicity of security commitments. Conversely, however, secret commitments are sure to be less credible, may compromise support within the U.S. and other democratic societies, and may seem by their clandestinity to admit wrongfulness. Further, secrecy is likely unsustainable. In the balance, formalizing and publicizing the general purposes and character of the deterrent structure while maintaining secrecy regarding sensitive specifics would likely be the superior course. Given likely congressional interest in such a structure, this might indeed be the only plausible course for the U.S.[41]

Recommendations: This assessment suggests that the Commission should consider recommending that the next President:

- Lead the United States and other interested countries in consultations about how to strengthen, refine, and, to the degree appropriate, formalize security commitments to those countries especially imperiled by Iran and those most likely to develop nuclear weapons in light of an Iranian capability, with the objectives of preventing any Iranian gains from obtaining nuclear arms, interruptions to the flow of commerce, and follow-on proliferation.[42] While the U.S. should be prepared to strengthen and extend unilateral security commitments, it should seek to multilateralize such a structure(s) to the degree commensurate with U.S. objectives and influence.
  - Special attention should be focused on consultations with Israel, Saudi Arabia, the key GCC states, Turkey, and Egypt.
- Communicate clearly to Iran and its associates that the United States and its allies and partners are prepared to deal with a nuclear Iran and would not be coerced into compromising their core interests because of an Iranian nuclear capability. Communicate also that Iran, while it would not profit from such possession, would be held to a very strict standard of liability in cases of use, transfer, and even negligence or loss.
- Task the Intelligence Community with assessing how best to deter and contain Iran should it develop a nuclear capability, and how best to "educate" Iran towards "normal" nuclear status should management of a nuclear Iran prove to be the least costly course.
- Task the National Security Council, the Department of State, and the Department of Defense to plan for developing, in consultation with partners in the region and without, a deterrent structure or structures against Iran profiting from a nuclear capability and against further proliferation in the region.
- Task the Department of Defense to explore the operational, programmatic, and strategic requirements that deterring a nuclear Iran would require. This should include exploring possible alternative military (non-nuclear and nuclear) postures for U.S. (and allied) forces to deal with Iran, particularly with respect to its nuclear forces.[43] DOD should also explore possible alternative postures for U.S. nuclear forces that might be required to undergird any such deterrent structure(s). This might involve considering deployment of dual-capable aircraft beyond NATO and/or deploying nuclear weapons aboard surface combatants, should either or both of these moves prove useful.[44]

- Task the NSC, State, and the IC to develop plans for focusing their non- and counter-proliferation efforts to prevent follow-on proliferation should Iran obtain a nuclear capability.
- Task the NSC, State, Defense, and the IC to develop plans for how to convey to Iran and other unfriendly nuclear aspirants safety and security techniques designed to minimize the possibility of accidental nuclear use or loss, while simultaneously preserving a strong U.S. strategic message of disapproval. Consultations with other key nonproliferation states and international organizations such as the International Atomic Energy Agency would also be necessary in this effort to ensure conformity with broader nonproliferation goals. The U.S. would need to ensure compliance with Article I of the NPT and ensure any safety and security assistance would minimize "moral hazard" concerns.[45]
- Continue research, investment, procurement, and deployment of strike and defensive capabilities necessary for assurance and deterrence purposes in the Middle East.

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1. For a discussion of different scenarios for what a "nuclear Iran" might look like, see Richard Haass, "Living with a Nuclear Iran," in *Iran: Assessing U.S. Strategic Options* (2008), 115.
2. This would include the protection of the flow of oil, capital, and other economic goods and services to and from the Gulf region. For more on the possibilities for cascades, see "Report on Discouraging a Cascade of Nuclear Weapons States," International Security Advisory Board to the U.S. Department of State (October 2007); Defense Science Board, 2007 Summer Study on Challenges to Military Operations in Support of National Interests, Report of the Panel on Nuclear Proliferation (2007).
3. See, e.g., *Chain Reaction: Avoiding a Nuclear Arms Race in the Middle East.* Report to the Senate Foreign Relations Committee. (February 2008), available at: http://www.fas.org/irp/congress/2008_rpt/chain.pdf. This report, based on extensive interviews with officials in the region, suggests that Saudi Arabia is "the most likely" to pursue a nuclear capability, and that Saudi Arabia's decision would be a significant determinant in Egypt's decision whether or not to follow Iran. (viii-ix) The credibility of American security guarantees is, however, the primary determinant for all three states. For Saudi Arabia, according to the report, it is the "only factor that would likely dissuade the Saudis from pursuing a nuclear weapon." (viii) For Turkey, "U.S.-Turkey relations and Turkish perceptions regarding the reliability of NATO will serve as the decisive factors in Turkey's decision regarding nuclear weapons." (xi) See also the International Institute of Strategic Studies' Nuclear Programmes in the Middle East: In the Shadow of Iran. (2008).
4. For an extensive analysis of this and associated issues concerning extending the U.S. nuclear umbrella to new states, see Victor Utgoff and David Adesnik, *On Strengthening and Expanding the U.S. Nuclear Umbrella to Dissuade Nuclear Proliferation.* (2008).
5. For a good statement of the logic appropriate for determining whether or not to extend such commitments: "Rational alliance building [means] the principle of marginal utility…That is, a state should add allies and increase alliance commitments up to the point at which the 'last' unit of commitment to the last-chosen ally yields a marginal value equal to its marginal cost and risk." Of course, "a fully rational calculation of alliance values must be farsighted [and "wide-angled"]; it must take account of consequences in the distant as well as the immediate future." Glenn Snyder, *Alliance Politics.* (1997), 45-46. See also Bruce Riedel and Gary Samore, "Managing Nuclear Proliferation in the Middle East" in *Restoring the Balance: A Middle East Strategy for the Next President* (2008), 127.
6. For discussions of this "minimal rationality," see, *inter alia*, Thomas Schelling, *Arms and Influence.* (1966); Patrick Morgan, *Deterrence: A Conceptual Analysis.* (1977); and Herbert Simon,

Models of Man. (1957) or "Human Nature in Politics" (1985). One scholar defined the "typical meaning of the word 'rational'" for deterrence theory to be: "To describe an action as 'rational' is to say that it is consistent with the actor's values, whatever they may be." Stephen Maxwell, *Rationality in Deterrence.* (1968), 3. Or: "A decision is rational from the standpoint of the group…if it is consistent with the values governing the group, and the information that the group possesses relevant to the decision." Herbert Simon, *Administrative Behavior.* (1997), 324.

7. There is an extensive literature on the point that defensive deterrence is far more effective than offensive compellance. For the analytical distinction between "deterrence" and "compellance," see Thomas C. Schelling, *Arms and Influence.* (1966), 69 et seq. Schelling described the "typical difference" as "between a threat intended to make an adversary do something and a threat intended to keep him from starting something." See also David E. Johnson et al., *Conventional Coercion Across the Spectrum of Operations: The Utility of U.S. Military Forces in the Emerging Security Environment (*2002) at 13, fn 19. For an examination of the historical record and the conclusion that nuclear compellance is generally ineffective, see Richard Betts, *Nuclear Blackmail and Nuclear Balance* (1987).

8. Most prominently, the Intelligence Community, in its 2007 National Intelligence Estimate on Iran's nuclear program, reportedly assessed that evidence "indicates Tehran's decisions are guided by a cost-benefit approach rather than a rush to a weapon irrespective of the political, economic, and military costs." http://www.washingtonpost.com/wp-dyn/content/article/2007/12/03/AR2007120300846_pf.html According to *Washington Post* columnist David Ignatius: "In the new NIE, the analysts forcefully posit an alternative view of an Iran that is rational, susceptible to diplomatic pressure and, in that sense, can be 'deterred'…Asked if this meant the Iranian regime would be 'deterrable' if it did obtain a weapon, a senior official responded, 'That is the implication.' He added: 'Diplomacy works. That's the message.'" http://www.washingtonpost.com/wp-dyn/content/article/2007/12/04/AR2007120401669.html?nav=emailpage. Private experts exhibit similar views. For instance, Iran expert Vali Nasr summarized: "They are pragmatic, but pragmatism does not mean that you cannot follow dangerous policies. The Soviet Union under Brezhnev was very pragmatic. It depends on what kinds of assumptions and factors you are basing your decisions on…The problem right now is not that the Iranians have some kind of an idealistic view of world revolution or Armageddon. It is that looking at their environment, they think the pragmatic decision is to push very, very hard, because they believe that they can either get away with it or that the United States is weak because of Iraq, and that they have room to maneuver. Or they perceive that the United States would want to topple them; therefore, there's no point in compromising. In other words, I don't think that they are in a kamikaze mode with the West. It is, rather, that the way they are seeing the world and then making decisions on that basis leads them to believe, much like the Soviet Union when they decided to go into Afghanistan, that this is the rational thing to do in order to maximize their interests." Available at: http://www.cceia.org/resources/transcripts/5374.html. For other similar views, see: http://www.foreignpolicy.com/story/cms.php?story_id=4122. Former NSC Director for Iran Andrew Erdmann believes that the Iranian regime most likely can be deterred from using nuclear weapons, but that doing so will require significant investment by the U.S. to establish political credibility with the Iranians and others in the region and to deploy the necessary offensive and defensive systems to reinforce the credibility of its extended deterrent in the region. He notes, however, that the Iranian Islamic Republic's confidence in "meddling" in the region could well increase once it has its own nuclear "umbrella," thereby increasing risks of potential unintended escalation of a confrontation with the United States over a "non-nuclear" issue. Furthermore, he believes that Iranian nuclear weapons or material could fall into "non-deterrable" hands should the regime collapse, a growing risk we see today in Pakistan. Conversation with Andrew Erdmann, November 2, 2008; Barry R. Posen: A Nuclear-Armed Iran: A Difficult But Not Impossible Policy Problem. (2006), 9; 15-16, available at: http://www.tcf.org/publications/internationalaffairs/posen_nuclear-armed.pdf. For open source discussion of Iran's perspective on unconventional weapons, see Gregory F. Giles, "The Islamic Republic of Iran and Nuclear, Biological, and Chemical Weapons," in *Planning the Unthinkable.* (2000). The "rationality of the irrationality" insight would also suggest that Iran might actually be incentivized to appear at least somewhat irrational, given its inferior strategic position.

9. Discussion with General John P. Abizaid, USA, Ret. (November 21, 2008) and comments of General John Abizaid at meeting of Center for Strategic and International Studies, available at: http://blogs.abcnews.com/politicalradar/2007/09/abizaid-we-can-.html; David Kay, "The Iranian Fallout," The National Interest, September 9, 2008, available at http://www.nationalinterest.org/Article.aspx?id=19832; Barry Posen, "We Can Live With a Nuclear Iran," *The New York Times*, February 27, 2006, available at: http://www.nytimes.com/2006/02/27/opinion/27posen.html; Posen, *A Nuclear-Armed Iran*; Conversation with Barry R. Posen (November 4, 2008); Richard K. Betts, "The Osirak Fallacy," *The National Interest* (Spring 2006), available at: http://www.columbia.edu/cu/siwps/images/newsletter3/Betts%20-%20Osirak%20Fallacy.pdf; Samore and Riedel, 111, 126. According to Riedel and Samore, the Chinese and Russians "argue that Iran will act as a responsible nuclear power, susceptible to being managed through the usual tools of deterrence and containment." 111. Samore and Riedel conclude that, "[i]f Iran acquires nuclear weapons, it is likely to behave like a 'normal' nuclear weapons state, not recklessly using the bomb or giving it to terrorists, but trying to extract maximum leverage from its nuclear deterrent to increase its influence and defend itself from external threats." 126.
10. Discussion with General Abizaid (November 21, 2008); discussion with Department of State official (November 14, 2008); discussion with Department of Defense official (November 18, 2008). For an overview of U.S. commitments to the Gulf region, see the CRS Report The Gulf Security Dialogue and Related Arms Sales Proposals. (October 2008). For a recent snapshot of the U.S. posture in the region, see the statement of Admiral William J. Fallon, Commander, Central Command, before the Senate Armed Services Committee, May 3, 2007, available at http://www.centcom.mil/en/about-centcom/posture-statement/. Kuwait and Bahrain are major non-NATO allies, as are Egypt and Jordan in the wider region. Kuwait, Bahrain, and Qatar host U.S. bases, while the UAE hosts multilateral air exercises.
11. This dates at least from the Carter Doctrine through dual containment, Desert Shield/Storm, and onwards. For a recent overview, see Secretary Gates' speech at Manama in December 2007, available at http://www.defenselink.mil/speeches/speech.aspx?speechid=1201.
12. Discussion with John Hillen, formerly Assistant Secretary of State for Political-Military Affairs (November 18, 2008). Hillen describes the GSD as essentially an effort to deepen U.S.-GCC relationships and build partner capacity in order indirectly and "implicitly" to address threats to the Gulf states. For a discussion of the GSD in the context of the Iran challenge, see the October 2008 CRS report, 2-4. See also the CRS report *Iran: U.S. Concerns and Policy Responses*. (July 2007), 33-34.
13. This memorandum presents one general approach. Commissioner Dr. Morton Halperin argues for a different approach, one that separates the existing U.S. posture and alliance structure in the region from a broader regional effort to demonstrate to Iran the inadvisability of fielding a nuclear weapons capability. He counsels in favor of extending both positive and negative security assurances to counter any Iranian attempt at nuclear coercion or use. Dr. Halperin also argues that this effort should begin early and should be aimed at convincing Iran to stop at most at a "virtual" nuclear capability. This should be coupled with substantial engagement at the political level with Iran to seek to address their legitimate security concerns. (Discussion with Dr. Morton Halperin, November 20, 2008). For a general discussion of this issue, see, e.g., Judith S. Yaphe and Charles D. Lutes, *Reassessing the Implications of a Nuclear-Armed Iran*. (2005)
14. Because of the fraught political circumstances in the region, several structures, potentially in tension with one another, might be necessary as opposed to a single security structure along NATO lines.
15. This memorandum does not address the question of whether or how the United States should engage Iran on the political level. Broadly, however, the approach postulated here would require providing Iran with a plausible route out of its isolation. Beyond that, the United States could pursue a number of different approaches.
16. General Abizaid believes that the Arab states would prefer maintaining the informality of current relationships while seeing more evidence of American commitment. Discussion with General Abizaid (November 21, 2008). Ambassador Lewis Dunn suggested basing a post-Iranian nuclear strategy on the prongs of isolation, containment, and regional engagement. See Lewis A. Dunn, "After Iranian Acquisition, What? Containing the Dangers of a Proliferating Middle East," (July 2007), 13 et seq. For a policy course with both similari-

ties and differences to that laid out in this memorandum, see Kori Schake, "Dealing with a Nuclear Iran," *Policy Review* (April & May 2007), available at http://www.hoover.org/publications/policyreview/6848072.html.

17. Discussion with Department of State official (November 14, 2008).
18. Discussion with Dr. David Kay (November 17, 2008). Kay analogizes the role of such a political process to that of the European Coal and Steel Community (and subsequent iterations) in Europe. One Commission expert advisor offered the following proposal: "If all five UNSC permanent members repeated their [positive security assurances (PSAs)] and made it clear they would apply in this case, that could enhance deterrence (note that Israel is outside the scope of the PSA; that will have to be a unilateral U.S. deterrent, which could conflict with gaining support for a broader statement)."
19. Former NSC staffer Andrew Erdmann emphasizes that establishing the political credibility—both to the Iranians and to key prospective member states such as Saudi Arabia—of the partnership would be a critical challenge. He also points to deployment of an effective theater BMD as a potential way to raise the costs and minimize the benefits for Iran of achieving a nuclear capability. For further suggestions along these lines, see Kathleen J. McInnis, "Extended Deterrence: The U.S. Credibility Gap in the Middle," *Washington Quarterly* (Summer 2005), 169-186. McInnis also emphasizes the importance of non-U.S. extra-regional involvement, and suggests the use of economic incentives to discourage proliferation in the wake of an Iranian nuclear capability breakthrough.
20. Discussion with Barry R. Posen (November 13, 2008).
21. Discussion with Department of Defense officials indicates that such an approach would strain existing production schedules for ballistic missile defense and other desirable capabilities. In general, the U.S. would likely need to have on have more "capabilities in being" to pursue a strategy of this kind. (Discussion with Department of Defense officials, November 14, 2008.)
22. According to the Department of Defense, existing exercises are not aimed directly at any third country, in large part due to GCC sensitivities. In the event of Iran achieving a nuclear capability, one method of escalation could be to conduct joint exercises of a more directed nature. (Discussion with Department of Defense official, November 18, 2008.)
23. A number of Commission expert advisors have pointed out the importance of defining what would be protected, what would be defended against, what would be deterred, and other key objectives. The U.S. would clearly want to be chary, for instance, about guaranteeing the survival of governments from internally-generated reform, even if that reform were through violence. The Gulf Security Dialogue initiative has attempted to address this irregular threat through appropriate arms sales, training, and other comparable measures. General Abizaid notes that, while Iranian IRGC and MOIS-backed subversion is a serious problem, it is not truly a "decisive…element." (Discussion with General Abizaid, November 21, 2008.) During the Cold War, NATO included irregular warfare in its defensive purview, though the issue did not arise in the European context. See, e.g., NATO document MC 14/3 (1967).
24. Saudi Arabia is, by general agreement, the lynchpin state. (Discussion with Department of State official, November 14, 2008; SFRC report.)
25. Discussion with David Kay (November 17, 2008). Kay likens this to the "poison pill" U.S. offer to extend Marshall Plan assistance to the Eastern Bloc countries, an offer which elicited a self-wounding Soviet rejection.
26. Discussion with Department of State official (November 14, 2008); discussion with David Kay (November 17, 2008); discussion with General Abizaid (November 21, 2008). The sensitivities around the Israeli-Palestinian problem would counsel serious efforts at making progress towards a settlement on these issues and to pressure Israel to maintain a posture of nuclear opacity. General Abizaid suggests that Israeli military professionals believe that Iran is deterrable and therefore that Israel could "live with" a nuclear Iran.
27. See, e.g., Haass, "Living with a Nuclear Iran," 117.
28. Discussion with David Kay (November 17, 2008). Kay suggests encouraging other countries to provide the face for convincing Iran and other problem states of the inadvisability of "going nuclear."
29. Future U.S. strategic commitments should likely take into account the shifting power balance that will narrow America's relative power margin. On this point, see, for instance, the

National Intelligence Council report *Global Trends 2025: A Transformed World*, available at http://www.dni.gov/nic/PDF_2025/2025_Global_Trends_Final_Report.pdf. In leading the construction of this partnership, the U.S. should be aware of the tendency of smaller powers within such a structure to "free ride" on the larger powers and, to the extent possible, seek to control for this dynamic. For a classic analysis of the near-inevitability of this dynamic, see Mancur Olson, Jr. and Richard Zeekhauser, "An Economic Theory of Alliances," *The Review of Economics and Statistics*, 48, 3 (August 1966), 266-279.

30. For further discussion of these advantages and other aspects, see Elizabeth Sherwood-Randall, *Alliances and American National Security.* (October 2006).

31. Discussion with General Abizaid (November 21, 2008). According to General Abizaid, U.S. forces could readily meet any challenge from Iranian conventional forces; Arab forces would also be reasonably prepared to deal with Iranian conventional aggression. For principles useful in determining the appropriate U.S. posture for such a deterrent structure, see, e.g., *U.S. Department of Defense, Strengthening U.S. Global Defense Posture.* (September 2004), esp. 9; Andrew Krepinevich and Robert Work, *A New Global Posture for the Second Transoceanic Era.* (2007), esp. 187 et seq.; Stephen M. Walt, "Containing Rogues and Renegades: Coalition Strategies and Counterproliferation," in *The Coming Crisis: Nuclear Proliferation, U.S. Interests, and World Order.* (2000); Victor A. Utgoff, "Extended Nuclear Deterrence and Coalitions for Defending Against Regional Challengers Armed with Weapons of Mass Destruction," in *Post-Cold War Conflict Deterrence.* (1997); Henry Sokolski and Patrick Clawson, Eds., *Getting Ready for a Nuclear Iran.* (2005), esp. Part IV.

32. Discussion with General Abizaid (November 21, 2008). According to General Abizaid, the existing U.S.-backed regional air defense umbrella could be improved to meet the Iranian missile challenge. See also especially Krepinevich and Work, *A New Global Posture,* 189, 191-192.

33. See especially Krepinevich and Work, *A New Global Posture,* 214-216. Discussion with Department of Defense official (November 18, 2008). General Abizaid notes that U.S. and allied air and naval forces have thus far served as the "primary" elements against the Iranian threat, and that this dynamic would be unlikely to change if Iran achieves a nuclear capability. (Discussion with General Abizaid, November 21, 2008.)

34. Discussions with David Kay and Barry Watts. Dr. Kay points out that "effective, or at least believable, defenses were in the past and will be in the future an important part of any effort at extended deterrence. By its very nature extended deterrence is attempting to provide deterrent protection to those that are not central to the state offering extended deterrence. The states being offered such protection will always question the extent of the commitment as well as fear/suspect that they may simply become the battlefield for larger geopolitical interests."

35. Discussion with David Kay. Dr. Kay writes: "[E]ffective ME/Gulf missile defense effort would be a contribution to the diplomatic effort to convince the Iranians to not proceed all the way to deployable nuclear weapons, and if that diplomatic effort fails such defenses will be an important brake on proliferation pressures in the region."

36. In the seminal study *Nuclear Weapons That Went to War,* a survey of the sixteen cases before 1996 in which countries deployed nuclear weapons operationally or seriously considered them for combat use, the authors concluded from the evidence that: the U.S. "must maintain a flexible doctrine and nuclear forces must be able to respond to a variety of crisis and conflict solutions"; because other countries "can learn the same lessons," the U.S. "should be careful…to avoid setting self-imposed constraints which an adversary can exploit"; and nuclear weapons can be very effective at deterring conventional and CBW aggression and coercion because "nuclear weapons in the inventory make both adversaries and allies more cautious." The "mere existence of the weapons may deter an enemy from use of chemical or biological weapons and they may prevent or limit some conflicts for fear of escalation." William C. Yengst et al., *Nuclear Weapons That Went to War.* (1996), i, 24. For a contemporary discussion of these issues by one Commissioner, see Keith Payne, *The Great American Gamble: Deterrence Theory and Practice From the Cold War to the Twenty-First Century.* (2008), 420-423. For a rubric for determining requirements for nuclear forces in such an environment, see Victor A. Utgoff and Brad Roberts, *Beyond the Moscow Treaty: Alternative Perspectives on the Future Roles and Utility of Nuclear Weapons.* (2008), II-18-19, Part VIII in toto, and IX-18. Utgoff and Roberts recommend, in the face of a more proliferated environment, holding nuclear forces in reserve "for purposes of threatened preemption and retaliation against WMD-willing rogues." VIII-6.

37. The U.S. several times deployed nuclear-capable forces to the Middle East during the Cold War, communicating an inherent nuclear capability while maintaining a restrained overt posture. The Eisenhower Administration deployed nuclear-capable forces to Lebanon in 1958. The Nixon Administration deployed nuclear-capable carrier battle groups to the Eastern Mediterranean during the 1970 Jordanian Crisis and during the 1973 War and to the Indian Ocean during the 1971 Indo-Pakistan War. The U.S. also raised the alert status of its bombers during the 1973 War to deter direct Soviet intervention into the conflict. Nuclear-capable bombers were also deployed for effect during the Korean War. The author discussed several more contemporary options for an Iranian eventuality with Department of Defense officials, but these proposals should be discussed at a classified level. (Discussion with Department of Defense officials, November 14, 2008.)

38. "Negative security assurances" refer to commitments given by the nuclear weapons states to non-nuclear weapons states that the former will not use nuclear weapons against non-nuclear weapons states not allied with nuclear-armed states. The U.S. has several times issued such assurances. A 1997 U.S. Presidential Decision Directive stated: "The United States reaffirms that it will not use nuclear weapons against non-nuclear-weapon state-parties to the Treaty on the Nonproliferation of Nuclear Weapons, except in the case of an invasion or any other attack on the United States, its territories, its armed forces or other troops, its allies, or on a state toward which it has a security commitment carried out, or sustained by such a non-nuclear-weapon state in association or alliance with a nuclear-weapon state."

39. Recent rhetoric has tended to emphasize the transformational impact of nuclear weapons, thus incentivizing countries seeking to negate overwhelming U.S. conventional supremacy to field nuclear forces. The U.S. should consider taking a more restrained line towards the impact of the acquisition of nuclear weapons, one that would concede their effectiveness as deterrents (especially homeland deterrents), while emphasizing their limited utility as instruments of coercion.

40. See, for instance, the speech of Secretary of Defense Robert Gates at the Carnegie Endowment for International Peace, October 28, 2008, available at http://www.defenselink.mil/speeches/speech.aspx?speechid=1305. See also, Elbridge A. Colby, "Expanded Deterrence," *Policy Review* (June/July 2008), 43-59; Lewis A. Dunn, "Influencing Terrorists' Acquisition and Use of Weapons of Mass Destruction—Exploring a Possible Strategy." (August 2008).

41. Reidel and Samore conclude that only formal, Senate-approved treaty guarantees to the Gulf states and other threatened Middle East powers (including Israel) would both assure countries in the region and ensure real American commitment. Reidel and Samore, 127.

42. For a similar proposal, see Riedel and Samore, 113-118.

43. Richard Haass, for instance, proposes that the U.S. issue a pledge to launch preemptive strikes against Iranian nuclear facilities in the event the U.S. concludes that Iran had alerted its nuclear forces. Haass, "Living with a Nuclear Iran," 116.

44. This would require reconciliation with U.S. arms control commitments under the Presidential Nuclear Initiatives of 1991 pledging the removal of nuclear arms from surface combatants.

45. This is not an unprecedented problem. For instance, according to Bruce Riedel, the U.S. has been assisting Pakistan in securing its nuclear arsenal. See, Bruce Riedel, "Pakistan and the Bomb," *Wall Street Journal*, May 30, 2009, available at http://online.wsj.com/article/SB10001424052970203658504574191842820382548.html.

Part IV: Arms Control

Since 1969, the United States and first the Soviet Union and now Russia have engaged—and are still engaging—in bilateral negotiations to limit and reduce their strategic nuclear forces in an effort to strengthen their own security and make the world a safer, more stable place. Probably the centerpiece of this nuclear arms control process is the Strategic Arms Reduction Treaty (START) I, which is set to expire at the end of 2009. With this deadline approaching and a new U.S. administration in office, there has been renewed focus on negotiating a successor treaty that would maintain START I's verification procedures while resuming further reductions of Russian and U.S. nuclear stockpiles. Aside from START, strategic arms control encompasses other nuclear and related issues, including nuclear testing and the Comprehensive Test Ban Treaty, the Fissile Material Cut-Off Treaty, the Intermediate-range Nuclear Forces Treaty, national missile defense, non-strategic nuclear forces, de-alerting, and space arms control.

The expiration of START is perhaps the most urgent unresolved arms control issue at the moment: on December 5, 2009, the treaty expires, and this threatens to allow the reductions and verification procedures that both sides have so far achieved to expire with it. As a member of the Commission's Arms Control Tiger Team, Linton Brooks begins the chapter with a paper that provides follow-on START I treaty options. In a contextual analysis of the bilateral agreements between Russia/Soviet Union and the United States in years past, Brooks offers ten conclusions to guide the commission's final recommendations for a successor agreement to START.

In his paper, Brooks raises several START-related subjects that may make negotiations between the United States and Russia more difficult, including the issue of missile defenses in eastern Europe, the inclusion of tactical nuclear weapons in bilateral reductions, and the de-alerting of weapons. Experts took up these tangential issues in turn and crafted guidance for the Commission. On missile defense and its relationship to arms control, Bruce MacDonald addresses the relationship between strategic defense and offense and discusses options for addressing U.S. missile defense plans for a "third site" in Europe in the context of U.S.-Russian negotiations on START. On tactical nuclear weapons, Barry Blechman—like Brooks—argues that they should be the subject of further follow-on, but separate, negotiations, given that they are not covered under START I. Blechman notes that Russia has developed and possesses thousands of tactical nuclear weapons, explained at least in part by the erosion of its conventional military capabilities, while the United States maintains a much smaller number of such weapons. Blechman recommends that in an effort to reduce this large numerical gap, the United States should seek to include numerical limits on tactical nuclear weapons in a formal, separate arms control agreement with Russia. In a more broadly framed paper, Victor Utgoff asserts that non-strategic nuclear forces (NSNF), including nuclear-armed tactical aircraft, the TLAM/N, short-range nuclear-armed ballistic missiles, and an assortment of other nuclear-related weapons, are outside the purview of START and the Intermediate Nuclear Forces Treaty (INF). Utgoff presents observations to the Commission on how to count NSNF, how to engage Russia on NSNF reductions, and how to reconcile U.S. extended deterrence obligations to NATO with possible NSNF future reductions.

On the issue of de-alerting (removing nuclear weapons from high alert where they can be launched on short notice), Brooks suggests in a second paper that while de-alerting is an outlier issue for a START I follow-on treaty, it could prove to be a "poison pill" if it is included in formal arms control negotiations with the Russians: if Russia considers de-alerting as a proposal that would put them at a disadvantage, as they have on missile defenses in Eastern Europe, it could further complicate such negotiations. In his paper on the subject, Frank Miller addresses some of the arguments made on behalf of de-alerting, or the "hair trigger alert" issue, explaining what the term actually refers to, and how de-alerting would affect nuclear planning, and argues that the real need is to give national leaders more decision-making time.

The success or failure of negotiations on the START follow-on treaty and missile defense issues addressed earlier may also affect other treaties and negotiations that are tied to strategic arms control. In one such case, Brad Roberts argues that the INF treaty, agreed to in 1987, is causing Russian some dissatisfaction because of "INF-derived imbalances" between itself and China, which deploys such weapons near Russia; Roberts also notes that a U.S. decision to place missile defenses in Eastern Europe could provoke Russian withdrawal from the INF. As strategic force numbers are reduced, Roberts points out that Russia may seek to correct imbalances with China by abandoning the INF and reconstituting its intermediate-range nuclear forces. Roberts concludes that the long-term viability of the INF treaty should not be taken for granted.

Several experts provided papers to the Commission to illuminate the issues on the Comprehensive Test Ban Treaty, which President Obama has pledged to resubmit for Senate ratification. In his extensive paper on the subject, Burgess Laird presents the arguments in favor of the CTBT ratification while also addressing the criticisms of the CTBT opponents and the political dimensions of the treaty. In his narrative, Laird explores the technical concerns and possible military advances associated with low-yield testing, verification and enforcement difficulties, and the Stockpile Stewardship Program (SSP) that has maintained our nuclear stockpile without testing for over a decade now. In two shorter papers, Kathleen Bailey, followed by Linton Brooks and Dan Poneman, address specific issues that might thwart CTBT ratification in the future. Bailey assesses why the Senate rejected the CTBT in 1999 and provides options for recommendations in the run-up to a future CTBT ratification review. Linton Brooks and Dan Poneman focus on the definitional criticism of what is and is not considered banned activity and the safeguards that would need to accompany ratification. Safeguards, as the authors point out, are intended to act as a hedge should the United States need to withdraw from the treaty. In order to allay the fears of those who may worry about stockpile safety and reliability, the authors present six safeguards previously proposed by the Clinton administration and offer modifications to strengthen two of them. In a related paper on CTBT, James Goodby examines how explosive testing of nuclear weapons fits into broader U.S. policies concerned with keeping the U.S. nuclear stockpile reliable, safe, and secure. Goodby also provides a list of policy options, including the advantages and disadvantages of each, to illustrate how future choices about CTBT could play out.

An emerging arms control conundrum is fast developing over the proliferation of space weapons capability and technology and the implications for future negotiations. Bruce MacDonald notes that in 2006, the Bush administration declared that space assets were "a vital national interest"; indeed, he points out that the United States heavily depends upon its space assets, including satellites, so that their damage or destruction could have a profound military and economic impact on the country. MacDonald identifies China as a particular concern for anti-satellite (ASAT) capabilities in view of its 2007 ASAT test and argues that the United States should consider seeking a ban on kinetic energy ASAT testing, not least because of the dangerous and long-lived debris such tests produce. He concludes that more attention and study should be focused on this growing threat to U.S. security. In a supporting piece on the subject, Alicia Godsberg briefly summarizes past space arms control negotiations and treaties to provide a context for the Commission to consider space arms control.

There is increasing interest in an international treaty to halt fissile material production, and the United States has long argued for a fissile material cut-off treaty (FMCT) as a way to hinder nuclear proliferation. Susan Koch examines the basic structure of a potential treaty, including an examination of the definitional variations of fissile material, adherence options, verification concerns, and the appropriate forum for future discussion. She concludes her paper—and the chapter—by suggesting four possible treaty provisions while noting the inevitable roadblocks that the FMCT will likely encounter.

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START Follow-on

Linton F. Brooks

Summary. This paper provides options for the Strategic Posture Commission concerning the START Treaty and potential follow-on bilateral nuclear agreements with the Russian Federation. It is based on two important presumptions:

- Just as the Commission has elected not to prescribe a particular force posture, it should also not specify negotiating details. Rather it should focus on broad principles.
- Although there is a plausible future in which the United States and Russia will seek to engage other nuclear powers in multilateral arms control, such an outcome is well in the future and it is not possible to make any meaningful judgments about such negotiations. Thus, this paper is limited to bilateral issues.

Current status. The bilateral nuclear relationship between Russia and the United States has four components:

- The 1987 Intermediate Nuclear Forces (INF) Treaty, requiring the elimination of ground-launched cruise and ballistic missiles with ranges between 500 and 5500 kilometers. All reductions under this treaty are complete; the Russians have recently suggested it either be expanded to cover all states or scrapped.
- The 1991 Strategic Arms Reduction Treaty (START), which limits strategic delivery vehicles, warheads (both overall and on ballistic missiles),[1] and ballistic missile throw-weight and contains a number of subsidiary limits to preclude circumvention and aid verification. START, which is exceptionally complex (primarily to ensure effective verification), will expire in December 2009 unless extended.

- A series of 1991–2 reciprocal, unilateral steps, referred to in the United States as the Presidential Nuclear Initiatives, removing nuclear weapons from Navy ships and attack submarines, eliminating nuclear artillery and short-range nuclear missiles, and withdrawing many so-called tactical, or non-strategic nuclear weapons to central storage.[2] The United States has officially stated that Russia is no longer in compliance with these commitments.
- The 2002 Treaty of Moscow (also called the Strategic Offensive Reduction Treaty or SORT), reducing operationally deployed strategic warheads to between 1700 and 2200 by 2012. Because the Treaty of Moscow lacks verification provisions and allows an immediate increase in deployed forces after 2012, it is widely regarded as little more than a joint declaration of intent expressed in treaty form.

The immediate question facing the United States and the Russian Federation is what, if anything, should replace the START Treaty when it expires in December 2009. Neither the Bush administration nor Russia wished to extend the Treaty in its present form.[3] Both saw advantages to a replacement regime that would preserve the benefits of START while reducing burdensome and expensive verification requirements. Russia sought (and presumably still seeks) a formal follow-on treaty that would include legal limits on forces. The Bush administration, convinced that the era of large-scale East-West arms control has ended and that it must retain flexibility to adjust future force structures, preferred to focus on transparency and confidence building.

The lack of Bush administration interest in formal bilateral arms control arose in part from an attempt to move beyond the adversarial relationship of the Cold War and develop more "normal" bilateral relationship between the two countries. It also reflected doubts as to arms control's relevance. Virtually all analysts and administrations of both parties accept the principle that arms control is not an end in itself but a means to ensure national security and international stability. It is thus useful to consider traditional benefits of U.S. Soviet or U.S.–Russian arms control to see if they are still relevant.

While each analyst and policy maker will have a slightly different list, the following are commonly considered benefits of formal bilateral arms control:

- *Provide predictability and avoid an action-reaction cycle where each side builds new systems in anticipation of similar moves by the other.* Called arms race stability, this was a major motivator during the Cold War. Today, however, with no new strategic systems in development in the United States and with Russian modernization proceeding at a very slow rate, it is irrelevant.

- *Reduce incentives to preempt in time of crisis (provide crisis stability).* Much of the Cold War arms control effort was aimed at encouraging a shift away from ICBMs with multiple warheads that were seen as "use or lose" systems during a crisis. While this concern is still theoretically valid, economic conditions in Russia preclude massive restructuring no matter what arms control agreements say. Further, the dangers from the antiquated Russian warning system outweigh any pressures caused by force structure.
- *Save money by capping expenditures on new systems.* This advantage has vanished due to the very slow rate of strategic spending on both sides.
- *Reduce suspicion and avoid misunderstanding through increased transparency and predictability.* This benefit remains important and argues for retention of data exchanges and other transparency measures regardless of the whether or not there are any numerical limits on force structure.
- *Improve the overall political relationship between the two sides.* This is probably the strongest argument for extending or replacing the START Treaty and was a major reason for concluding the Treaty of Moscow. It has been given increased urgency by the deterioration in political relations between Russia and the United States incident to Russia's turn away from democracy and transformation into a security state.

In addition to these traditional reasons, there are three new reasons for continuing some form of strategic arms agreement with Russia. First, continuing formal arms control (especially in parallel with ratification of the CTBT) will put the United States in a stronger position during the NPT Review Conference, slated to open April 26, 2010. Second, the United States has long maintained a *de facto* policy of maintaining nuclear forces "second to none," in part because of the importance of assuring allies of our ability to maintain extended deterrence.[4] If this policy is retained, the United States can only implement the President's desire to reduce U.S. nuclear forces in parallel with Russia. Formal arms control is the easiest way—though not the only way—to ensure such equality. Finally, some NATO allies see continuation of arms control as important both for predictability and for limiting the threat from Russia.

> Conclusion #1: *The Commission should call for United States to seek a new START treaty to halt the deterioration of relations with Russia, maintain transparency and predictability, and prepare for the 2010 Review conference. The Commission should make it clear that there are limited "traditional" military/strategic benefits to be expected from such a treaty and that it is not necessary for such a treaty to drive Russian force structure in a stabilizing direction.*

Timing. START expires in December 2009. Based on history, appropriate senior U.S. sub-cabinet officials may not be in place until late spring. Although in theory, a replacement treaty could be negotiated quickly (especially using the approach set forth below) it is probably desirable to await the completion of a Nuclear Posture Review before determining the final warhead and launcher levels to accept. Therefore, the United States should move immediately to negotiate an extension to the existing START treaty in order to (a) preserve the transparency regime and (b) make it clear that the United States and Russia intend to move forward with strategic arms negotiations. Such an extension could be done without waiting for any additional nominations or confirmations of American officials.

START can be automatically extended for five years if all five parties (including Ukraine, Belarus and Kazakhstan) agree. This is not likely to be acceptable to Russia and should be unattractive to the United States because it holds open the specter of retaining unnecessarily complex verification provisions. The easiest course would be to exchange diplomatic notes agreeing to continue to observe the provisions of the treaty pending negotiation of the replacement. An alternate would be a simple amendment extending the treaty unaltered for at least 6 months and probably a year, either between the United States and Russia or among all five parties. An amendment would require Senate advice and consent, but could be provisionally applied pending ratification. The Commission need not select among specific extension options.

In her opening statement at her confirmation, the Secretary of State said, "We will work with Russia to secure their agreement to extend essential monitoring and verification provisions of the START Treaty before it expires in December 2009, and we will work toward agreements for further reductions in nuclear weapons." To the extent that this suggests extending monitoring and verification provisions without extending the limitations of START, it is a mistake. The Bush administration tried this approach and failed. Appearing to call for extending those provisions we like (verification) but not the provisions of concern to Russia (numerical limits) will probably fail and will certainly establish a poor attitude for subsequent negotiations.

> Conclusion #2: *The Commission should propose an immediate 12-month extension of the entire START treaty without waiting for additional officials to be confirmed but should not specify the mechanism for this extension.*

One plausible approach. The United States and Russia could replace both START and the 2002 Treaty of Moscow (SORT) with a new treaty that:

- Limited operationally deployed strategic warheads to a number significantly less than the current limits of 1700–2200.[5]

- Limited launchers to slightly above the current levels (perhaps 1300). This number could be lower if systems withdrawn from strategic nuclear service—like the U.S. B-1 bomber or the four ballistic missile submarines converted to carry conventionally armed cruise missiles—were excluded. On balance, it seems easier to simply count everything that is being counted now.
- Mandated that both deployed warhead and launcher limits be reached no later than the end of 2011.
- Preserved the START inspection regime (except for portal monitoring), most of the data exchange provisions, the ban on telemetry encryption,[6] and the provision for a Joint Compliance and Inspection Commission. Simplification is possible.
- Eliminated all auxiliary limits, launcher restrictions, throw weight restrictions, limitations on deployment of mobile ICBMs, and destruction provisions (other than for launchers).

The Commission need not—and probably should not—specify the details of the follow-on approach. What is crucial is to specify that the follow-on treaty provide numerical limits on both launchers and warheads (or their surrogates under counting rules similar but not identical to those used in START).[7] In particular, the Commission should not propose a specific force structure or number of warheads for the new treaty, consistent with its decision not to prescribe a particular force posture for U.S. strategic forces. It should, however, note that this initial phase of negotiations should lead to levels on both the Russian and U.S. side sufficiently high that the forces of other states need not be considered and that there be no incentive for a Chinese "sprint to parity."[8] Virtually all analysts would agree that deployed strategic warhead numbers of 1000 or above would meet this condition.

> Conclusion #3: *The Commission should stress that the new treaty must provide numerical limits on both launchers and warheads (or their surrogates under counting rules similar to those used in START), should not offer incentives to China to seek parity or require consideration of the forces of other states, should replace both START and the Treaty of Moscow (SORT), and that the new limits should be reached as rapidly as possible.*

Risks in negotiating the replacement treaty. The greatest danger will be the temptation to expand the scope of the agreement to cover ballistic missile defenses, nonstrategic nuclear weapons, nondeployed warheads, so-called "hair-trigger alert" or other areas. These areas may well be suitable for separate parallel or follow-on discussions. The priority, however, should be given to replacing START and the Treaty of Moscow. Doing so will maintain continuity in the strategic nuclear relationship.

A second danger will be for one side or the other to seek to "improve" the existing text on peripheral issues (such as definitions or the Annex of Agreed Statements). In general, the parties should base negotiations on the premise that if either side wishes to retain existing language, it should be retained. At the same time, the sides should include "viability and effectiveness" language to permit later adjustment.

A final danger will be that the sides will be unable to agree on handling so-called conventional strategic weapons (also referred to as weapons for Prompt Global Strike) such as the proposed (and thus far rejected by Congress) Conventional Trident Modification. Some Americans, hopeful that such a program will play an important anti-terrorism role in the future, will resist any constraints, while Russians will fear an unrestrained ability for the United States to have strategic impact outside the new treaty. Because this system makes strategic sense only as a niche capability deployed in small numbers, the best solution would be to count such systems against the limits of the treaty if they are launched from existing ICBM silos, ballistic missile submarines or heavy bombers. A slight adjustment in launcher limits may be appropriate.

> Conclusion #4: *The Commission should strongly urge that the new treaty not seek to capture ballistic missile defenses or non-strategic nuclear weapons. Discussions on both could occur in parallel (the Russians will probably insist on this in the case of missile defenses) but should not be allowed to delay the START replacement.*

> Conclusion #5: *The Commission should strongly urge that any Prompt Global Strike systems launched from existing ICBM or SLBM launchers should be counted under the new treaty.*

Future flexibility. One reason some analysts oppose additional permanent reductions is the fear that geopolitical conditions will change and that it will be difficult to modify the treaty to take account of such changes.[9] They can accept reductions well below 2200, but only if there is flexibility to alter those limits in the future. To the extent that the Commission shares this concern, it could be alleviated if the new treaty allowed either side to increase warhead and launcher numbers (as in the Treaty of Moscow) but only with five years' notice. This approach would meet U.S. concerns with preserving the option to react to unforeseen international developments. Because geopolitical changes develop slowly, five years' notice for increasing operationally deployed strategic warheads would not pose any significant risk to national security. At the same time, such an approach will significantly lessen the value of the new treaty in building international support for the 2010 NPT Review Conference. It should be noted that START (and presumably its replacement) has the common provision allowing withdrawal in cases where supreme national interests are threatened.

> Conclusion #6: *The Commission should explicitly consider whether the United States requires any additional flexibility beyond the standard ability to withdraw from a treaty. If so, it should consider recommending the provision described above.*

An alternate approach. The discussion thus far presumes a single treaty that would replace both START and the Treaty of Moscow (SORT). There is another plausible option. The United States and Russia could amend SORT to reduce the number of operationally deployed strategic warheads dramatically below the current level of 1700–2200, retaining the 2012 date for accomplishing these reductions. The amended SORT Treaty should expire far enough in the future (perhaps four years from entry into force) so that a successor START treaty with all the necessary details could reasonably be negotiated and brought into force within that time. Verification would be provided by an extension to the current START Treaty. This option could prove attractive if negotiations for the ultimate follow-on START Treaty take longer than expected. In such a case, it could make it clear to the international community that the two sides were serious about moving forward with the reductions process.

Next steps after negotiating a replacement treaty. The approach set forth in this paper will result in a simplified version of START at lower levels. The United States will probably wish to continue the arms control process further (indeed, promises to do so may become necessary during the initial negotiations). Two obvious areas for follow-on negotiations are missile defenses (covered in a separate Tiger Team paper) and non-strategic nuclear weapons. In addition, Secretary Clinton promised in her opening statement at her confirmation hearing to "work with Russia to take U.S. and Russian missiles off hair-trigger alert."

The United States might also seek further reductions in strategic offensive arms. Such additional reductions may require direct constraints on warheads (including non-deployed warheads), especially if the United States reaches the limits of the treaty through downloading of systems rather than the elimination of launchers.[10] Some Russian experts have asserted that the Russian military has become concerned with U.S. non-deployed weapons. They see the disparity in the potential for uploading of ballistic missiles as putting Russia at a significant disadvantage.

Verification of numbers and locations of non-deployed weapons (whether strategic or non-strategic) is difficult and we lack a good conceptual approach. Some work was being done at the end of the Clinton administration on warhead verification; it should be resumed. Compared to the 1990s, however, Russia has become much less willing to allow intrusive verification. In 2002 the United States proposed inspections of all USAF bomber weapons storage areas, an approach the Russians rejected it because it was "too intrusive."[11] Almost certainly, they would take the same attitude today. The ideal approach would be for the United States and Russia to work jointly (at the technical rather than the political level) to consider approaches and technology that might allow for verification without unacceptable intrusiveness.

Quite apart from verification considerations, any proposal on non-strategic nuclear weapons needs to take the attitude of our NATO allies into account.[12] Given the vast disparity in non-strategic stockpiles, the only thing the United States has to offer in negotiations on non-strategic nuclear weapons is removal of the limited number of weapons deployed in Europe.[13] If mismanaged, such a step could damage the alliance and even induce some states to consider their own weapons programs.[14] No benefit from any Russian action on non-strategic nuclear weapons is worth fragmenting the NATO alliance.[15]

> Conclusion #7: *The Commission should recommend that the United States and Russia begin technical discussions separate from any formal arms control negotiations on verification of non-deployed weapons. These discussions should include representatives of the weapons laboratories and uniformed military from both countries.*

> Conclusion #8: *The Commission should strongly urge that the United States should conduct intensive and extensive consultations with NATO before entering into any discussions with Russia on non-strategic nuclear weapons and that it should not agree to removal of weapons from Europe without the concurrence of our NATO allies.*

Longer term multilateral discussions. As noted earlier, it is premature to bring other countries into any formal arms control negotiations and it is difficult or impossible to make any meaningful judgments about such negotiations. But it is possible that within the eight years that this administration hopes to be in office there will be a desire to move toward a multilateral regime. The challenges of doing so are daunting. They include fundamental issues such as whether all involved states will have rights to the same level of strategic forces (probably important to China and India), treatment of non-strategic weapons (a term with little meaning to such states as India and Pakistan), multilateral verification (made more complex by attitudes in China that transparency is a weapon the strong use to disadvantage the weak), and the role of defenses, especially against ballistic missiles.

Preparing for such an uncertain future should not be allowed to distract the United States from near-term negotiations. There may be merit, however, in some discussions on transparency and confidence-building measures for nuclear forces. Initially these discussions should occur among the United States, United Kingdom and France. Later they could be expanded to include all five nuclear powers recognized under the Nonproliferation Treaty.

> Conclusion #9: *If the Commission considers it necessary to comment on longer term negotiations, it should advocate limited discussions as outlined above. In doing so, it should stress that the primary focus should remain on overall discussions with Russia on nearer-term issues.*

The outlier issue: So-called "hair trigger alert." It is important to be clear on the actual problem with current alert postures. Provisions against accidental or unauthorized launch are extremely robust in both states. Further, the current de-targeting agreements between Russia and the United States reduce the consequences of the launch of a single missile. But the ICBMs of both sides depend for survivability in part on the ability to launch them quickly in the face of an attack. The issue therefore is that one side might assume it was under attack and respond quickly (but erroneously) to avoid a "use or lose" situation. Were one side to attack, the other would have only about thirty minutes to detect and characterize the attack, make a decision to launch, communicate appropriate orders, and execute the launch before ICBMs were destroyed. This time could be even shorter for attacks involving submarine-launched ballistic missiles; the Russians often express concern about the ability of Trident to destroy their ICBM force.

In theory, lengthening decision time could give more time for verification that an actual attack was in progress and could therefore reduce the risk of a side launching a "retaliatory" strike in the mistaken belief that it was under attack. Proposals for lengthening decision time typically fail on one of two grounds. First, in time of great tension (which is when a side might be predisposed to believe it was under attack) prudent planners would restore launch readiness. Second, if one constructed a regime where it took a very long time to restore launch readiness, the chances that ICBMs would be destroyed would be increased. It is not in U.S. interest to have a situation in which the forces of either side are only useful in a first strike.

In addition to these technical problems, the Russians have shown no interest in changing the alert status of their forces. Because Russia depends more heavily on ICBMs than does the United States, the Russians will assume that such a proposal is aimed at putting them at a disadvantage, just as they assume that ballistic missile defense in Europe is actually aimed at them. It would appear much more fruitful to focus on avoiding the mistaken belief that an attack was in progress by improving Russian warning systems, building on the Joint Data Exchange Center.[16]

Separate papers will provide a more complete analysis of de-alerting. From the standpoint of arms control negotiations, however, it is important to keep this issue from becoming a poison pill. Thus, it should be raised with the Russians separately from any formal negotiations and only after we have begun to repair the overall relationship and have a better understanding of exactly what we hope to accomplish. Even then, it appears more suitable for discussion in a broad strategic stability dialogue than for formal arms control.

> Conclusion #10: *Whatever attitude the Commission adopts toward the issue of "hair trigger alert," it should recommend that the issue be kept separate from any other arms control negotiations (especially the initial follow-on to START) and should be raised only after a productive arms control dialogue has been restored.*

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1. More precisely, the Treaty limits the ability to deliver warheads by limiting delivery vehicles (missiles and bombers) and using a system of attributing a number of warheads to each delivery vehicle.
2. The United States deployed non-strategic nuclear weapons (also called tactical or battle field weapons) extensively during the Cold War to serve as a counterweight to Soviet conventional superiority and a means to link the defense of Europe to the U.S. nuclear arsenal. The term "non-strategic" is a misnomer; in political terms, all nuclear weapons are strategic.
3. Ukraine, Belarus and Kazakhstan are also parties to START but play no meaningful role in decisions on its future.
4. It is important to understand that this policy deals with perception. Arguments for maintaining it are not evaluations of military sufficiency or of the size of U.S. forces necessary to deter a Russian strike.
5. The practice of expressing a binding limit as a range (e.g. 1700–2200 operationally deployed strategic warheads) is intellectually illogical and should be discontinued.
6. Some analysts would object to this provision. They note that the encryption requirements pose a concern both for some U.S. development activities related to ballistic missile defense (in particular use of C4 SLBMs as target missiles) and for prompt conventional global strike (from delivery vehicles limited under START). Others would give primacy to the ability to continue to monitor Russian developments. The Commission need not take a position on this issue.
7. Existing START counting rules are probably unworkable and certainly unattractive at the lower levels envisioned for a follow on treaty.
8. There is no evidence that the Chinese are interested in such a sprint and they have repeatedly said they are not. Still, getting in a realm where such a sprint is feasible is an unnecessary complication.
9. Those who make this argument often cite the difficulties of modifying or withdrawing from the ABM Treaty as an example.
10. This will be a particular issue for submarine-launched ballistic missiles where there are operational reasons to maintain a certain number of ships and where elimination of launch tubes on individual SSBNs is prohibitively expensive (although tubes could easily be disabled).
11. Private communication with a senior NSC official.
12. Particular attention will need to be given to the very different views expressed by officials in private discussions versus in public as well as the different views expressed by officials of the ten Eastern European member states that have joined the alliance since 1999 and the Western European states and Turkey that constituted most of NATO member states prior

to 1999. These "new" NATO allies generally feel (a) both a stronger distrust of Russia than the Western European states and (b) a stronger need for U.S. security reassurances. Russia's actions against Georgia late last year only strengthened their distrust of Moscow and their need for security reassurances from Washington. In addition, any proposal on forward deployed nuclear systems in Europe would also need to take the attitudes of Japan and South Korea into consideration. Both Tokyo and Seoul look at U.S. commitments within NATO as a reflection of the strength of their commitments in the Asia-Pacific. The common thread among all of these actors—Western European officials "behind closed doors," Eastern European capitals, and Tokyo and Seoul is that they see the United States' forward-deployed systems as of immense symbolic/political importance. They realize that these weapons were designed for a different (Cold War) context and that they are greatly outnumbered by Russian weapons—and thus that they possess marginal operational utility—but nevertheless see them as outward and visible signs of a U.S. commitment to extended deterrence and to Article V of the NATO Treaty. Their removal could well be interpreted, in Eastern European nations especially, as a willingness of the United States to make their territories safe for conventional war.

13. In principal, one could trade Russian action on non-strategic weapons for U.S. actions in a totally different area (for example, with respect to the CFE Treaty). There are few if any examples of such an approach working in the arms control area.

14. Turkey is often cited in this regard, especially if the Iranian nuclear program continues.

15. The costs to the United States of not considering the views of the new members could be quite concrete. On a per capita basis, the new members are making significant contributions in military personnel and other capabilities to both Iraq and Afghanistan In addition, several have offered basing rights to the U.S. military, and Poland and the Czech Republic appear eager to host U.S. missile defense installations. The point is not that the new members would renege on these commitments, but that they could attempt to exact a high cost in other ways. At the very least, U.S. moves regarding non-strategic nuclear weapons that did not come as a result of extensive consultations with our NATO allies might well sound the death knell for U.S. requests that NATO members increase their contributions to Afghanistan.

16. The problem would effectively vanish if forces were restructured to eliminate ICBMs or even reduce them to a small fraction of the strategic forces of the two sides. Much of the twenty-year history of Soviet-U.S. arms control was a (largely unsuccessful) attempt to drive the Soviets away from their dependence on ICBMs.

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Missile Defense and Arms Control

Bruce W. MacDonald

Introduction and Background

While the U.S. withdrew from the ABM Treaty on June 13, 2002, Russia has expressed in several fora its interest in re-establishing some limits on strategic defensive weapons as a precondition to agreeing to substantial reductions in strategic offensive weapons. A particular matter of concern to Russia is the "third site" U.S. missile defense deployments currently planned for Poland and the Czech Republic. While the U.S. is probably unlikely to offer, and may not accept, limits on strategic defenses in its forthcoming strategic dialogue with Russia, Russia almost certainly will press the U.S. for some restrictions, which means that the U.S. will need to evaluate the conditions under which it may want to consider strategic defensive limitations, what its options are, and what it should seek in return. Accordingly, the Commission may wish to address the issue of restrictions on missile defenses.

In its interim report, the Commission found that

> "Missile defenses appropriate to defend against a rogue nuclear nation could serve a damage-limiting and stabilizing role in the U.S. strategic posture, assuming such defenses are perceived as being effective enough to at least sow doubts in the minds of potential attackers that such an attack would succeed. On the other hand, levels of defenses sizable enough to sow such doubts in the minds of Russia or China could lead them to take actions that increase the threat to the U.S. and its allies and friends." [Finding 16]

Following this logic, there is in theory a negotiating "trade space" in which the U.S. could accept limitations on national missile defenses that did not seriously affect its ability to defend against rogue nuclear threats as long as the "price" for accepting such restrictions was deemed acceptable. The possibility of cooperation with Russia in addressing rogue threats that challenge both nations adds an important negotiating dimension to this issue.

In thinking about limits on missile defenses, there are larger issues that affect the missile defense issue. For Russia, the Third Site touches the sore spot of NATO expansion, and U.S./NATO "encroachment" closer to Russia. China has for some time been quite concerned about the viability of its nuclear deterrent, and advocacy by some in the U.S. for defenses against Chinese missiles, and seeks U.S. acceptance of mutual vulnerability. China already worries about the challenge that just current U.S. plans and deployments pose to its strategic forces and suspects that the U.S. has plans for space-based missile defenses, which causes them particular angst. China's ongoing strategic modernization may in part reflect a hedging strategy against their worst-case projections of U.S. defenses.

Options

There are a number of missile defense options, not all mutually exclusive, that could be considered, including:

A. No restrictions on strategic defenses, which would give the U.S. maximum flexibility in addressing rogue threats and preserve a mid-term option to pursue a damage-limiting strategy against China and even Russia. On the other hand, neither Russia nor China would be likely to acquiesce in such a strategy and presumably would take important steps to offset such U.S. defenses. Even absent a concerted U.S. attempt at damage limitation, such a posture could be an important disincentive to Russian agreement to reductions below what they would reduce to even in the absence of a START agreement, and both Russia and China could take additional hedging steps to preserve the credibility of their respective nuclear deterrents.

B. Confidence-Building Measures (CBMs) that would seek to reassure chiefly Russia and China but also the U.S., UK, and France that missile defense deployments and activities were not aimed at blunting others' nuclear deterrents while still providing credible defenses against rogue states. The Bush Administration was pursuing this approach with Russia, particularly on the European Third Site, which was initially welcomed by Russia but apparently fell out of favor. This option could be combined with any of the others presented here. Such CBMs could include permanent exchanges of observers at production and deployment sites, a commitment not to deploy interceptors until Iran takes some objective step, agreements for consultation before increasing interceptor numbers, and many others. U.S. pursuit of credible boost-phase missile defense, much more relevant to the North Korea-Iran threats than to Russia or China, could with appropriate consultations help build confidence as well. If successful, such CBMs could head off Russian and Chinese responses to U.S. defenses that would be adverse to U.S. security interests and reassure them that the U.S. was not planning to pursue "worst case" defenses that Russia and China might otherwise hedge against. On the other hand, given the stakes involved, Russia and China may be reluctant to rely just on CBMs, seeing them at best as useful but insufficient to address their security concerns. This would be especially relevant to China, whose much smaller deterrent is potentially much less resilient against a sizable and effective U.S. missile defense. At a minimum, Russia would probably want such CBMs codified in a treaty and not made voluntary. Renewing the Bush Administration offer, at least as an initial step, could allow the U.S. to better determine if it was the offer or the U.S. administration that Russia was rejecting.

C. *Limitations on numbers of sites and numbers of interceptors.* Under this option, the U.S. would presumably preserve its ability to defend against rogue nuclear threats while agreeing not to deploy current technology defenses sufficient to call into question the credibility of China's or Russia's strategic deterrents. The U.S. could maintain R&D on more advanced systems as a hedge against Russian breakout and also preserve its options in the event of an unexpected technological breakthrough in missile defense. The right of both the U.S. and Russia to pursue such limited national protection could be explicitly recognized in the agreement. This option would prevent the U.S. from pursuing, for the life of the agreement, a damage-limiting strategy against Russia and China, although the U.S. would retain the option of withdrawal for supreme national interests. One potential problem is that, depending on the size of defenses permitted, defenses sufficiently modest to keep China from feeling threatened could affect U.S. capabilities to defend against rogue threats. This would depend upon the projected size of the Chinese strategic arsenal and the number of interceptors and sites permitted, among other factors. Indeed, the current U.S. plans for 40 interceptors in Alaska and four at Vandenburg AFB already cause concern to China.[1]

D. *Resurrection of the ABM Treaty.* The U.S. and Russia could resurrect the ABM Treaty and operate again under its terms. At a minimum, it would need to be adjusted to permit nationwide ABM defenses, and adjustments could be sought in its numerical limits to accommodate U.S. missile defense plans. Such an option would likely be reassuring to Russia and could enable them to agree to deeper reductions in offensive forces, as well as providing reassurance to the UK, France and China, who in the past were major Treaty supporters because of the limited sizes of their deterrents. On the other hand, making adjustments in the ABM Treaty may be problematic: it would need to be updated in a number of ways and could well be as challenging and time-consuming as starting over. Furthermore, such a step could be politically difficult in the U.S. Were the U.S. to agree to limits on defenses, it may want to draw on portions of the ABM Treaty.

E. *A ban on strategic defenses.* While theoretically possible, such a restriction would force both Russia and the U.S. to dismantle existing strategic defenses that serve important national interests and thus would likely be unacceptable to both sides.

F. *Third Site.* Under both A and B above, there are several options for how the U.S. can choose to address the third site issue, not all mutually exclusive:

a. *Proceed with current plans.* This would support our commitments to NATO and provide some protection against a projected Iranian ICBM threat, though it could pose a stumbling block to a larger START agreement. It would not foreclose, and could facilitate, U.S.-Russian collaboration on defense against an Iranian threat.

b *Delayed third site IOC, with prior NATO consultations, based either on interceptor deployment or radar completion, awaiting outcome of U.S.-Russian discussions.* This provides almost all the benefits of "a," although it would delay protection against an Iranian ICBM threat, which is not projected for a few years at least. Deployment of some U.S. troops at the locations could provide some of the political reassurance that Poland and the Czech Republic are seeking.

c. *Cancel plans to activate the third site.* Unless the U.S. could extract a sufficient "price" from Russia, this option would cleanly remove a stumbling block to START and could save modest funds, although it provides no protection for Europe or the U.S. and could hinder missile defense cooperation with Russia.

d *Use the third site for missile defense cooperation with Russia.* Consistent with both options "a" and "b" above, this option envisions active engagement with Russia to win their agreement to cooperate in the development and operation of this third site and would likely produce additional benefits, both military and diplomatic, in joint efforts to address the Iranian threat.

Observations

1. The likelihood that Russia will press this issue at some point in the reductions process makes it unnecessary for the United States to initiate

discussions, but regardless of what outcome it is willing to agree to, the U.S. should be prepared to address Russian proposals. The growing relevance of China in U.S. missile defense thinking suggests that even if not a party to negotiations on missile defenses, ongoing consultations with China should be considered.

2. Fiscal and technological considerations make substantial increases in U.S. spending for national missile defense unlikely, at least in the near term, though simply maintaining current spending levels would allow the U.S. to deploy a sizable number of interceptors over an extended period of time.
3. While Russia may agree to modest START reductions without any limits on missile defenses, it appears likely that they would need to make substantial changes to their national security strategy before they would agree to more substantial offensive reductions without at least some limits on strategic defenses. Such changes do not appear likely in the near- to mid-term.
4. Willingness to agree to some restrictions on strategic defenses could be an important lever to win Russian concessions on issues of interest to the United States without significantly compromising U.S. ability to defend against rogue threats. Such restrictions could even facilitate collaboration between the two countries on rogue state defenses in general and the Iranian threat in particular.
5. CBMs appear unlikely by themselves to be sufficient to resolve Russian and Chinese anxieties about U.S. missile defense efforts but can be helpful as an adjunct to other restrictions.
6. There is room for compromise on the third site issue that would advance U.S. security interests.
7. As discussed in the separate START paper, discussions with Russia on this subject can occur in parallel with START follow-on discussions but should be kept formally separate because the solutions are likely to be very different in legal form. The parallel negotiating approach of the 1980's provides one model.

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1. The Obama Administration have proposed reducing this deployment to 30 interceptors since this paper was written.

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Future Role of Tactical Nuclear Weapons

Barry Blechman

The term "tactical" nuclear weapons, typically used to designate shorter range weapons that would be used for war-fighting purposes, is misleading as weapons of any range can be used for either strategic or tactical purposes, depending upon the situation.[1] Still, we'll adhere to the convention for the purposes of this paper.

The U.S. has a relatively small number of tactical nuclear weapons, mainly nuclear gravity bombs that can be delivered by tactical aircraft. The U.S. also has a small number of nuclear-armed Tomahawk cruise missiles that were taken off deployment in the early 1990s but are held in a reserve status. Of U.S. allies, the UK no longer deploys tactical weapons. France retains a small number of nuclear-armed short-range missiles that would be delivered by tactical aircraft, but recently announced plans to halve this inventory.

In addition, several other U.S. allies in NATO, who have no nuclear weapons of their own, deploy tactical aircraft squadrons equipped and trained to deliver nuclear bombs. Such weapons are maintained on bases on their territory—in some cases at U.S. bases, in others at the ally's base. In all cases, release of these weapons requires approval of both the U.S. and the host nation. During the Cold War, these weapons were intended to be one means of implementing NATO's threat to initiate nuclear warfare in the event NATO's forces were in danger of being overrun by quantitatively superior Soviet conventional forces. Today, some U.S. allies, or at least their national security officials, place importance on retention of these weapons in support of maintaining a special role in the alliance. The special arrangements concerning these weapons and the need to plan for their possible use are also believed to support closer relations among the allies. In addition, the possibility of an Iranian nuclear weapons capability and deteriorating relations with Russia have been reinvigorating support for maintaining tactical weapons in some countries.

All U.S. tactical nuclear weapons in the Pacific are retained only on U.S. territory. Japan, however, or at least some Japanese officials, is said to place importance on retention of the Tomahawk missiles, even if in a reserve status, as evidence of the credibility of U.S. security guarantees.

Since the end of the Cold War, with the erosion of its conventional military capabilities, Russia has placed increasing emphasis on nuclear weapons generally, and on tactical weapons in particular. As NATO has expanded, Soviet military writers have envisioned the possibility of warfare on its borders or in what they call "the near-abroad," and have stated that Russia would not hesitate to use tactical nuclear weapons in such circumstances. Russia is believed to have thousands of such weapons, both air-delivered munitions and ground-launched missiles, and there have been press reports that Russia has continued to modernize these weapons throughout the post–Cold War period.[2]

China also has nuclear weapons that could be delivered by short-range aircraft, as well as a growing inventory of short- to medium-range missiles that could be armed with nuclear warheads.[3] China probably envisions these weapons in a strategic context, however, either with regard to a confrontation with the U.S. over Taiwan or Korea, or in a future conflict with Russia or Japan.

Tactical nuclear weapons of the types addressed in this paper have never been discussed in any formal arms control negotiation and are not subject to any negotiated constraints.[4]

In considering its future nuclear posture, the U.S. needs to decide whether or not it wishes to retain its tactical weapons and, if so, which ones and where they should be deployed. These questions should be considered along with decisions on strategic nuclear forces as, for example, a decision to make deep cuts in strategic forces might cause one to place greater emphasis on tactical weapons, or vice versa. Decisions on tactical weapons may be particularly important in the near future as, if they are to be retained in the force, steps have to be taken with respect to modernizing the aircraft that would deliver them, the facilities in which they are stored, particularly in Europe, and even with regard to some of the weapons themselves. Also, NATO is reconsidering the role of dual-key weapons in the post–Cold War environment and the U.S. needs to lead that process. Complicating all these issues is the likelihood that any public debate on nuclear modernization in Europe could have significant political repercussions. None of these decisions can be discussed in any detail in an unclassified paper.

The future of the Tomahawk missiles also poses an important question. The Navy has sought to retire these weapons for many years as maintaining their reserve status requires special training of some submarine crews and special certification of some submarines—an allocation of manpower time and financial resources the Navy would prefer to forego. The question is whether or not Japan could be reassured about the U.S. nuclear guarantee through some other means, such as an action to draw attention to the presence of U.S. strategic submarines in the Pacific.[5]

Regardless of its near-term decisions about tactical nuclear weapons, the U.S. clearly should attempt to include these weapons in future arms control negotiations so as to attempt to place some controls on Russian forces. While the two nations seem to have similar numbers of strategic warheads, the Russians clearly have a huge advantage in tactical warheads. Moreover, it is these weapons which perhaps are most vulnerable to being acquired by a terrorist organization, either because of laxity in Russian security precautions or because of corrupt Russian officials. Perhaps not the next agreement with Russia on nuclear issues, but certainly the agreement after that should seek to define limits on both nations' (and other nations') total warheads, both strategic and tactical.

1. For example, the nuclear forces of Israel, India, and Pakistan would all be considered "tactical" in that they are of relatively short-range, but are obviously intended for strategic purposes.
2. Of course, use of numerous nuclear weapons on its border could have very negative unintended consequences for Russia itself; still, Russian military officials appear to believe the threat has deterrent value.
3. Most of China's short- to medium-range missiles appear to be conventionally armed.
4. The U.S.-Soviet Treaty on Intermediate-range Nuclear Forces in 1985, which eliminated the two nations' ground-launched ballistic and cruise missiles with ranges between 500 and 5,500 km, might be considered an exception to this statement, but the U.S., at least, considered the missiles it was giving up in a strategic context.
5. When the U.S. withdrew its intermediate-range missiles from Turkey in the 1960s as a consequence of the Cuban missile crisis, a Polaris strategic submarine, then deployed in the Mediterranean, made a port call to Izmir to demonstrate the continuing U.S. nuclear presence in the region.

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Potential U.S.-Russian Nuclear Arms Control/Non-proliferation Initiatives on Non-strategic Nuclear Forces

Victor A. Utgoff

What Does the Term Non-Strategic Nuclear Forces Encompass?

By definition, non-strategic nuclear forces (NSNF) do not include the kinds of nuclear forces that have been captured in the strategic arms control agreements concluded between the U.S. and Russia or the former Soviet Union. Further, this paper will not consider intermediate-range nuclear forces as the INF Treaty eliminated these forces for the U.S. and Russia. NSNF does include forces such as nuclear-armed tactical aircraft, the TLAM-N, short-range nuclear-armed ballistic missiles, artillery-fired atomic projectiles, nuclear warheads for air and ballistic missile defense, nuclear depth charges, nuclear torpedoes, and atomic demolition munitions. This collection of weapons with its wide spectrum of yields, delivery ranges, sizes, uses, etc., defies any simple and useful characterization in terms of physical properties, except that they are all nuclear weapons.

In this short paper, we will consider NSNF as belonging to one or the other of two classes. The first will be battlefield weapons broadly defined as those having relatively small nuclear yields and planned for use against opposing forces at ranges of at most a few hundred miles. The second will be referred to as theater nuclear weapons—which are capable of larger yields and could be planned for use against forces or other targets at ranges of perhaps 500 to 1000 miles.

Note that many nuclear-armed states other than Russia and the U.S. own weapons that would fall into the second of these two classes. As it seems unlikely those forces will become subject to arms control limitations in the foreseeable future, this paper restricts its attention to NSNF owned by the U.S. and Russia.

Primary Values of NSNF as Seen by Russia and the U.S.

During the darkest periods of the Cold War, the U.S. and the Soviet Union deployed many thousands of NSNF. Their primary value for the U.S. and its allies was to offset the large numerical superiority in conventional forces fielded by the Soviet Union and its allies. The Soviet Union built NSNF in order to be able to hold its own if not win the nuclear combat the U.S. and its allies might escalate to, and to avoid being seen as inferior in this category of military capabilities.

As the Cold War ended, substantial reductions were made in NSNF. In 1987, the U.S. and the Soviet Union agreed to the Intermediate Nuclear Forces Treaty which eliminated all land-based ballistic and cruise missile with ranges between 500 and 5500 km. In 1991–92 further reductions in NSNF were promised by both sides in sequential "Presidential Nuclear Initiatives." President George H.W. Bush first promised to unilaterally withdraw all land-based tactical nuclear weapons (those that could travel less than 300 miles) from overseas bases and all sea-based tactical nuclear weapons from U.S. surface ships, submarines, and naval aircraft. In late 1991, NATO further agreed to reduce by "about half the number of nuclear weapons for nuclear-capable aircraft based in Europe." NSNF were also removed from bases in South Korea by 1991.[1]

In October 1991, "Russia's President responded by stating that…the Soviet Union would destroy all nuclear artillery ammunition and warheads for tactical missiles; remove warheads for nuclear anti-aircraft missiles, and destroy some of them, destroy all nuclear land-mines; and remove all naval [NSNF] from submarines and surface ships and ground-based naval aviation, destroying some of them." "President Yeltsin [amplified these promises by] stating that Russia would destroy all warheads from short-range missile, artillery, and atomic demolition devices; one third of the warheads from sea-based [NSNF]; half the warheads from air-defense interceptors; and half the warheads from the Air Force's [NSNF]."[2]

These reductions and redeployments reflected recognition on both sides that the prospects of war between them had essentially disappeared for the foreseeable future. The reductions were especially welcome for NATO front line allies as the possibility that they would have to mount a nuclear defense on their territory had always been viewed with great skepticism. Many experts believed that such a defense could not be implemented effectively, and in any case would lead to enormous destruction for both sides.

Shifts in Perceived Values of NSNF

The values of NSNF now seen as most valuable have shifted for both sides. Russia's conventional forces have suffered a serious decline and it no longer sees itself capable of defending its vast territory with conventional forces. Consistent with this view, in 1993, Russia "rejected the Soviet Union's no-first use pledge, indicating that it viewed nuclear weapons as a central feature in its military and security strategies." During a meeting of the Kremlin Security Council in 1999, President Yeltsin and his security chiefs reportedly agreed "that Moscow should develop and deploy tactical, as well as, strategic nuclear weapons." Vladimir Putin, then chair of the Council, stated that Yeltsin had endorsed "a blueprint for the development and use of non-strategic nuclear forces." In military doctrine published in 2000, Russia stated that it could use nuclear weapons "in response to large-scale aggression utilizing conventional weapons in situations critical to the national security of the Russian Federation.[3] In 2003, President Putin went so far as to refer to nuclear deterrence forces as "the main foundation of Russia's national security."[4]

These statements indicating a change in Russian policy toward NSNF are consistent with rebuffs of NATO's requests for information about the status of Russia's NSNF. In 1997, NATO expressed its concerns about "the large number of tactical nuclear weapons of all types" and called on Russia "to bring to completion" the reductions called for in the 1991 and 1992 presidential nuclear initiatives. In a December 2000 report NATO also "proposed a set of transparency measures… including an exchange [of] data on U.S. and Russian sub-strategic nuclear forces." As of May 2002, these proposals "had not achieved many tangible results."[5] More recently Rose Gottemoeller noted that "differences over how to exchange data under the Presidential Nuclear Initiatives [have] been a persistent irritant between Russia and NATO practically since [they] were agreed to the early 1990s."[6 7]

For the U.S., the value of its nuclear umbrella as a tool for dissuading nuclear proliferation primarily by allies has increased substantially since the end of the Cold War. Nuclear proliferation by North Korea and especially its test of a nuclear device in 2006 have led both Japan and South Korea to seek reassurance from the U.S. that they can continue to rely on its nuclear umbrella. NATO members, especially those nearest to Russia, also appear to value greatly the extended nuclear guarantees provided through the Alliance. Iran's pursuit of capabilities to build nuclear weapons has raised concerns among some Middle East states about their possible need for the deterrent protection provided by nuclear forces.

U.S. allies see NSNF specifically as an important if not essential component of extended nuclear deterrence. Japan especially values U.S. capabilities to deliver nuclear strikes from forward locations within Northeast Asia, especially those that can be provided by deploying the U.S. TLAM-N on attack submarines. South Korea raised the question of redeployment of U.S. NSNF onto its territory in consultations with the U.S. immediately after North Korea's nuclear test in 2006. NATO has been a strong supporter of nuclear programs of cooperation with the U.S. that store nuclear bombs on the territories of some NATO states that would be released to and flown to their targets by the allies.

NATO's 1999 Strategic Concept states that "a credible Alliance nuclear posture and the demonstration of Alliance solidarity and common commitment to war prevention continue to require widespread participation by European Allies involved in collective defence planning, in nuclear roles, in peacetime basing of nuclear forces on their territory and in command, control and consultation arrangements. Nuclear forces based in Europe and committed to NATO provide an essential political and military link between the European and the North American members of the Alliance."[8] NATO's Strategic Concept is being revised this year. While it is possible that the new concept may not take so strong a position on retention of U.S. NSNF in Europe, European concerns about Iran's pursuit of a capability to build nuclear weapons and Russia's invasion of Georgia point in the other direction.

Primary Concerns with U.S. and Russian Deployed NSNF

The primary concerns with Russian battlefield nuclear forces are the large uncertainties in their numbers, the possibility that they have not been relocated at central storage facilities but are instead deployed at a large number of bases across Russia, and that those bases are not adequately secure against the possibility of theft, capture, or misuse of such weapons. CTR support has apparently been focused on assistance in moving nuclear weapons from Ukraine and Kazakhstan back to Russia after the Cold War and on improving the security of only its central storage locations.[9]

The technical features of some Russian NSNF are also a source of worry. Some of these weapons, such as atomic demolition munitions, are light enough to be man portable and small enough to easily hide. It is also possible that Russia has had some success in developing weapons with specialized features for "battlefield" use. For example, an air-air defense weapon producing directed high-intensity neutrons or directed EMP effects might greatly increase the effectiveness of Russian fighter-interceptors.

More generally, NATO was never satisfied that it had a practical doctrine for employing nuclear weapons against maneuvering ground forces in a way that would be effective but would be unlikely to produce large amounts of blast, radiation, and fire damage to non-military targets. But effective battlefield nuclear doctrines that produce low collateral damage are possible, especially using relatively clean low-yield weapons.[10]

Finally, some argue that a "nuke is a nuke" and that Russia should not be allowed to retain a substantial advantage in numbers of NSNF, especially new types for fighting on the battlefield. Perhaps so, but NATO's European Allies have always preferred that any nuclear warfare not be restricted to their territories but quickly escalate to the adversary's homeland. It seems likely that NATO would not act on the opportunity to build nuclear forces specialized for battlefield use, though a modest number of some types of specialized low-yield weapons might be useful from a strictly military point of view.

Among the primary concerns expressed about U.S. forward deployed NSNF are that they too might not be adequately secure against the possibility of theft, capture, or misuse. As part of an Air Force effort to upgrade the handling and security of its nuclear weapons, it inspected nuclear storage sites in NATO Europe and reported that most of those sites "do not meet U.S. security requirements." This report stirred up some anti-nuclear sentiment in Europe. At the same time, officials from NATO states and NATO HQ rejected the review's findings and methodology. They argued that the review added nothing new to the reports on the security of these sites that are provided quarterly to the NATO Nuclear Planning Group, and added that security enhancements are being implemented.[11] Another concern expressed by some is that forward deployment of NSNF in Europe is simply not needed in the current security environment.[12]

Possible Commission Recommendations

Unless and until Russia finds a way to build conventional forces sufficient to give it reasonable confidence that it can defend its territory from conventional attack, it seems most unlikely to consider eliminating all its NSNF. Similarly, the various means for implementing U.S. extended nuclear deterrence guarantees to NATO for more than 40 years, especially forward deployment of NSNF for potential release and use by Allies if necessary, have become a powerful symbol of Alliance solidarity.

In the current international security environment, with its fractious U.S.-NATO relations with Russia, and with some NATO Allies becoming increasingly concerned with Iran's pursuit of capabilities to build nuclear weapons, unilaterally withdrawing forward deployed U.S. NSNF seems likely to shake the confidence of NATO in U.S. nuclear security guarantees. And, all other things being equal, their concerns would be widely shared by non-NATO allies who also depend upon U.S. extended deterrence guarantees.

> *Possible Recommendation 1:* The commission could recommend that the U.S. not consider withdrawing all U.S. NSNF from Europe without comprehensive consultations with all the NATO states and the organization as a whole.[13] Further, all U.S. allies depending upon the U.S. nuclear umbrella should be assured and satisfied that such redeployments do not imply any weakening of their extended nuclear deterrence guarantees.[14] Arrangements for quick redeployment should the need arise would be maintained, as would all the other planning, training, exercise, and command and communication capabilities required to maintain overall NATO capabilities to support nuclear deterrence. Sufficient conditions for redeployment could be agreed in advance.[15]

NATO seems less likely to support redeploying U.S. NSNF in Europe back to the U.S. unless they see substantial gains from doing so. This suggests that such redeployments be paired with a valuable change in Russia's NSNF deployments.

> *Possible Recommendation 2:* The commission could recommend that the U.S. seek an understanding with Russia that all NSNF would normally by held in storage facilities centrally located within each state's territory.[16]

As mentioned above, since only a few years after the Presidential Nuclear Initiatives, NATO bids to get Russia to discuss the disposition and nature of remaining Russian NSNF or to consider NSNF arms control have gotten at best minimal responses. Pending a substantial improvement in NATO-Russian relations, movement toward any negotiated limits on NSNF may simply not be possible. In this event, small but useful steps might still be possible, especially in concert with the broader and more important diplomatic efforts the new administration appears to be interested in making.

> *Possible Recommendation 3:* The commission could recommend that the U.S. and NATO seek an agreement with Russia to begin to exchange information on the nature and disposition of the NSNF capabilities that both sides have maintained. Additionally, the sides might consider joint efforts to re-explore technical means for verifying the elimination of such weapons.[17]

U.S.-Russian negotiations to reduce both sides' nuclear weapons seem likely to eventually require taking formal account of Russian NSNF either by counting them with strategic nuclear weapons according to some agreed formula, or counting them in a separate agreement that limits NSNF. It is not too early to attack this problem. A failure to consider NSNF could even prove a "poison pill" when the executive branch seeks acceptance of a START follow-on agreement.[18] It is important to understand that nuclear weapons are not all equal and incorporate this fact into thinking about arms control.

> *Possible Recommendation 4:* The commission could recommend that DOD and DOS explore alternative approaches to counting rules for NSNF.

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1. Amy Woolf, "Report for Congress, Nonstrategic Nuclear Weapons," Congressional Research Service, updated July 29, 2008, pp. 9-10.
2. Ibid, p. 11.
3. Ibid, pp. 15-16.
4. Dmitri Trenin, "Russia's Nuclear Policy in the 21st Century Environment," IFRI, Autumn 2005, p. 8.
5. "The Pressing Need for Tactical Nuclear Weapons Control," Arms Control Today, May 2002.
6. Rose Gottemoeller, "Eliminating Short-Range Nuclear Weapons Designed to be Forward Deployed," in "Reykjavik Revisited: Steps Toward a World Free of Nuclear Weapons—Complete Report of 2007," Hoover Institution Conference, December 2008.
7. Note that this shift in Russian attitudes toward NSNF is consistent with the possibility of continued Russian development of nuclear weapons. Use of nuclear weapons against conventional forces operating on or over Russian territory or that of an opponent would place a premium on very small nuclear weapons and on weapons that produce minimal residual radiation or provide special effects such as directed EMP or enhanced neutron radiation.
8. "The Alliance's Strategic Concept," approved by Heads of State and Government participating in the meeting of the North Atlantic Council in Washington, D.C., April 23-24, 1999, paragraph 64.
9. Woolf, op. cit., pp 25-26.
10. Victor Utgoff and Willard Christenson, "Battlefield Nuclear Forces: An Undervalued Option for Improved Deterrence in Europe" (U), Institute for Defense Analyses, Paper P-2076, May 1988, unclassified Executive Summary.
11. Hans M. Kristensen, "USAF Report: Most Nuclear Weapons Sites in Europe do not meet U.S. Security Standards," FAS Strategic Security Blog, June 19, 2008.
12. See Oliver Meier, "NATO Mulls Nuke Modernization, Security," Arms Control Today, September 2008.
13. See "Report of the Secretary of Defense Task Force on DoD Nuclear Weapons Management, Phase II, review of the DoD Nuclear Mission, December 2008, p. v.
14. This potential recommendation parallels a conclusion in Linton F. Brooks, "START Follow-on," February 15, 2009.
15. For example, redeployment in the event that Iran tests a nuclear device or is otherwise discovered to be building nuclear weapons could be guaranteed.
16. See recommendations in "Toward a Nuclear-Free World," George P. Schultz, William J. Perry, Henry A. Kissinger and Sam Nunn, Wall Street Journal, January 15, 2008.
17. Gottemoeller, op. cit.
18. Burgess Laird made such an observation in his comments on Linton Brooks' START Follow-on.

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De-alerting Strategic Missile Forces

Franklin C. Miller

The so-called de-alerting debate has been with us for well over two decades. The "failure" of the U.S. and Russian governments "to solve the problem" has been attributed to bureaucratic resistance on both sides. Some authors today continue to insist "quick-use forces could exacerbate instability in a crisis and are vulnerable to inadvertent use." It is certainly correct that officials in both Moscow and Washington have resisted appeals to take their respective missile forces off alert; that this is true underscores three underlying realities: (1) the alert posture of both sides nuclear force is in fact highly stable and subject to multiple layers of controls, *i.e, neither side is on a "hair trigger alert"*; (2) there is confusion about what the ultimate goal of de-alerting is; and (3) given this uncertainty, it is far more difficult to prescribe corrective action that does not contain within it the seeds of crisis instability.

Are we on "hair trigger alert" today?

Both U.S. and Russian strategic nuclear missile forces (i.e., land-based missiles {ICBMs} and submarine launched missiles {i.e., SLBM}) can only be launched if the proper codes are provided to the launch crews by the respective national leaderships. These codes are needed to unlock electro-mechanical devices which otherwise would prevent missile system launch. Access to the codes is highly restricted, and the codes are not maintained at the ICBM launch sites or onboard the strategic missile submarines (SSBNs). In the United States, only the President has the authority to release the codes to the forces, thereby enabling the launch of a nuclear-armed system. It is generally believed that the Russian President holds the same nuclear-launch authority as well. All of this said, there was concern in some quarters during the Cold War that the inherent vulnerability of ICBMs to pre-emptive attack would cause a U.S. President or the Soviet leadership to order the launch of their ICBMs if early warning information received from infra-red sensing satellites and long-range ground-based radars suggested that the other side had initiated such a pre-emptive attack. This Cold War situation has changed significantly since the early 1990s. As both sides gradually reduce the warhead loadings on their ICBMs to meet the limits of the START treaty and the Moscow Treaty, the military value of a pre-emptive strike on the other side's ICBMs is greatly reduced; attacking an ICBM armed with a single nuclear warhead is generally considered to be of no interest to nuclear planners on either side. Moreover, by fielding mobile ICBMs which can be dispersed in a crisis, Russia has taken further steps to insure the survivability of its nuclear deterrent and to reduce the pressure to make an early decision to launch its nuclear forces. And, in fact, since the end of the Cold War, Russian strategic forces have been operated in a manner which suggests the Kremlin does not fear a bolt out of the blue attack: the majority of their SSBNs have been kept in port and their mobile ICBMs have remained inside their bases.

All of this said, some believe that false indications of an attack could cause the President or the Soviet leadership to order an all-out launch by mistake. Recognizing this, U.S. national policy stressed for decades that our deterrent should not rely on such a "launch under attack" capability and, in fact, U.S. retaliatory plans were built in a manner to insure that this was so…thereby increasing stability. According to some commentators, however, the Soviet leadership created a "doomsday system" which could, under certain circumstances (total loss of communications with the Soviet leadership, confirmed detection of nuclear detonations on Russian soil, etc.) bypass the electro-mechanical interlocks and launch Russian ICBMs; these commentators believe the Russian Government has retained this doomsday system and that it could be activated accidently. The U.S. intelligence community has never verified the accuracy of these reports.

Would taking strategic missile forces off of alert increase stability?

Despite a general belief in both the U.S. and Soviet/Russian governments that maintaining missiles in an alert status did not create instabilities, for more than twenty years an element of the arms control community has worried about alert intercontinental ballistic missiles (ICBMs), and in particular Russian ICBMs standing day-to-day alert, concerned that they are particularly susceptible to accidental or inadvertent launch. An often-voiced argument is that the Russian military is concerned to the degree of paranoia about a U.S. surprise attack and that it is predisposed to call for a rapid launch of its ICBMs if indications of a U.S. attack were received; these fears are compounded by the fact that the Russian missile early warning system has deteriorated since the Cold War and that major gaps in coverage exist. They have led to calls for taking steps to disable the U.S. Minuteman force in the hope that Russia would follow suit with its ICBMs—thereby increasing strategic stability. The de-alerting proponents allow that if a crisis developed the systems could be returned to alert status in order to deter attack. In the abstract, all of this sounds reasonable. The rationale, however, begins to unravel when it confronts reality.

Russia has far more warheads on its ICBMs than the United States has in its Minuteman force (because Russian strategic culture places far more confidence in its land-based forces than it does in its submarine-based forces). As a result, even if the United States were to eliminate its entire ICBM force, Russia would probably still maintain ICBMs on alert. Put another way, if all U.S. ICBMs were disabled, Russia might arguably be willing to take a number of ICBMs carrying warheads equal to the U.S. ICBM force off alert…but this would still leave a sizable portion of the Russian ICBM force on alert. And, to the degree one worries about Russian paranoia leading to "hair-trigger" responses, the prospect of taking only a portion of the Russian ICBM force off alert should raise major worries, because the remaining alert forces would logically be placed on an even higher alert status than is the case today (because the prospect of the loss of these remaining alert missiles would be absolutely unacceptable in Russian eyes). *If, therefore, the goal of a de-alerting policy is to decrease Russian reliance on quick launch, this step would fail to meet that goal.* Nothing short of removing all Russian ICBMs from alert would do—and the prospect for this is highly unlikely.

Furthermore, the idea of disabling U.S. ICBMs is premised on the view of some Americans that the threat the Russian General Staff fears is a preemptive strike carried out by U.S. ICBMs. Various Soviet and Russian officials over the years, however, have pointed more often to the U.S. SLBM force as the source of a U.S. first strike. *From an American standpoint, however, it is difficult to conceive of a more destabilizing action than that of disabling the ability of our ballistic missile submarines to launch their missiles—and therefore to be able to deter under all possible circumstances.*

Finally, even if both sides were able to muster the political will to take the great step into the unknown by de-alerting/disabling some or all of the ICBMs and/or SLBMs, no verification scheme has yet been devised to provide confidence that a missile, land- or sea-based, either has been taken off alert or returned to alert status. Should a crisis develop, moves by each side to return disabled nuclear forces to an alert status would further heighten tensions and raise the specter of one side launching first in the belief that the other side had not completed its re-alerting activities.

If we disable our missile forces, can we return them to alert status safely?

If there is one lesson to be learned from the recent December 2008 report by the Secretary of Defense Task Force on Nuclear Weapons Management (also known as the Schlesinger Task Force), it is that once crews stop believing their mission is real they cease to pay attention to their responsibilities and lose competency; de-alerting would create such attitudes (as an example, examine the challenges of maintaining morale of the Minuteman II launch crews who continued to carry out their functions once their systems were deactivated in the fall of 1991). We should be quick, therefore, to note the dangers which would arise from using badly motivated and incompetent forces to return systems to alert status in a crisis.

If we are concerned that false warning information could create pressures for a launch decision, are there other steps we can take?

To the degree that one worries about launch based on faulty information, the best answer has always been to improve Russian warning systems to make an accidental launch impossible; the moribund U.S. effort to establish a Joint Warning Center with Russia attempted to help fill this need.

1. The term "de-alerting" has many interpretations. A de minimis approach to de-alerting would be to remove target coordinates from a missile's guidance computer; if somehow launched by accident, the missile would head for the open ocean rather than any land mass. **This action was taken by the U.S., Russia, UK, France and China in the mid-1990s.** Another approach would call for removing a component necessary to launch the system from the launch control complex; in the U.S. this might be removing the firing keys and storing them off-site. In a building crisis, the keys, it is argued by proponents, always could be returned to the launch complexes. (Obviously, it is much more difficult to do something similar with SSBNs.) Verifying that a second set of launch-critical components had not been hidden on-site would be a daunting task, however. A less reversible and more dramatic approach would call for the removal of warheads from the missiles; this could be verified with higher confidence, but re-arming the missiles could take a year or more; in a crisis, the side that re-armed first would have an obvious advantage. The conundrum here is that the more dramatic and verifiable steps make it impossible to fire a missile in peacetime (when there is no need to deter another state) but create circumstances where, in a crisis, when a deterrent is necessary to help manage and de-escalate the situation, there could be both a rush to re-arm and a premium for pre-emption. I have used the term"disable" in this paragraph to indicate that the steps being recommended would not be reversible in a matter of minutes.

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The Future of INF

Bradley H. Roberts

Background

For most of the U.S. arms control community, the Treaty on Intermediate-range Nuclear Forces is little more than an historical footnote. Agreed in 1987, the treaty led to the elimination of all U.S. and Soviet ground-launched cruise and ballistic missiles with ranges between 500 and 5500 kilometers. The elimination of these weapons was completed years ago. The INF treaty is far more prominent in Russia's arms control debate. Russian concerns about the treaty crested in 2007 with a series of high-level statements threatening to withdraw. The Bush administration was able to persuade Russia to agree to a renewed effort to globalize the treaty. The Obama administration has signaled its commitment to this globalization effort. Diplomatic efforts have been made to expand INF membership to all countries with missiles of the specified ranges. But this seems highly unpromising, as it would require states as varied as Israel, Iran, Pakistan, India, and China to relinquish such capabilities. The fate of the treaty is a matter of considerable importance to U.S. allies in both Europe and Asia, among many others.

Key Issues

The INF treaty may resurface as an issue for U.S. arms control strategy in one of two ways. The first would be through failure to re-start START. At this time of renewed high-level commitment to renewed strategic dialogue with Russia, such a failure seems unlikely. But dialogue may yet not result in a return to the START process envisioned by many. From a top-level political perspective, the United States is renewing its interest in arms control at a time when Russian leaders talk increasingly about the need for strategic flexibility in order to meet the different requirements of a new security environment around Russia's periphery. They talk explicitly about the need to escape "cold war relics" in the arms control realm. These explicitly include CFE and INF. Their complaint about the treaty on Conventional Forces in Europe is that it locks them into a cold war force posture that is ill-suited to Russia's current and emerging security environment. Their complaint about the INF treaty is that it prevents their deployment of counters to the medium- and intermediate-range nuclear weapons deployments on-going around their periphery. Some Russian experts have argued that being freed from these restraints might actually enable the Russian military to reduce its reliance on tactical nuclear weapons as a cover for weakness in other dimensions of Russian military power. In dealing specifically with the INF-derived "imbalances," Russian experts argue that neither ICBMs nor tactical weapons are useful for re-establishing the desired nuclear balances with these states. Russian leaders have explicitly threatened to withdraw from INF in response to U.S. missile defense plans in Central Europe. If ultimately Russia cannot accept what the U.S. and NATO deem necessary in this regard, there may be many repercussions, including INF withdrawal. This would lead, presumably, to Russian redeployment of intermediate-range nuclear forces to counter-balance comparable systems in countries oft-mentioned of specific concern: Iran, India, and China. A quick means of doing so has also been touted by some Russian military leaders: enhancements to the new Iskander SRBM.

The second way in which INF may resurface would be if re-starting START succeeds. As is widely recognized, reductions in the number of operationally deployed strategic nuclear weapons would raise a host of new arms control challenges. One of the most complicated relates to how to bring China into the equation. So far at least, the U.S. side has conceived this problem as largely a challenge of dissuasion (i.e., how many U.S. weapons are enough to ensure that China is not tempted to make a "sprint to parity"). Russia shares this concern about a possible Chinese sprint, but it also sees China as already well ahead in the local nuclear balance of power, as it fields medium- and intermediate-range forces against Russia for which Russia has no counter-balancing force. The large Russian advantage in tactical nuclear weapons seems useless to Russians for this purpose, as there is no Russian conventional force structure along the border with China whose presence these weapons might support. China is highly unlikely to relinquish these weapons in order to globalize the INF treaty. This imbalance of forces will become even more pronounced in Russian eyes as the strategic reductions accelerate, and it may seek escape from the restraints of the INF treaty as part of the process of reducing strategic forces. Some Russians have spoken privately about altering the INF Treaty so that it permits Russia a fixed number of deployments in a limited number of geographic regions. This might prove tolerable to the United States and its allies under certain conditions. But U.S. allies, especially those in East Asia, keenly remember an initial U.S.-Soviet INF deal two decades ago that would have shifted SS-20 deployments from west of the Urals to East Asia, a deal that Japan in particular saw as a sell-out of its interests. These sensitivities are certain to re-erupt if and as the INF treaty reemerges as a topic of political interest.

Suggested action by the SPC: final report might include a finding on this topic but no specific recommendation seems necessary at this time.

Notional finding: The long-term viability of the INF treaty should not be taken for granted. Russian complaints that it is a "cold war relic" that locks Russia into an increasingly disadvantageous military position as medium-range nuclear-tipped missiles proliferate around its periphery have led to renewed efforts to "globalize" the treaty. This seems highly unpromising, as countries like Israel, Iran, India, and China seem highly unlikely to relinquish capabilities they see as essential to their regional military postures. Collapse of the treaty would undermine the U.S.-Russian arms control process more generally, while also negatively affecting the security interests of U.S. friends and allies in both Europe and Asia. Success in renewing strategic arms control with Russia (and more generally, in renewing a genuine strategic dialogue) could assuage some Russian concerns about INF, but may also raise new questions about how to stabilize strategic competition in Eurasia.

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Assessing Technical Concerns with the Comprehensive Test Ban Treaty

Burgess Laird

Introduction

Following a short floor debate in October 1999, the Senate rejected ratification of the Comprehensive Test Ban Treaty (CTBT) by a vote of 51–48, falling far short of the 67 votes necessary for ratification. Over the past few years, there has been growing support across the U.S. political spectrum for reconsideration and ratification of the CTBT, which prohibits conducting any nuclear weapons test explosion or any other nuclear explosion anywhere. In both of their frequently cited op-ed pieces in *The Wall Street Journal*, four senior U.S. statesmen (former Secretary of State Henry Kissinger, former Secretary of State George Shultz, former Secretary of Defense William J. Perry and retired Senator Sam Nunn) have urged the U.S. Senate to reconsider and ratify the CTBT. President Obama has made ratification of the CTBT one of the major pillars of his arms control and disarmament policy.

Many experts see ratification of the CTBT as essential to restoring confidence in the nonproliferation regime. Indeed, the CTBT has long been seen as a litmus test of the Nuclear Weapons States' commitment to their obligation under Article VI of the Non-Proliferation Treaty (NPT) to pursue measures leading to nuclear disarmament. Moreover, a key part of the bargain that secured the indefinite extension of the NPT in 1995 and at the 2000 NPT Review Conference was commitment on the part of the Nuclear Weapons States to achieve the CTBT. U.S. failure to ratify the CTBT has come at a cost. It has repeatedly put the United States on the defensive at different international nonproliferation meetings, including the NPT Review Conferences. It has complicated the U.S.'s ability to persuade other states to address the challenges posed to the NPT regime by countries such as North Korea and Iran. Finally, it has served as a convenient rationale for other states to avoid embracing important new non-proliferation measures such as the International Atomic Energy Agency's (IAEA's) Additional Protocol, which requires the IAEA to assess the entire nuclear fuel cycle through intrusive verification measures such as short-notice inspections of suspected facilities.

CTBT proponents argue that the global norm against nuclear testing remains strong, as the international condemnation of the 1998 tests by India and Pakistan and the 2006 test by North Korea reflected, and that Treaty ratification can only strengthen that global norm and with it the NPT regime. Norms matter, it is asserted, because they help in pressuring violators.[1]

Noting that the United States enjoys significant advantages over China, Pakistan, and India in the sophistication of its nuclear arsenal and the depth of its knowledge related to nuclear weapons technology, some CTBT proponents maintain that a test ban would place technical constraints on these states that would greatly restrict any further qualitative improvements in their weapons.[2] Finally, CTBT proponents note that, though Russia and the United States possess the most advanced nuclear weapons and nuclear weapons expertise, a test ban would provide insurance against a renewal of the nuclear arms race by impeding the development of so-called "fourth generation" nuclear designs.[3]

Finally, some Treaty proponents argue that, because the United States has a voluntary moratorium on testing that enjoys overwhelming political support and for which it is already paying the technical price for a CTBT, it only makes sense that the United States gain the political benefits to be had from the CTBT.

To be clear, U.S. ratification of the CTBT does not ensure its entry into force; for that Washington would need to mount an extensive and adept diplomatic strategy. To date, 180 countries have signed the CTBT and 145 countries have ratified it, including all U.S. NATO allies. Nine countries must still ratify the CTBT for it to achieve entry into force; the United States and China are the two key holdouts. China has indicated on numerous occasions that it will ratify the CTBT as soon as it is confident that the United States will do so. Many Indian scholars and former policy makers argue that if the United States ratifies the CTBT, India will also do so. The major diplomatic efforts will likely focus on encouraging Egypt and Pakistan to ratify the Treaty.

But while U.S. ratification would appear to be the key to breaking the international logjam preventing the CTBT's entry into force, the Obama Administration's success in securing ratification is by no means assured. Indeed, the Administration's efforts to win Senate approval of the Treaty will face major political challenges in securing the 67 votes necessary for the Treaty's passage. Leading Senate critics of the Treaty include Senators John Kyl of

Arizona and Jeff Sessions of Alabama, who oppose the CTBT based on the claims that adherence to its terms cannot be effectively verified and that in the long term the United States cannot maintain confidence in the reliability of the U.S. nuclear deterrent force in the absence of testing. Treaty opponents also cite related concerns over the possible military advances that states like Russia and China might make through clandestine testing at very low yield levels and the Treaty's lack of teeth for enforcing compliance.

The technical concerns cited by CTBT opponents today are in essence the same as the arguments cited in the 1999 Senate debate to help defeat ratification. An appreciation of those concerns, therefore, appears imperative. This paper reviews and assesses the key features of those concerns and offers the Commission options for their consideration in light of them.

Persistent Technical Concerns with the CTBT

In 1999, three major technical concerns and one political-legal concern played a large role in the defeat of the CTBT.[4] Each persists today. One concern is that adherence to the terms of the CTBT could not be effectively verified despite the Treaty's extensive verification provisions, including an International Monitoring System (IMS), consisting of remote sensors; confidence building measures; provisions for consultation and classification; and once the treaty enters into force, the possibility of short-notice, on-site inspections. Since 1999, this concern has been the focus of three different in-depth technical studies, each of which has concluded that adherence to the terms of the CTBT can be effectively verified.[5]

A second technical concern is that even if testing of nuclear weapons at traditional yields of several kilotons and above could be detected, countries could still make significant advancements in their nuclear weapon capabilities through nuclear testing at yield levels that might escape detection. This concern was a principal focus of a 2002 National Academy of Sciences (NAS) study, which concluded that militarily significant improvements in nuclear weapons capabilities cannot be achieved via low-yield tests by states with little testing experience or states, like Russia and China, with extensive testing and design expertise. Nonetheless, some U.S. nuclear analysts and experts assert that Russia and China can achieve militarily significant gains to their weapons capabilities through very-low-yield tests that might go undetected.[6]

A third technical concern involves the capacity of the United States, in the absence of nuclear testing, to maintain confidence in the safety, security, and reliability of the U.S. nuclear deterrent force. This argument rests on the proposition that the Department of Energy's Stockpile Stewardship Program (SSP)[7] will prove unable to live up to its stated goal. This concern has been the source of continuing controversy, and the terms of the argument itself have evolved significantly to form the basis of the case for the Reliable Replacement Warhead (RRW)—itself, a source of on-going debate.

A fourth concern that is not so much technical as it is political-legal is that the CTBT has no teeth to enforce compliance among States Parties. Lacking enforcement teeth, the Treaty provides little reason for countries to forego nuclear testing. The issue of CTBT enforcement is a political-legal issue, not strictly a technical issue. The Treaty is neither more enforceable nor less enforceable than other non-proliferation accords.

The Issue of Effective Verification of the CTBT

One of the principal objections to the CTBT in the October 1999 Senate floor debate was that the Treaty's verification measures were inadequate to detect, locate, and demonstrate potential cheating. Treaty proponents counter that the CTBT has extensive verification provisions, including an IMS, consisting of remote sensors; confidence building measures; provisions for consultation and classification; and once the treaty enters into force, the possibility of short-notice, on-site inspections. As of the fall of 2008, 233 of the 337 IMS facilities were certified.[8] The IMS will include monitoring stations inside Russia, China, and other sensitive locations, including locales where the United States cannot otherwise gain access.

Treaty proponents note that the IMS technologies, which actually met the standards of effective verification in 1999, have only improved since the Senate's defeat of ratification. Today, because of the continued global expansion of the IMS facilities as well as improvements in, *inter alia,* the algorithms, sensors, seismic models and new detection techniques that comprise IMS technologies,[9] there are virtually no conceivable scenarios in which potential violators could conduct militarily significant explosive tests and escape detection by the IMS.

The 2002 NAS study, mentioned above, concluded that underground nuclear tests "can be identified as explosions using IMS data down to a yield of 0.1 kilotons (kt) in hard rock if conducted anywhere in Europe, Asia, North Africa and North America."[10] The NAS panel also found that improvements in regional seismology provide additional confidence, lowering the threshold below 0.01 kt. Moreover, as David Hafemeister points out, North Korea's 0.6 kt test was promptly detected and identified from signals recorded at 31 seismic stations in Asia, Australia, Europe, and North America, including 22 IMS stations established by the Preparatory Commission for the CTBT Organization.

Out of 10 evasion scenarios examined by the NAS panel, the only scenarios identified as needing to "be taken seriously" are those involving cavity decoupling and mine masking, but it also determined that an explosion in a cavity cannot be confidently hidden if its yield is larger than 1 or 2 kt. A number of major technical hurdles exist that would greatly complicate the ability of even the most advanced nuclear weapons states to test and avoid detection.[11] Together, they would appear to constitute a nearly foolproof barrier to clandestine testing by new and aspiring nuclear weapons states.

Issue of Improvements That Can Be Achieved via Low-Yield Testing

The second technical concern in the 1999 Senate debate was that other countries could improve their nuclear-weapon capabilities through nuclear testing at low yields that might escape detection. The 2002 NAS report tackled this issue directly, addressing the advances that could plausibly be made under a CTBT by clandestine testing in various yield ranges, both by countries with greater prior nuclear test experience and/or design sophistication and by those with lesser experience and/or sophistication.

The NAS concluded that in no case could any country have high confidence of successfully concealing a test with a yield over 1–2 kt from seismic detection. Two key findings emerged. First, in the "very-low-yield" range from 10 tons to 1 kt, countries of lesser prior nuclear test experience might be able to improve the efficiency and yield-to-weight of unboosted fission weapons compared to the performance of the first-generation weapons that could be developed and deployed with some confidence without any testing at all. For experienced nuclear weapons states, tests in this range might serve to help partially develop primaries for thermonuclear weapons. But, the report noted that "deployment of such an untested component by one of the five NWS, which have available fully tested primaries of adequate yield, would not increase the state's capability and would reduce its confidence in its stockpile. A state that has not yet fully tested primaries could not rely on a primary test of less than full yield."[12] Second, in the "low-yield" range of 1 kt to 20 kt, states with lesser test experience or experienced states could develop and fully test primary nuclear explosives and low-yield thermonuclear weapons, but concealment would be highly unlikely.

The NAS panel drew two key conclusions from its evaluation of plausible achievements by testing at various yields: First, "Countries of lesser nuclear test experience and design sophistication would be unable to conceal tests in the numbers and yields required to master nuclear weapons more advanced than the ones they could develop and deploy without any testing at all." Second, "Those countries that are best able to successfully conduct such clandestine testing already possess advanced nuclear weapons of a number of types and could add little, with additional testing, to the threats they already pose or can pose to the United States."[13]

Nonetheless, as mentioned above, some authorities claim that militarily significant gains can be achieved by advanced nations like Russia and China through very-low-yield tests that might go undetected. The author does not have information which would enable him to assess this argument. Thus, while it appears that low-yield testing will not enable states with little testing experience to achieve militarily significant improvement to their nuclear weapons capabilities, it is not yet clear whether very-low-yield testing that might escape detection will enable states with greater testing and design experience from achieving militarily significant improvements to their capabilities.

The Ability of the SSP to Ensure the Reliability of the U.S. Nuclear Arsenal

The third principal objection to the CTBT is that, in the face of complex and unforeseen threats of the future, the United States may need to conduct nuclear tests to assure the safety, security, and reliability of its nuclear deterrent force. At the time of the Senate debate in 1999, the SSP was seven years underway and its technical ability to provide confidence in the stockpile was still in question, in the view of some experts.

Over the course of the next three years, both the 2001 report of the Special Adviser to the President and Secretary of State, Gen. John Shalikashvili (USA, Ret.), and the NAS report concluded that the SSP was succeeding in meeting its aim of providing confidence in the safety, security, and reliability of the stockpile in the absence of testing, and that there were no problems on the horizon that should cause the SSP to fail.[14] But the question has become more nuanced. Almost no one denies that the SSP (to include its Life Extension Program) has been extremely successful[15] to date and that it is expected to continue to fulfill its original aim for the next decade. The real issue concerns the ability of the SSP to ensure the stockpile's reliability into the future, some 20 or 30 years hence. As Thomas D'Agostino explains:

> With every life extension program we do on a weapon, we slowly move further and further away from the designs that were certified with underground nuclear tests. These inevitable accumulations of small changes over the extended lives of these highly-optimized and complicated systems, has give rise to concerns about the reliability of the weapons over time. While we are confident that today's stockpile is safe and reliable, it is only prudent to explore alternative means to ensure stockpile reliability over the long term.[16]

A 2007 American Academy for the Advancement of Science (AAAS) study elaborates upon the concerns to which D'Agostino refers. These concerns are documented as "findings" and while most of the findings to date are age-related findings associated with the more numerous non-nuclear parts of the warhead system,

> [S]ome significant findings involving nuclear and non-nuclear parts are potentially more serious, because they raise questions about whether the findings can be assessed without nuclear testing and because remediation may require cycling through the full production complex….For example, recent plutonium aging data show that the properties of plutonium metal change very slowly because of radioactive decay with minimum plutonium lifetimes approaching a century. Consequently, chemical processes (e.g., corrosion of pit materials) rather than radioactive properties will determine the lifetime of pits in most systems. In any case, pits probably will need to be replaced at some point, and it is unclear whether the projected capability will be adequate. Changes have been observed in other parts of the physics package that may eventually require repair. Furthermore, as one looks to the future, it is possible that, even with a functioning production complex, changes introduced by aging and frequent repairs will, in the absence of nuclear testing, gradually undermine confidence in the reliable performance of the weapon (although progress in the SSP could offset this trend)."[17]

It is this concern over the ability to maintain confidence in the stockpile over time—a concern shared by the Laboratory Directors—that served as one impetus for the RRW program.[18] It is critical to note, D'Agostino's and the AAAS Report's concerns notwithstanding, that the SSP has already made significant contributions to shedding light on one of the central concerns in an era of no-testing: the ability to understand the effects of aging on the plutonium that comprises the nuclear weapon pit. To be more precise, the SSP has enabled a much greater understanding of self-irradiation damage on the structure and properties of plutonium alloys. This enhanced understanding of aging effects in plutonium was integral to a 2006 JASON assessment which came to the conclusion that "there is no degradation in performance of primaries of stockpile systems due to plutonium aging that would be cause for concern regarding their safety and reliability. Most primary types have credible minimum lifetimes in excess of 100 years as regards aging of plutonium; those with assessed minimum lifetimes of 100 years or less have clear mitigation paths that are proposed and/or being implemented."[19]

This paper will not evaluate the many arguments made on behalf of or against the RRW as those arguments (like the RRW itself) are inextricably bound up with the issue of nuclear weapons infrastructure "Complex Transformation"—a subject area addressed by the Nuclear Infrastructure Experts Working Group.[20]

The technical questions surrounding the narrower issue of whether the SSP, as currently conceived, will be sufficient to maintain confidence in the stockpile into the future, or whether it is necessary to create a transformed complex (to include an RRW, or something very much like it) have reached an impasse. Politically, the RRW would seem to be dead or at least dormant,[21] for the next few years; the broader issue of Complex Transformation, exclusive of the RRW, continues to be hotly debated on Capitol Hill.

In the face of this impasse, some have proposed the idea of a "grand bargain" that would entail support for CTBT ratification in exchange for support of the RRW. While the idea is proposed as a compromise designed to gain domestic political support, it is unlikely to secure the hoped-for political support on the Hill and it would almost certainly meet with strong protest from most NPT member states (with the possible exceptions of the United Kingdom and France). It is important to note that others argue that the RRW should be seen as a safeguard for the CTBT. In this understanding, the CTBT and the RRW should be cast as a package, not for reasons of political expediency, but out of the conviction that the RRW is a key element in ensuring the reliability of the stockpile over the long term. Importantly, the argument that the RRW will enable the United States to undertake deep reductions (to include ridding itself of its sizeable reserve of non-deployed warheads) because we will have greater confidence in each remaining warhead, is a compelling argument that just might be able to attract political traction abroad.

And therein may lie the ingredients for a proposal that *might* stand a good chance of gaining both domestic political support on the Hill and meeting with support (or at least a lack of vocal opposition) from most other NPT member states. The proposal would entail (1) encouragement of U.S. ratification of the CTBT together with (2) a commitment to proceed with the R&D on, but not production of, a surety warhead that would entail many of the features of the RRW, and (3) a U.S. commitment to deep, negotiated reductions in its nuclear arsenal. The commitment to deep reductions would neutralize most Article VI-related concerns (both at home and abroad) over the U.S. commitment to pursue R&D on a warhead with relaxed margins.

But there is another option. Rather than retreating into the corners of making the best possible case for the SSP on the one hand or the RRW on the other, two highly regarded scientists—Bruce Goodwin of Lawrence Livermore National Laboratory and Glenn Mara of Los Alamos National Laboratory—have proposed a novel alternative for ensuring stockpile reliability over the long term.[22]

Goodwin and Mara contrast the current set of "polar possibilities"—the *status quo*, which they characterize as Cold War weapons maintained indefinitely through incremental Life Extension Programs (iLEPs) and the RRW approach—and argue that "both approaches carry baggage." The RRW currently has no political traction and successive iLEPs carry an increasing risk. This risk increases because, as the overall stockpile size is reduced (and importantly weapons types are reduced) through arms control agreements, the issue of the reliability of each remaining weapon (and weapon type) becomes that much more important. Hedging against this risk means preserving a large reserve stockpile—in itself a politically unpopular, costly and strategically improbable option. Instead, they advance a novel alternative that they call "extensive reuse LEP" or "erLEP" that might mitigate the above dilemma.

Goodwin and Mara characterize the erLEP as sitting "in a continuum between the iLEP and the high-margin, high-surety RRW." As they see it, the erLEP concept could be applied not only to plutonium pits but to other tested weapon components. It would make use of embedded microsensors to monitor each and every weapon's health—a necessity in a future of vastly reduced stockpiles. They maintain that erLEP would enable a smaller production complex and eliminate the costly production of many secondary components because it could utilize more than two decades of such components that currently sit in storage.

Whether the SSP is sufficient to ensure the reliability of the nuclear arsenal into a future without testing is unclear. What is clear is that the RRW—the proposed solution for the postulated future shortcomings of the SSP—is currently a political non-starter—at least as a stand-alone item. At the same time, the SSP brings its own risks, such as long-term affordability problems and, according to many experts, the possibility of increasing technical problems that could well require the maintenance of a large reserve stockpile with its own cost and political downsides. The "grand bargain" idea is unlikely to secure the hoped-for political support on the Hill and is likely to be met with strong protest from most NPT member states. But a package that combines U.S. ratification of the CTBT, R&D on a surety warhead, and a commitment to deep reductions might well win support on the Hill and meet with some degree of support from abroad. Finally, an in-depth study of the erLEP concept might be added to such a package as an additional safeguard.

The Issue of Enforcement

During the 1999 floor debate, Senator Lugar was particularly concerned that the Treaty did not contain measures sufficient to respond to States Parties in non-compliance. Citing the ineffectiveness of international sanctions and norms in the face of North Korean, Iranian, Iraqi, Indian, and Pakistani actions, the Senator argued that he did not find the CTBT's range of responses to non-compliance to be especially compelling. These responses include (i) suspending the rights and privileges of a State Party that fails to cooperate fully with requests from the Conference or the Executive Council, (ii) recommending collective action by States Parties and (iii) bringing violations to the attention of the United Nations. This concern still exists and is cited as a reason to oppose the Treaty.

In his report, General Shalikashvili responded to such criticism, arguing that "Making the Treaty's enforcement mechanisms more explicit or more automatic would have gone against the long-standing U.S. position that States Parties, not international organizations, should have the authority to decide whether other Parties are in compliance, and what to do if they are not. And while it is possible to imagine times when more draconian enforcement provisions might be a stronger deterrent against cheating, it is equally easy to imagine ways in which the United States or its friends could become the victim of unwisely crafted enforcement provisions."

General Shalikashvili further noted that that the CTBT is not an isolated effort, but part of what he called "an intricate web of bilateral, regional, and global arrangements," which together help to hold proliferation in check. The lack of the CTBT's entry into force is part of what today weakens the overall system of proliferation constraints. In other words, the CTBT is a necessary, but not sufficient, condition for non-proliferation. The Treaty alone may not be able to ensure that every State Party remains in compliance, but its lack of entry into force provides cover to those states intent on testing nuclear weapons. CTBT proponents maintain that the Treaty's entry into force would make it easier to mobilize the international community against the violation both of a norm and of a legally binding prohibition against nuclear explosions. It should be expected that this new reality would also exert a greater deterrent effect than an international norm alone. Finally, the Treaty does not foreclose any options that the United States currently has for responding, unilaterally or multilaterally, should another state conduct a nuclear explosion. Specifically, if the United States discovered that a particularly grave incidence of non-compliance occurred for which sanctions were deemed an insufficient response, then under the "supreme interests" clause of the Treaty, the United States would be able to withdraw. If the United States implements certain long-discussed safeguards—about which more below—then the six months' notice to withdraw from the Treaty would be somewhat less than the time it would take to prepare for a test.

The CTBT is neither more enforceable nor less enforceable than other non-proliferation accords. To demand that the Treaty contain enforcement mechanisms that will guarantee punishment and with the guarantee of that punishment succeed in deterring non-compliance actions by States Parties is to ask too much of the Treaty. It is, in short, setting an unrealistically high bar. While the CTBT does not guarantee a world in which states do not test nuclear weapons, it is a major addition to the web of arrangements that help hold proliferation in check.

Safeguards

A discussion of the principal technical concerns with the CTBT would not be complete absent a discussion of safeguards entertained in order to guard against a collapse of the Treaty, or in the event of some event jeopardizing the supreme interests of a State Party.

Elements of the SSP itself were advanced as safeguards by the Clinton Administration.[23] These include maintaining a readiness to test; maintaining the safety and reliability of the existing nuclear weapon stockpile; maintaining a cadre of scientists and engineers with expertise in nuclear weapons; and maintaining an intelligence capability to provide assurance that other states are not carrying out nuclear explosions. The Shalikashvili Report urged additional safeguards, including enhanced surveillance and monitoring activities within the SSP; a dedicated infrastructure revitalization fund; strict discipline over changes to existing nuclear weapon designs to ensure that neither an individual change nor the cumulative effect of small modifications would make it difficult to certify weapon reliability or safety without a nuclear explosion; establishment of a high-level external advisory mechanism, and an intensive review of the Treaty's net value for U.S. national security at ten-year intervals, together with a willingness to withdraw under the "supreme national interests" clause, if there are deep doubts on this score.

More recently, the RRW has been argued to be a critical safeguard for ensuring the reliability of the stockpile on into a future absent of testing (whether the United States ratifies the CTBT or not, it is already adhering to its self-imposed moratorium). Because it has relaxed performance margins relative to the current stockpile of warheads which were designed with extremely stringent performance margins, the RRW will be a more reliable warhead. As a result, the argument proceeds, the United States will be able to undertake deeper reductions (and rid itself of its substantial non-deployed warhead reserve that brings its own dollar, security, and political costs) than it might otherwise have been able to without raising risk. As noted previously, a package that combines CTBT ratification, R&D on a surety warhead, and deep strategic arms reductions might gain domestic political support and meet with approval from other signatory states.

Options

In light of the above discussion, the following options are proposed for the Commission's consideration:

Option 1

Recommend U.S. ratification of the CTBT, together with the safeguards outlined above in Section IV except for the RRW, arguing that the benefits of ratification outlined in Section II are paramount and that, because of the success of the SSP, the United States is well positioned to sustain its nuclear deterrent on into the future under the CTBT. This position would essentially take its cue from the findings of the Shalikashvili and NAS reports. At the same time, the view that the SSP positions the United States well to sustain its deterrent on into the future would be at odds with the misgivings of such experts as Tom D'Agostino, and other technical experts such as Goodwin and Mara.

Option 2

Recommend U.S. ratification of the CTBT, but only as part of a package deal in which the United States simultaneously proceeds with the RRW as an essential safeguard in addition to the other safeguards outlined above. In this instance, the Commission would cite the benefits of ratification outlined above in Section II, but note that technical concerns over the ability of the SSP to ensure the reliability of the stockpile into the future make the RRW a necessity. This position would seek to strike a compromise, but it would have uncertain prospects on Capitol Hill and would be certain to meet with loud protests from other NPT member states who would cast RRW support as contrary to Article VI obligations.

Option 3

Recommend a package deal that combines U.S. ratification of the CTBT, a commitment to support for R&D on a surety warhead as a safeguard, and a commitment to negotiated, deep nuclear reductions. This position might succeed on Capitol Hill and meet with some degree of support from important signatory states abroad. The commitment to deep reductions would neutralize concerns over the U.S. commitment to pursue R&D on a warhead with relaxed margins. Again, an in-depth study of the erLEP concept might be added to such a package as an additional safeguard.

Option 4

Recommend neither support for nor opposition to ratification of the CTBT, but that the Commission note its concern over the technical ability of the SSP to ensure the reliability of the future nuclear arsenal. This recommendation would take its cue from the argument advanced by Tom D'Agostino and other experts.

Option 5

Recommend against U.S. ratification of the CTBT, arguing that the technical risks of being unable to ensure the reliability of the future stockpile mandate that the United States retain its ability to conduct tests when significant problems arise. This recommendation would take its cue from the arguments that prevailed in the 1999 debate and still hold sway with Treaty opponents today.

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1. As O'Hanlon points out, until North Korea's October 2006 nuclear test, Beijing and Seoul had largely protected Pyongyang from severe sanctions, even after it broke out of the NPT in 2003. But following North Korea's test, China, South Korea and Russia agreed to a significant tightening of economic sanctions against Pyongyang, an action which appears to have contributed to North Korea's return to the negotiating table and the subsequent 13 February 2007 accord that, imperfectly and far from completely, has begun to restrain the North's nuclear efforts. See Michael O'Hanlon, "Resurrecting the Test-Ban Treaty," Survival, Vol. 50, No. 1, February-March 2008, pp. 125-126.
2. Specifically, while it would not completely foreclose all of Pakistan's and India's nuclear options (see the subsequent discussion of what can be achieved by clandestine testing at low yields), a CTBT that includes those states would impede their ability to perfect boosted fission weapons and thermonuclear weapons, thus hampering their ability to engage in an otherwise destabilizing nuclear arms race. In the absence of a test ban, China would be able to reduce the size and weight of its nuclear warheads in an effort to produce multiple independently targeted warheads for its nuclear force. (It is important to note that data from Chinese tests indicate that China may already be capable of "MIRV-ing" (Multiple Independently Targeted Reentry Vehicles), but that it has simply chosen not to do so. On this point, see Thomas C. Reed, "A Tabulation of Chinese Nuclear Device Tests," Physics Today, September 2008, accessed at <http://ptonline.aip.org/journals/doc/PHTOAD-ft/vol_61/iss_9/47_1s.shtml>). With a test ban, this would be next to impossible as China would have very little confidence that any radically new weapons would work as desired.
3. See National Academy of Sciences, Technical Issues Related to the Comprehensive Test Ban Treaty, National Academy Press, Washington, D.C., 2002. Also see General John M. Shalikashvili (USA, Ret.), Special Advisor to the President and Secretary of State, Findings and Recommendations Concerning the Comprehensive Nuclear Test Ban Treaty, January 2001; Thomas Graham, "The Comprehensive Nuclear Test Ban Treaty," 2009 National Security and Nonproliferation Briefing Book, Peace and Security Initiative, November 2008, pp. 21-24.
4. See, for example, Senator Richard G. Lugar, "Statement in Opposition of the CTBT," October 7, 1999, accessed at <www.fas.org/nuke/control/ctbt/text/100799lugar.htm>.
5. See the NAS and Shalikashvili reports (referenced in footnote 1). Also see The Verification Research, Training and Information Centre, Final Report of the Independent Commission on the Verifiability of the CTBT, October 2000, (often referred to as the VERTIC report), accessed at <www.ctbtcommission.org/> and International Group on Global Security, A New Look at the Comprehensive Test Ban Treaty, Netherlands Institute of International Relations Clingendael, September 2008, accessed at <www.ctbto.org/fileadmin/user_upload/pdf/External_Reports/A_New_Look_at_the_Comprehensive_Nuclear-Test-Ban_Treaty.pdf>.
6. The author has been told that the concerns about the ability of Russia and China to learn from very-low-yield tests are shared by some technical experts in the U.S. nuclear complex. The author has been unable to independently verify those concerns.
7. The SSP was launched following the suspension of U.S. nuclear testing in 1992 expressly as the means to ensure confidence in the nuclear weapons stockpile in the absence of nuclear

testing. The SSP includes a set of very advanced and very costly tools and initiatives to include the Dual Axis Radiographic Hydro Test facility, the National Ignition Facility, the Advanced Simulation and Computing program, and others that have raised concerns about the long-term cost and opportunity cost implications of the SSP.

8. See David Hafemeister, "The Comprehensive Test Ban Treaty: Effectively Verifiable," Arms Control Today, October 2008, accessed at <http://armscontrol.org/act/2008_10/Hafemeister>.
9. See Hafemeister's discussion of interferometric synthetic aperture radar and improvements in waveform comparison.
10. NAS Report, p. 5.
11. See Hafemeister, who identifies six technical hurdles.
12. NAS Report, p. 69.
13. Ibid, pp. 10–11.
14. The NAS panel argued (pp. 3-4) that the SSP "can already point to significant successes in [problem solving in the nuclear weapons program], as seen, for example, in the implementation of numerous new, relatively small-scale, measurement and analysis techniques ranging from new bench-top inspection instruments to larger-scale laboratory facilities (including, e.g., accelerated aging tests, novel applications of diamond-anvil cells and ultrasonic resonance, synchrotron-based spectroscopy and diffraction, and subcritical and hydrodynamic tests). All of these provide additional assurance that defects due to design flaws, manufacturing problems, or aging effects will be detected in time to enable evaluation and corrective action if such is deemed necessary."
15. See, for example, Nuclear Weapons Complex Assessment Committee, The United States Nuclear Weapons Program: The Role of the Reliable Replacement Warhead, AAAS, April 2007. Also, the Directors of the National Weapons Laboratories and the Administrator of the National Nuclear Security Agency readily acknowledge the SSP's success to date.
16. See Thomas D'Agostino, "The Reliable Replacement Warhead Program," Presentation at the Woodrow Wilson International Center for Scholars, June 15, 2007, accessed at http://nnsa.energy.gov/news/print/905.htm.
17. See Nuclear Weapons Complex Assessment Committee, pp. 15 and 22.
18. To be clear, this concern has existed for some time; the plans for and discussion over the RRW have simply brought it greater prominence. For two different perspectives, see the NAS report, page 5, and the Secretary of Energy Advisory Board, Recommendations for the Nuclear Weapons Complex of the Future: Report of the Nuclear Weapons Complex Infrastructure Task Force, July 13, 2005, esp. pp. 6-13.
19. See Pit Lifetime, JASON Report JSR-06-335, November 20, 2006. Dr. Siegfried S. Hecker, former Director of Los Alamos National Laboratory and a world-renowned plutonium metallurgist, challenged the conclusions of the JASON report regarding plutonium aging as too optimistic; his views inform and indeed are reflected in the concerns outlined by D'Agostino and addressed in the AAAS Report. See S.S. Hecker, "Comments on the JASON Report on 'Pit Lifetime'," March 29, 2007 and AAAS Report, p. 22.
20. As the Infrastructure Working Group's papers reflect, Complex Transformation is intended to meet the goal of making the complex smaller, safer, more secure, and more cost effective while restoring its ability to make nuclear weapons in a responsive manner—a goal that includes but goes well beyond the goals of the RRW.
21. Secretary Gates' recent statements asserting the imperative of the RRW are very important because they indicate that the debate for RRW may be more latent than dead and that there may well be attempts to raise the issue anew in the near future. See Robert M. Gates, "A Balanced Strategy," Foreign Affairs, January/February 2009, Vol. 88, No. 1, pp. 28–40.
22. See B.T. Goodwin and G. Mara, "Stewarding a Reduced Stockpile," (LLNL-CONF-403041), AAAS Technical Issues Workshop, Washington, D.C., April 21, 2008.
23. See *A New Look at the Comprehensive Test Ban Treaty*, p. 47.

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The Comprehensive Test Ban Treaty: Options and Analysis for the Strategic Posture Review Commission

Kathleen C. Bailey

The paper examines the key reasons why the Comprehensive Test Ban Treaty (CTBT) was rejected by the U.S. Senate in 1999 and presents some options for consideration by the Commission.

Major Issues Regarding the CTBT

Issue: Certification of safety and reliability of the U.S. nuclear arsenal

Proponents say that the stockpile stewardship program has demonstrated that the current nuclear arsenal can be effectively and reliably maintained under a permanent CTBT.

Opponents say that the ability to certify absent some level of testing is becoming increasingly difficult. The nuclear weapons laboratories have continued to find problems with each of the warheads in the stockpile every year since the current moratorium began. Some of the problems are associated with the manufacturing process and some are due to aging. As then-Director of LANL, John Browne, testified in 1999,

> We also continue to find problems that were introduced during the original manufacturing of some specific weapons. We have identified several issues

> that, if they had occurred when testing was active, most likely would have been resolved by nuclear testing.

Issue: Testing enables safety upgrades

The weapons in the current U.S. stockpile do not have all of the most modern safety and security features, the so-called surety features, currently available. Of the 9 warhead types in the U.S. stockpile only 6 have the surety features. For example, they do not all have insensitive high explosive, which would minimize the chances of the explosive detonating if it were accidentally struck or dropped. Nor do all of the stockpiled weapons have a feature that would protect against plutonium release in case the weapon is accidentally engulfed in fire. Because introduction of different materials or protective features could affect warhead performance, it would be necessary to conduct a nuclear test to determine the effects of adding any of the safety measures now available.

In the future, there may be discoveries that would improve weapons surety, such as the invention of materials that might make accidental detonation even less likely or mechanisms to prevent terrorist use and access. As the former Director of Sandia National Laboratories, Dr. Paul Robinson, noted,

> While improvements to safety and security systems for nuclear weapons can be developed and implemented without nuclear explosive testing, several attractive technical concepts for enhancement of these features will be foreclosed by the inability to test.

The inability to test has another adverse impact on the development of new safety measures: it reduces the motivation of technologists. As former Assistant to the Secretary of Defense for Atomic Energy, Dr. Robert Barker, stated,

> The absence of nuclear testing also removes any incentive for designers to invent further enhancements to inherent nuclear weapon safety. Even if such features are invented they will sit unused as long as we deny ourselves the ability to conduct nuclear tests.

Issue: The CTBT is not verifiable.

Proponents frequently quote a 2002 National Academy of Sciences study that determined "underground nuclear explosions can be reliably detected and can be identified as explosions, using IMS data down to a yield of 0.1 kilotons (100 tons) in hard rock if conducted anywhere in Europe, Asia, North Africa and North America." They claim that advances in regional seismology have provided additional confidence.

Opponents counter that de-coupling and masking can readily be used to dramatically reduce seismic signals, making it difficult or impossible to detect clandestine nuclear tests. As the NAS study referenced in the above paragraph states, "Accepting the possibility of a cavity decoupled test, we conclude that such an underground nuclear explosion cannot be reliably hidden if its yield is larger than 1 or 2 kilotons."

Even if a signal is detected, identifying it as a nuclear test and pinpointing the location of the event may be impossible. Thus, neither the treaty's verification measures nor U.S. national technical means can detect all militarily significant tests. Furthermore, there are no sure technical means to attribute tests conducted over the open ocean.

Issue: A test ban forecloses modernization

Proponents say the CTBT forecloses U.S. nuclear weapons modernization, which is good because it helps devalue nuclear weapons and makes them less usable.

Opponents think that this is a negative effect. They think the U.S. should have the ability to develop nuclear weapons in response to technological advances, whether they are advances to accomplish new goals, or advances that could make the weapons safer and more secure.

Issue: CTBT doesn't define "nuclear test"

The CTBT bans "any nuclear weapon test explosion or any other nuclear explosion," but it does not define what constitutes a nuclear test. This is because no agreement could be reached.

At present, the U.S. interprets the CTBT as banning nuclear tests with any yield. Russia does not accept this "zero-yield" definition. It is likely that Russia continues to adhere to a definition consistent with the older TTBT (i.e. tests that can be contained are not nuclear explosions). It is possible that China, India, North Korea, or others may also interpret the CTBT as allowing tests with some level of nuclear yield.

Some proponents of the CTBT argue that it doesn't matter that the treaty doesn't define "test," because very-low-yield testing cannot be used to develop new weapons. Furthermore, they argue, reopening the treaty to achieve a definition would be politically impossible.

Opponents say that we should not mirror image: although very-low-yield tests might not be useful to U.S. nuclear weapons designers, such tests may be useful to others. More importantly, nuclear tests of any yield may actually be made difficult or impossible to detect due to masking or de-coupling.

Issue: Will the CTBT contribute meaningfully to nonproliferation?

Proponents argue that the CTBT is essential to nonproliferation because it makes it harder for nations with nuclear arsenals to develop and deploy new nuclear warheads, and it helps prevent those without nuclear arsenals from developing them.

Opponents argue that all NWS other than the United States have already modernized their nuclear arsenals, despite the test ban since 1992, and the inability to test does not foreclose nuclear proliferation (e.g. South Africa, Israel). Nations that pursue nuclear weapons do so because they perceive them to be in their security interests. Whether other nations test or not is not a factor.

Issue: The CTBT is essential to maintaining the NPT

Proponents believe that the CTBT is a necessary political step to fulfilling our obligations under NPT Article VI. They further point out that allies strongly urge us to ratify.

Opponents believe that the CTBT is an effective disarmament measure only for those who have not yet modernized and who will abide by the zero-yield definition of what constitutes a nuclear test (e.g. the U.S. only). As for allied pressures, it depends upon whom you talk to. As one German MOD representative stated in November 2008, "It is our position publicly that the U.S. should ratify the CTBT. More quietly, it is also our position that the U.S. nuclear deterrent is essential to Europe and you must do whatever required to keep it safe, secure and reliable."

Options for Consideration

In addition to the obvious options of either recommending or not recommending ratification of the CTBT are some intermediate actions that could be considered.

Option 1: Recommend a study and report be undertaken on the issue of verification. The study should specifically examine the extent to which cheating could take place without detection and identification, and the military significance that such cheating could have.

Option 2: Recommend a study and report on the effectiveness of the U.S. certification process. The study should address questions of what problems have been discovered with stockpiled weapons, how they have been dealt with, and the difference that nuclear testing (and at what level of yield) would make to the certainty of certification.

Option 3: Recommend an assessment of the types and numbers of nuclear weapons that will be required for the foreseeable future to fulfill

U.S. extended-deterrence obligations. This should be undertaken in close consultation with allies. The impact of a CTBT on the ability to fulfill the needs should be assessed.

Option 4: Recommend a reassessment of the safety and security technologies associated with stockpiled weapons, to include a close look at what new technologies might make our weapons even safer and more secure, and whether such measures would require testing. And, if so, what level of yield and number of tests would be required. The objective should be to identify what level of additional safety and security we would forego if we were to ratify the CTBT.

Option 5: Recommend a protocol be negotiated to achieve a definition, acceptable to all nations now in possession of nuclear weapons, of what constitutes a "nuclear test" under the CTBT.

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1. The George H.W. Bush Administration determined that it would be more cost-effective to develop new, safer warheads instead of adding safety features to older warheads, and so recommended. Subsequent administrations did not follow up on that recommendation.

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Issues Concerning CTBT Ratification

Linton F. Brooks and Daniel Poneman

What Is Limited?

Issue. The CTBT obligates states parties "not to carry out any nuclear weapons test explosion or any other nuclear explosion." Neither "nuclear weapons test explosion" nor "nuclear explosion" are defined. U.S. practice is to ban any test that results in a self-sustaining nuclear reaction. Russia is widely believed to use a different, less constraining definition, although details are unclear. Different Russians (none speaking officially) have suggested different formulations. Russia has acknowledged that it understands the U.S. definition.

Some believe that if Russia and China interpret the CTBT in a fashion that permits sub-kiloton testing they could gain military benefits through such testing, benefits that would be denied to the United States under the definition we are using. Further, some believe that under some scenarios the United States might be unaware that such testing is in progress.

Regardless of one's position on the likelihood of such testing, it is a sound principle of international agreements that the obligations on the parties should be equal. Many (including the CTBT negotiator) believe that all five recognized nuclear states had an identical, common understanding of what was permitted during the negotiations and that current U.S. practice is consistent with that understanding. The State Department advises, however, that there is no documentation that such an understanding was reached. The lack of a clear understanding could complicate—or even prevent—CTBT ratification.

A possible approach. The United States should approach the other recognized nuclear states (Russia, China, the United Kingdom and France) and seek an agreed joint statement on how the five of them will interpret the prohibition. The United States should push for a definition consistent with U.S. practice and should portray the effort as simply documenting an understanding that existed at the time negotiations were complete. Involving all of the recognized nuclear states is logical, both in terms of international politics and as a practical matter. Only these more sophisticated programs are likely to be capable of benefiting from an interpretation that would allow testing at sub-kiloton levels.

It is possible that Russia will agree to a joint statement but will suggest a different definition. While it would be preferable to reach agreement on the U.S. definition, what is most important is to have an agreed definition of what is permitted. The United States can decide later whether to take advantage of any additional flexibility.

Once the five recognized nuclear states have agreed on a joint statement, that statement would be submitted to the Senate as part of the common understanding between the Executive Branch and the Senate on the meaning of the Treaty. The Senate would then rely on this submission in providing its advice and consent to ratification.

What Safeguards Are Required?

Issue. Some may fear that it will prove impossible to maintain the safety, security, and reliability of the U.S. nuclear arsenal once the CTBT is ratified. The Senate normally deals with these concerns through safeguards. Safeguards are proposed by the Administration and—often after significant discussion—are included in the Senate resolution providing advice and consent to ratification. In essence, the Senate makes its approval contingent on continued implementation of safeguards.

In submitting the CTBT for Senate consideration, the Clinton Administration proposed the following six safeguards, which are similar to those agreed upon for other arms control treaties:

- Safeguard A: "conduct of a Science Based Stockpile Stewardship program to insure a high level of confidence in the safety and reliability of nuclear weapons in the active stockpile";
- Safeguard B: "maintenance of modern nuclear laboratory facilities and programs";
- Safeguard C: "maintenance of the basic capability to resume nuclear test activities prohibited by the CTBT";
- Safeguard D: "a comprehensive research and development program to improve our treaty monitoring";
- Safeguard E: intelligence programs for "information on worldwide nuclear arsenals, nuclear weapons development programs, and related nuclear programs";

- Safeguard F: the understanding that if the Secretaries of Defense and Energy inform the President "that a high level of confidence in the safety or reliability of a nuclear weapon type which the two Secretaries consider to be critical to our nuclear deterrent could no longer be certified, the President, in consultation with 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."

To meet the concern of those who worry about the future of the stockpile, Safeguards A and/or B could be strengthened as follows:

- Modify Safeguard A: "conduct of a Science Based Stockpile Stewardship program to insure a high level of confidence in the safety and reliability of nuclear weapons in the active stockpile, including the ability to resolve any problems identified by implementing traditional life extension programs, by the development of modified warheads, or by options in between."
- Modify Safeguard B to read "maintenance of modern nuclear laboratory facilities and programs and an effective production complex, including the ability to design and produce modified warheads if required."

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1. Some U.S. experts assert that the statements made by the Russian government in submitting the CTBT to the Russian Duma for approval during the 1990s suggested a definition very close to that used by the United States. If this is true—and if the Russian government reaffirms it—that should partially alleviate the concerns.
2. This is a common practice in arms control treaties.
3. Based on history, safeguards are somewhat perishable. While in theory they bind the Executive, in practice there is no mechanism for reconsideration of a treaty if safeguards are not observed. Further, if funding is involved, the involvement of the House of Representatives (which plays no role in ratification) is required.
4. White House, Office of the Press Secretary, "Fact Sheet: Comprehensive Test Ban Treaty Safeguards," August 11, 1995.
5. This concern is not shared by the Directors of the national laboratories; from their perspective, a test ban has already been in effect for the past 15 years.

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Assuring the Reliability, Safety and Security of U.S. Nuclear Weapons: Policy Options

James E. Goodby

Purpose. The purpose of this essay is to describe the array of issues that U.S. decision-makers must take into account in assuring the reliability, safety, and security of U.S. nuclear weapons. During the Cold War, explosive testing of nuclear weapons was conducted almost exclusively for the purpose of confirming the validity of new weapons designs. Today, the question of whether to conduct explosive nuclear testing is linked almost exclusively to the reliability, safety, and security of existing U. S. nuclear weapons. Explosive nuclear testing, however, is only one of several factors that bear on this problem. In fact, the absence of explosive nuclear testing has proved to be less of a challenge to maintaining the U.S. nuclear arsenal in good condition than other constraints, such as inadequate funding for the Stockpile Stewardship Program (SSP) and for maintaining a strong scientific and technical base at the nation's national laboratories. Ironically, these self-imposed constraints inflict wounds on public and congressional support for U.S. international commitments designed to roll back the gravest danger the nation faces: nuclear proliferation and nuclear terrorism.

Understandings Concerning the Comprehensive Test Ban Treaty (CTBT). Constraints on the explosive testing of U.S. nuclear warheads involve only the "physics package," i.e., the fissile materials and related materials that together, under particular conditions, produce a self-sustaining explosive chain reaction. It is this process that marks the boundary between what is permitted and what is banned under the terms of the CTBT. The nuclear weapons states that participated in the negotiation of the CTBT in Geneva in the mid-1990s agreed that all nuclear explosions (i.e., self-sustaining explosive chain reactions) were to be banned. The record is quite clear on this. This is the position that the CTBT Office in Vienna has adopted in its approach to monitoring: "zero means zero." This means that hydronuclear experiments, which can produce up to four pounds of fission yield (i.e., an explosion equivalent to four pounds of TNT) are banned, while hydrodynamic experiments and underground sub-critical nuclear explosive tests (i.e., tests that do not produce self-sustaining chain reactions) are permitted.

U.S. Policy. Since a self-sustaining chain reaction is not the anticipated result of a hydrodynamic, or subcritical experiment, such tests are permitted under the regime that would exist were the CTBT in effect. Accordingly, U.S. policy is to conduct subcritical experiments as necessary. During the U.S. self-imposed unilateral moratorium on nuclear test explosions (self-sustaining explosive chain reactions) that began in 1992, the United States has conducted subcritical experiments. It has refrained from conducting test explosions that would be banned, were the CTBT ever to enter into force. This policy also has been pursued by the Bush Administration, which declared at the outset that it had no intention of allowing the CTBT to enter into force.

The Unilateral Moratoriums. It is not clear what other nuclear weapons states, such as China and Russia, who have signed or ratified the CTBT regard as permissible under the current moratorium. The CTBT is not in force but the law of treaties says that "a State is obligated to refrain from acts which would defeat the object and purpose of a treaty…until it shall have made its intention clear not to become a party to the treaty." If putative parties to a treaty expect that the treaty will never enter into force, they should so state, as the Bush Administration did. Since this has not occurred in the case of other signators, one would expect that other nuclear weapons states would abide by agreed understandings regarding the scope of the CTBT. But the nature of unilateral moratoriums is such that decisions about what is permitted and what is not permitted, are by definition unilateral. No formal or informal multilateral understanding about the scope of the several unilateral moratoriums exists.

Context. As noted above, each nuclear testing constraint needs to be considered in the context of other activities affecting the reliability, safety, and security of U.S. nuclear weapons. Three generic categories of constraints are 1) those that are self-imposed because of budgetary constraints; 2) those that are imposed by international law, i.e., treaties ratified by and with the advice and consent of the Senate; and 3) those imposed as a matter of policy or as the result of domestic laws by the U.S. Government, usually by the U.S. Administration but also frequently by Congress. An example of the first are budgetary shortfalls in funding the nuclear weapons program. An example of the second is the Limited Test Ban Treaty(LTBT), which requires that nuclear explosive testing be conducted underground (there is no definition of a nuclear explosive test in that treaty). An example of the third is the unilateral moratorium on all nuclear explosive testing that was declared by President George H.W. Bush in 1992 at the urging of Congress, and which continues today.

Each of these three categories of constraints presents policy options that, in their totality, will determine U.S. policies and actions regarding the reliability, safety, and security of the U.S. nuclear weapons arsenal. Only a comprehensive review of policies regarding the reliability, safety, and security of the U.S. nuclear arsenal will provide an adequate basis for national policy. Determining a policy regarding nuclear explosive testing, for example, in isolation from related policy options would lead to a flawed policy. Some combination of the several policy options will be required to produce a coherent policy; hypothetical combinations will be described in very general terms at the end of this paper to illustrate the point. The following disaggregated list of options describes the types of issues that the Administration and Congress should address together over the next year or two.

I. Future Stockpile Stewardship Program (SSP) Spending Options

SSP is the best example of potentially unconstrained warhead-related activities. It has a direct impact on warhead reliability, safety, and security and also on the U.S. capability to maintain a responsive nuclear infrastructure. U.S. Government witnesses have testified that under the constraint of no nuclear explosive testing, SSP thus far has been a success. The issue will be how to fund it, in relation to other national objectives.

Option A. *Expand*. Robust funding for the Stockpile Stewardship Program and a responsive nuclear infrastructure. If necessary, reduce funding for other DOE and DOD programs.

Option B. *Static*. Prioritize within the SSP and infrastructure projects to allow for more funds for other DOE and DOD programs.

Option C. *Reduce*. Continue with SSP projects already approved but suspend funding for new projects.

II. CTBT and Alternative Treaty Constraints on Testing

Option A. Proceed with ratification of the Comprehensive Test Ban Treaty.

Pro: Puts pressure on other countries to refrain from testing; important for success of 2010 NPT Review Conference; preserves U.S. relative advantages; the ability to detect attempts of countries to evasively perform

nuclear tests will be strengthened when the treaty enters into force and the international monitoring system (IMS) becomes fully effective.
Con: Risk that the Senate might not consent to ratification; unclear whether CTBT would enter into force because of failure to ratify by other required parties.

Option B. Seek to amend the treaty to clarify definitions or reach side agreements, e.g., transparency at test sites, concerning the treaty's implementation.

Pro: Would place U.S. concerns on record; side understandings might be possible with some parties.
Con: Amendments almost certainly would be rejected, leading to abandonment of the treaty; understandings regarding the scope of the treaty already are clear.

Option C. Abandon efforts to have the CTBT enter into force.

Pro: The resulting furor might lead to a more comprehensive arms control package that would include several nuclear restraint measures such as mandatory Additional Protocol (AP) for IAEA inspections or strengthened Proliferation Security Initiative (PSI).
Con: The likely result would be a resumption of underground nuclear testing; other nations that would be freed from testing constraints might benefit more from testing than would the United States.

Option D. Initiate efforts to negotiate a new treaty affecting nuclear explosive testing.

Pro: An effort undertaken in parallel with continued support for the CTBT or a strengthened moratorium (see III. B.), perhaps negotiated only among those states that already have tested, might produce additional measures of transparency.
Con: The effort almost certainly would not succeed in raising the permissible yield to some agreed number or limiting the treaty to some specified period of time; the likely result would be resumption of testing.

III. The Explosive Testing Moratorium

A. Continue the current moratorium.

Pro: If linked to continued support for the CTBT, the moratorium places some pressure on other countries not to test; this course avoids a Senate fight over consenting to ratification; avoids confrontation with states, like India, that have not signed the CTBT.

Con: Failure to bring CTBT into force deprives us of the full benefits of the International Monitoring System, including on-site challenge inspections provided for by the treaty; a moratorium will not be regarded by non-nuclear weapons states as fulfillment by nuclear weapons states of obligations in connection with the NPT; unilateral moratoriums inevitably lead to differences regarding what is permitted and what is not.

B. Seek agreements that would give the moratorium more international approval or legal standing.

Pro: Provisions such as not being the first to resume explosive nuclear testing might make the moratorium regime more stable; UN Security Council Resolutions, endorsed by the P5, condemning all nuclear explosive testing also would give the moratorium more credibility; it might be possible to reach an agreement regarding what testing is permitted during a moratorium and to agree on greater transparency.
Con: Measures that make the moratorium more permanent and irrevocable have few advantages, if any, over entry into force of the CTBT; this approach also would put the CTBT and the CTBT Office in Vienna into a state of limbo where the central, enduring regime would be expected to be the moratorium, not the treaty, and the full potential of the IMS will not be realized.

C. Modify the United States management of the moratorium to permit explosive testing below a given yield, with or without limits on numbers.

Pro: The United States would be able to test at low yields if it chose to do so; if successfully managed, a threshold-moratorium regime could be arranged.
Con: The most likely outcome would be the collapse of the CTBT effort and open season on testing; any limits on yield or numbers would be applied in a way that permitted whatever experimentation any testing country thought necessary; it is not clear that any security benefits the United States would gain from tests at low levels, particularly if the yields are restricted to levels significantly below 100 tons of TNT equivalent, would exceed the net losses resulting from testing conducted by other countries.

D. Give warning that the moratorium will be abandoned unless certain conditions (e.g., signature of the CTBT by all those necessary for the treaty to enter into force, definitive agreement by Iranian and North Korea governments to cease nuclear weapons programs) are met within some reasonable time period (e.g., one year, or conclusion of the 2010 NPT Review Conference).

Pro: This would apply pressure on other countries to strengthen their support for nonproliferation.
Con: For some countries, an ultimatum of this type would be taken as a signal that they could conduct underground tests at the end of the period.

E. Drop the moratorium and prepare to resume nuclear explosive testing

Pro: If there were violations of the moratorium by other nuclear weapons states, this might be an appropriate response.
Con: A resumption of nuclear testing by the United States would spell an end to nuclear constraint, and not only in the testing area; the nonproliferation regime would inevitably collapse.

IV. Coherent U.S. Policies as Regards Salience of Nuclear Weapons

A. A policy of leading, in an effort to reduce the salience of nuclear weapons, would 1) ratify the CTBT and 2) adequately fund a robust SSP and nuclear infrastructure programs.

B. A policy of hedging, in order to maintain the option of a higher profile for nuclear weapons in the U.S. defense posture, would 1) maintain the moratorium but 2) fund projects that would support the development of new nuclear weapons.

C. A policy aimed at enhancing near-term nuclear superiority as a means of dissuading would-be peer competitors would 1) seek to expand the scope for U.S. nuclear weapons testing while otherwise seeking to maintain the system of unilateral moratoriums and 2) concentrate SSP spending on near-term operational needs like, for example, shortening the lead-time for testing at the Nevada Test Site.

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Space Arms Control and Diplomacy

Bruce W. MacDonald

Introduction and Background

The U.S. is highly dependent on its space assets for strategic intelligence, surveillance, force-enabling conventional military superiority, and economic well-being, and grows ever more dependent on them. With the proliferation of space and other technologies, and specifically with the anti-satellite (ASAT) capability that China demonstrated in early 2007, there is a risk that an adversary could exploit this fast-growing U.S. dependence on space assets in a conflict to greatly weaken U.S. military and economic power. Apart from potential hostile actions, the growth of peacetime space operations by multiple countries has created a "space traffic" problem that in the future could impede or threaten the functioning of U.S. space assets. In addition, the growing cloud of orbiting space debris poses a threat to all space assets, as the recent collision between a working U.S. communications satellite and a lifeless Cosmos satellite dramatically illustrated.

Each administration since the Eisenhower years has recognized the importance of space to national security and established a space policy. In 2006, the Bush Administration issued a space policy that made two major changes in U.S. space policy. First, it declared for the first time that U.S. space assets are a "vital national interest," in recognition of the extraordinary and growing dependence of U.S. military forces on space for their effectiveness, as well as the growing dependence of the U.S. and world economy on them. The phrase "vital national interest" carries much heavier national security implications than has ever been attributed to space. The second major change was to reject any further role for arms control in addressing U.S. space security challenges, making explicit a policy that had been informally in place since early in that administration. The Obama Administration has spoken more favorably about arms control and space, but has to date only made a short statement on the White House website that it seeks to ban weapons that interfere with commercial and military satellites. The statement was silent on whether interference involved kinetic effects alone or covered electronic or information warfare.

The Strategic Problem

The U.S. has an overriding interest in maintaining the safety, survival, and functioning of its space assets and those of its allies so that the profound military, civilian, and commercial benefits they enable can continue to be provided to the U.S. and its allies.

These space assets face three forms of challenges and threats, all of them worrisome and growing:

1. China's 2007 ASAT test, which destroyed an old weather satellite, illustrated that the deployment of a significant number of these and/or other weapons could pose a serious threat to U.S. space assets within a decade if China chose to do so. China is also pursuing other programs that have important ASAT implications, and other nations are reportedly interested in ASAT capabilities as well. The U.S. shootdown of an errant NRO satellite in early 2008 demonstrated the inherent ASAT capability of many missile defense systems.
2. Space "traffic" is heavier than it has ever been and getting worse, both in terms of physical vehicles and also communications. Yet there is no "FAA for space," and even just the monitoring, much less the management, of objects in space is widely agreed to be far less than what is needed. The U.S. Air Force does freely provide data on about 17,000 orbiting objects, including almost all objects greater than 10 cm. in diameter. There is a substantial need for greater space traffic management capabilities, including enforceable rules of the road, codes of conduct, and space situational awareness that would inform a "space FAA" management capability.
3. Space debris poses an insidious and growing threat to all space assets. Debris in space does not quickly fall to the ground, as on earth; at orbits of 500 miles and more above the earth debris can stay aloft for centuries and more. In addition to the 17,000 orbiting objects cited above, there are perhaps hundreds of thousands of potentially lethal objects larger than one centimeter in orbit, and millions of smaller objects that pose at least some risk. The recent Iridium-Cosmos 2251

> collision in space generated still more debris: over 600 detectable pieces, an almost 4% debris increase from one incident, while the one Chinese ASAT test was estimated to have increased orbital debris by 10%. Orbital debris specialists believe there is a debris level at which such collisions could initiate a self-sustaining chain reaction. A space war in the next 10–20 years, involving kinetic energy weapons between the U.S. and China where many tens of satellites were destroyed, could render key orbital bands extremely hazardous to space assets.

Despite its stated opposition to space arms control, the Bush Administration took steps to begin addressing the larger space traffic management issue with other countries, and it had continued and expanded previous efforts to encourage international cooperation on mitigating civilian debris-producing activities. Ironically, as a growing satellite and space power, China had been an active participant in these discussions, and the ASAT test was reportedly a matter of great embarrassment to the civilian Chinese officials involved in them. There have been talks proposed on space weapons at the UN Conference on Disarmament, with China and Russia joining to call for a ban on space weapons. The U.S. opposed both the specific proposal and the whole idea of such discussions. The China-Russia space weapons ban proposal suffered from serious verification shortcomings in any event.

Space Arms Control Options

Arms control should be seen as one approach in a strategic toolkit of options to address important U.S. security concerns. The 1996 Clinton space policy laid down two criteria for space arms control measures: they should be in the U.S.'s security interests, and they should be verifiable. These criteria are used here.

Current space arms control regime. At present, the main agreement covering space is the Outer Space Treaty, which prohibits the placing of nuclear weapons in orbit or elsewhere in space and prohibits their testing in space as well. It does not prohibit the placement of conventional weapons in orbit. The OST is the chief agreement addressing space and entered into force in 1967. Reflecting an era when the U.S. and U.S.S.R. were the only real space powers, ASAT capabilities existed but were limited, and space offensive actions subject to a threshold for use, it does not address some key issues present in the strategic landscape of space today. The Bush Administration considered it sufficient, and that no further formal agreements were necessary, though it supported voluntary space management agreements.

Space Traffic Management

There is a slate of measures that fall under the rubric of "space codes of conduct," "space rules of the road," and others, that fall somewhere between informal agreements and formal arms control. The EU has proposals in this area, and various policy groups in the U.S. and elsewhere have similar proposals. The U.S. was working on similar ideas late in the Bush Administration, and military, civilian, and commercial operators within the U.S. have championed similar ideas. Rather than dive into a discussion that could consume volumes, the Commission may want to consider a general endorsement of international discussions that would facilitate the development of such space rules of the road, codes of conduct, space best practices, and an international system of management to ensure the smooth functioning of assets in space. There is the question of whether such codes should be optional or mandatory, as informal or formal agreements, but the Commission need not address that issue, though in the maritime arena there are formal agreements. Former Senator John Warner is reported to have stated that the "Incidents at Sea" agreement with the Soviet Union, which was negotiated while he was Secretary of the Navy in the mid-'70s, was valuable not just for the agreement itself, but also for the new channel of communication with the Soviet Navy it opened up, which proved useful on several occasions. He reportedly is supportive of a comparable agreement on space. The UK's recent paper, "Lifting the Nuclear Shadow: Creating the Conditions for Abolishing Nuclear Weapons" notes that "[a]n alternative way forward in the medium term [on space arms control] may be an International Code of Conduct on Outer Space Activities aimed at enhancing transparency and confidence-building measures."

Debris

There have been ongoing international discussions on space debris mitigation for a number of years. The restrictions to date have been voluntary, which may reduce incentives to comply. There are at least three options directly addressing debris:

1. Continue current voluntary compliance efforts, which have met with some limited success but have not prevented significant growth in the debris problem.
2. Substantially step up U.S. and international priority on debris mitigation issues, with consideration of space trade penalties where nations choose not to comply with "best practices" for debris mitigation. Such efforts would likely reduce the rate of growth of space debris by an

uncertain amount, and penalties imposed would not be cost-free for the imposers.

3. Further raise the ante on the space debris problem by negotiating a treaty on space debris. This would emphasize the importance of the issue but could face resistance from some less developed countries that would complain of a double standard and ask for exceptions. It will also place a greater onus on the U.S. to increase its space surveillance capabilities to enhance monitoring. It would take longer to implement and could be overkill in addressing this problem.

Ban on Kinetic-Energy ASAT Testing

A logical extension of the concerns over space debris, this option would seek to discourage the development of KE-ASAT weapons by banning their testing against orbiting objects and would make no judgments about space weapons overall. Careful language crafting need not impose any constraints on missile defense testing. Such a ban would put the parties on record as recognizing that this form of warfare has too much disproportionate collateral damage to be allowed. There is an inherent break-out capability through missile defense systems, but parties could be deterred by both the inherent capabilities of the other side and the indiscriminant nature of the collateral damage, which such tests or space sorties would pose a threat to their own satellite operations. Verification of such a ban would be much easier than a ban on the weapons themselves.

There is a useful analogy for such a testing ban in the Limited Test Ban Treaty of 1963, which banned atmospheric nuclear testing. While generally considered an arms control treaty, the LTBT actually had its political roots in tangible worldwide environmental fears when strontium-90, cesium-137, and other nuclear testing byproducts began showing up in milk and food supplies across the globe. As a result, the LTBT was negotiated in just eight weeks in the summer of 1963 (probably an arms control record), and atmospheric nuclear testing ceased, with resultant environmental gains. In the same way, steps to discourage KE-ASAT testing or employment would serve both important security and space environment purposes. The existence of other means for offensive counterspace operations makes this option more palatable as well to those who might otherwise oppose space arms control.

Other Arms Control Options

There are other potential options that frankly need much more study before they could be seriously considered. The Russian-Chinese proposed ban on all weapons in space has serious verification issues, which China privately admits. Furthermore, it appears not to cover ground-based space weapons. Some have proposed a ban on interference with the regular operation of other countries' space assets. This has the advantage of banning behavior, not existence, and so would be potentially more verifiable. Yet it has more substantial definitional problems as to what constitutes interference, and would not ban testing against one's own space assets. Other options include a peacetime "keep-out zone" for satellites, which could build confidence. A no-first use pledge could be in the interests of the U.S., though such pledges could not be counted upon to stand up in a crisis environment.

Clearly more study of space arms control options is needed, but there appears to be room to move forward, with broad civilian and commercial backing in the areas of space traffic management and space debris. Consideration in principle of a KE-ASAT testing ban may also merit priority consideration, especially in view of the potential near-term Chinese KE-ASAT capability based on its 2007 ASAT test. Furthermore, by making a proposal on space arms control and being willing to at least discuss the subject, the U.S. would be removing one of the arguments that China has used to deflect action on the fissile materials cut-off issue. Such removal may not lead to Chinese movement on FMCT, but it would make their current position less tenable.

Acquisition and Policy Postscript

All the options described above have certain acquisition implications. Improved space situational awareness is a sine qua non for every option, and much better space intelligence is needed to enable us to distinguish potentially hostile from benign space vehicles. To help us better determine our broad space security objectives, U.S. space policy needs, in the words of Gen. Moorman, former Vice Chief of Staff of the Air Force, the kind of "intellectual ferment" that we had in the early days of nuclear weapons, which so far is sorely lacking. In addition, space needs international cooperation if it is to continue to provide our military forces with the data that enables our conventional superiority and does so much to support our strategic nuclear forces.

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Summary of Previous Space Arms Control Negotiations

Alicia Godsberg

U.S.-USSR

The United States and Soviet Union held three rounds of negotiations on anti-satellite weapons in 1978 and 1979, which made only limited progress. There were important definitional and other issues, and the USSR was generally resistant. In the aftermath of the Soviet invasion of Afghanistan in late 1979, these talks were never resumed.

UN

1. Committee on the Peaceful Uses of Outer Space (COPUOS)
   a. The UN General Assembly established COPUOS in 1959 to review international cooperation in space, devise UN programmes related to the peaceful use of outer space, encourage research and dissemination of information on outer space, and consider legal issues arising from the exploration of outer space. The Committee has two subcommittees—the Scientific and Technical Subcommittee and the Legal Subcommittee—and meets annually in Vienna. COPUOS decisions are implemented by the UN Office for Outer Space Affairs.
   b. In June 2007 COPUOS adopted debris mitigation guidelines. The guidelines include measures to be considered for mission planning, design, manufacture, and operational (launch, mission, and disposal) phases of spacecraft and launch vehicle orbital stages. Member states have pledged to implement these guidelines "to the greatest extent feasible."

c. The 2007 session of COPUOS agreed on a draft resolution on the practice of states and international organizations in registering space objects to the General Assembly, and approved a workplan for the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER).

2. Resolutions on the Prevention of an Arms Race in Outer Space (PAROS)
   a. Since 1982, PAROS has been introduced annually to both the General Assembly and its First Committee. Only the U.S. (first abstained, but has voted "no" since 2005) and Israel (abstains) do not vote in favor of PAROS. The Bush administration argued that the existing multilateral arms control regime is sufficient, and that there is no need to address the non-existent threat of a space arms race.
   b. The PAROS resolution reaffirms the importance of the 1967 Outer Space Treaty, but notes that the current outer space legal regime is not sufficient to prevent an arms race in outer space. PAROS calls for states, especially those with space capabilities, to refrain from actions contrary to the objective of PAROS and to "contribute actively" to that objective. It argues for consolidation and reinforcement of the outer space legal regime, and says a new treaty on PAROS should be negotiated in the Conference on Disarmament (CD).
3. Other measures
   a. 2005, 2006, and 2007—Russia introduced resolutions on transparency and confidence-building measures in outer space activities. Only the U.S. has objected, and Israel has abstained.
   b. 2007—the UN Secretary General released a report on "Transparency and confidence-building measures in outer space."
   c. 2008—Russia and China introduced a draft treaty for a ban on weapons in outer space to the CD. The U.S. maintained its opposition to such a treaty.
   d. 2009—The European Union submitted a Draft Code of Conduct on Space Objects and Space Activities to the CD. This Code is meant to strengthen existing UN treaties and principles on space security and to codify new best practices, including measures of notification and consultation.

Treaties

1. Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water (1963)—also known as the Limited Test Ban Treaty (LTBT) [entered into force 1963; U.S. and USSR ratified]

   a. Each of the Parties undertakes to prohibit, prevent, and not to carry out any nuclear weapon test explosion, or any other nuclear explosion in the atmosphere, outer space, or under water.
2. Treaty on the Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (1967)—also known as the Outer Space Treaty [U.S. and USSR ratified]
   a. Parties undertake not to place nuclear or other WMDs in orbit and to use the moon and other celestial bodies for peaceful purposes. Military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers on celestial bodies are forbidden.
3. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (1979) [entry into force—1984; neither the U.S. nor the RF are Party]
   a. Arms control aspects of the Agreement reaffirmed the main principles of the Outer Space Treaty.
4. Draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects—submitted jointly by Russia and China to the CD on 12 February 2008.
   a. Terms of the draft Treaty
      i. Keep outer space free from "military confrontation" and open to peaceful uses and exploration for the "development of humankind."
      ii. Defines certain terms, such as "outer space," "outer space object," and "weapons in outer space."
      iii. States parties would undertake not to place in orbit any objects carrying any kind of weapons, not to install them on celestial bodies or other space structures, not to use or threaten to use force against outer space objects, and not to encourage any other parties to do so.
   b. The United States opposed the terms of the draft Treaty for several reasons, including that the definitions were inadequate and verification could not be assured.

PAROS Issues

1. No weapons in outer space: Because there are no weapons in outer space, the U.S. does not recognize the importance of a PAROS treaty. Many states see value in taking action, as preventing an arms race in outer space is preferable to managing one that has started.

2. Definitions: Many space assets are capable of performing both commercial and military missions; this makes the definition of what constitutes space militarization problematic. In addition, space objects and space debris are potentially harmful to spacecraft or could destroy important satellites or other devices. The U.S. argues that the inability to define space weapons is the main barrier to negotiating a PAROS treaty. Russia and China have produced a working paper in the CD that discusses definitions (i.e. Outer Space, Space Weapons, Space Objects and Peaceful Use of Outer Space) and suggested that a future PAROS treaty might not need specific definitions if agreeing on them proves too difficult (the Outer Space Treaty and the Moon Agreement do not have specific definitions).
3. Verification: Verification of a PAROS treaty would be difficult, and the issue might have to be postponed in order to move forward with negotiations in the CD. Russia suggested to the CD that *transparency and confidence building measures could, for a certain period of time, compensate for the lack of verification measures.* In 2006, Russia and China submitted a working paper on verification aspects of PAROS to the CD.

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Fissile Material Cut-Off Treaty

Susan J. Koch

Introduction

This paper presents options for consideration by the Strategic Posture Review Commission on a Fissile Material Cut-Off Treaty (FMCT). The paper assumes that the United States will and should support a legally-binding FMCT—given the near-universal support for such an agreement by U.S. officials and analysts and the fact that the new Administration has embraced such a position. Therefore, the paper does not offer options regarding support for an FMCT in principle or for a legally-binding treaty. Instead it examines the key issues of difference regarding an FMCT: its substantive coverage; adherence; verification; and negotiating forum.

The options below are not presented in the expectation that the Commission should choose among them. Instead, they are offered primarily to illustrate the range of issues involved in an FMCT. The final section of this paper recommends a Commission position on the FMCT that includes some, but not necessarily all, of those elements.

Substantive Coverage

Definition of fissile material

The first issue is the definition of the "fissile material" to be covered by the Treaty. The question here is not the nature of the material—plutonium (Pu) and highly-enriched uranium (HEU) —but its purpose. An FMCT could:

- Option One: Ban the production of fissile material for nuclear weapons or other explosive devices;

- Option Two: Ban the production of fissile material for any military purpose;
- Option Three: Ban the production of all fissile material; or
- Option Four: Ban the production of all fissile material by the P-5, and of fissile material for explosive (variant—military) purposes by all other signatories.

The initial official call for an FMCT, by the United Nations General Assembly in December 1993, proposed a "treaty banning the production of fissile material for nuclear weapons or other nuclear explosive devices." Since that time, relatively few officials or outside observers have supported a broader FMCT that would ban production of all fissile material or of fissile material for military purposes (the latter would essentially capture naval propulsion as well as nuclear weapons).

Limiting an FMCT to fissile material for nuclear weapons would have major advantages: it would clearly define the Treaty as a nuclear arms control/arms reduction measure and, above all, would not seek to constrain signatories' ability to produce Pu or HEU for other purposes (e.g., nuclear energy, research reactors, naval reactor fuel). An FMCT that sought to ban production of all Pu or HEU would be virtually impossible to negotiate, even though the P-5, at least, probably have more than ample stocks for all foreseeable explosive and non-explosive purposes (assuming that the treaty allows the retention of existing stocks, an issue discussed below). An FMCT that sought to ban production of fissile material for any military purpose would win broader support. However, and crucially, it would almost certainly be opposed by the P-5 and other states (such as Brazil) that either use or intend to use fissile material for naval propulsion.

On the other hand, the imposition of treaty constraints on the basis of the material's purpose rather than nature would create daunting verification problems and built-in breakout potential, even if effective verification were achievable. Still, even a ban on all fissile material production would not be without verification difficulties, caused in part by the continued production of low-enriched uranium. A ban on production of fissile material for any military purpose would fall between those two poles: more difficult to verify than a total production ban; potentially less difficult than a ban on production for nuclear explosive purposes.

Option 4 would seek to reduce the disadvantages of the other options, by differentiating between the large P-5 stocks and those of other signatories who might still need (or want) to produce fissile material for non-explosive purposes. Option 4 might be attractive to some potential signatories, but certainly not to the P-5: none of the P-5 would likely support differential obligations; China would undoubtedly insist on continuing production for other purposes; France would demand continued reprocessing; and all the P-5 would likely view this approach as prematurely cutting off potential avenues for disposition of spent nuclear fuel. Finally, Option 3 would carry all of the verification problems of Option 1 in regard to the states whose potential breakout would be of greatest concern.

Definition of "cut-off"

The second issue, about which analysts differ sharply, concerns the definition of cut-off. An FMCT could:

- Option One: Ban all future production of fissile material;
- Option Two: Impose a limit on fissile material stocks that would require all signatories to reduce existing stocks;
- Option Three: Impose a limit on fissile material stocks that would not require any signatories to reduce existing stocks, allowing all to maintain current inventories or to increase them until they reach the allowed level;
- Option Four: Impose a limit on fissile material stocks that would require some signatories to reduce existing stocks, allowing the others to maintain current inventories or increase them until they reach the allowed level.

Proponents of Options Two and Four support an FMCT that would reduce the over-large stocks of fissile material in the world (and especially in the United States and Russia), better preparing the way for future weapons reductions while reducing the proliferation risk of "loose nuclear material." Option Four may be particularly attractive to non-P-5 states, who want the P-5 to reduce but do not want to cease their own fissile material production in the near future. For those states, Option Three might be the second best choice, allowing them the flexibility they feel they need. From an arms reduction perspective, however, Option Three is the worst option—a limit above current U.S. or Russian levels would be almost meaningless, politically and substantively.

Whether "fissile material" is defined as all HEU and Pu, or limited to that produced for nuclear explosive or all military purposes, would affect the political feasibility of the cap and/or reduction options. The arguments discussed above against a broad definition of "fissile material" would apply a fortiori to any proposal to reduce existing stocks, whether held by some or all signatories.

Adherence

There appear to be four basic options for adherence to an FMCT:

- Option One: Open to the P-5 and the four states that do not belong to the Nuclear Nonproliferation Treaty (India, Israel, North Korea, Pakistan). Link entry-into-force to ratification by all nine;

- Option Two: Same as Option One, but link entry-into-force to ratification by the P-5 only;
- Option Three: Open to all states, but link entry-into-force to ratification by the P-5 and the four non-NPT parties;
- Option Four: Same as Option Three, but link entry-into-force to ratification by the P-5 only. (This was the approach taken in the draft FMCT tabled by the Bush Administration in May 2006.)

Many analysts have proposed that an FMCT bind the P-5 and the four non-NPT parties, because all other states have committed in the NPT not to produce or retain fissile material for weapons purposes. However, that begs some important issues. First, what about states that in the future might withdraw from the NPT, as North Korea did in 2003? Second, might an FMCT establish stronger constraints on other states who are now pursuing, or may in the foreseeable future pursue, nuclear weapons in violation of their NPT obligations? Third, would universality help to reinforce, even if not strengthen, the existing NPT constraints? Finally, and conversely, would it be useful to accept an FMCT that bound the P-5 only, given the relatively large size of their fissile material stocks and the extreme difficulty of winning adherence by India, Israel, North Korea and Pakistan? The answers to all of those questions strongly suggest that Option Four is the best approach.

Verification

There are four basic options:

- Option One: Include multilateral verification measures in the FMCT, striving to reach the "effective verification" standard;
- Option Two: Exclude all verification measures from the FMCT;
- Option Three: Include some verification measures in the FMCT, supplemented by confidence-building measures;
- Option Four: Same as Option Three, but impose more intrusive verification measures on non-nuclear-weapon states.

The verification issue has for the last few years been the focus of most attention regarding an FMCT. The original United Nations General Assembly resolution in 1993 called for an "internationally and effectively verifiable treaty." The decision by the Bush Administration in 2004 to support a legally-binding FMCT without verification measures generated considerable opposition, although it is doubtful that it significantly affected—one way or another—the prospects for actually negotiating an FMCT. The Obama Administration has provided no public details but has endorsed a "verifiable" treaty. In her prepared remarks at her confirmation hearing, Secretary of

State Clinton stated that, "…we will work…toward…reviving negotiations on a verifiable Fissile Material Cutoff Treaty."

The Bush Administration argued that FMCT verification measures would have to be too intrusive to protect core national security interests and too costly for many states to accept. Even then, the Bush Administration claimed, an FMCT would not be effectively verifiable. Advocates of verification disagree. They assert, among other things, that the Bush Administration standard of being able to "detect noncompliance in time to convince a violator to reverse its actions, or to take such steps as may be needed to reduce the threat presented and deny the violator the benefits of its wrongdoing" is inappropriate and could not be met by many extant treaties. Detailed proposals for FMCT verification are scanty, but most propose using the measures of the International Atomic Energy Agency (IAEA) Additional Protocol, supplemented by additional challenge inspections. The IAEA would monitor the FMCT, but would require major additional personnel and financial resources to be able to do so.

No matter what one's position on the desirability or feasibility of FMCT verification, the task is a daunting one. Some of the substantive complications have been discussed above. In addition, many (if not most) of the "target states" would be loath to accept the intrusiveness required into weapons-related fissile material areas. None of the nuclear-weapons states or the non-NPT Parties has disclosed its fissile material stocks (in or out of weapons). None of the nuclear-weapons states has accepted the most intrusive measures of either IAEA Safeguards or the Additional Protocol. The United States has come closest, but the U.S. Safeguards Agreement and Additional Protocol both allow the United States to exclude from their application any locations, activities or information of direct national security significance. None of the non-NPT Parties has full-scope safeguards or an Additional Protocol in effect. Iran has failed to ratify the Additional Protocol and no longer provisionally applies it; indeed, only 90 states have brought their Protocols into force.

Negotiating Forum

Two options appear available:

- Option One: Continue to seek to negotiate the FMCT in the Conference on Disarmament (CD); and
- Option Two: Establish a new multilateral forum dedicated to negotiating an FMCT, possibly under the IAEA Board of Governors.

Option One would carry the benefits, but also the costs, of inertia. The CD has been considering whether and how to open FMCT negotiations for 15 years. Some states have from time to time linked their support for such negotiations to other issues; China's long-standing linkage between FMCT and Outer Space Arms Control negotiations is the best example. The large CD membership further complicates the issue. Even if linkage ceased to be a problem (either because the United States accepted it or others dropped the demand), it would remain highly questionable whether the CD could be an effective negotiation forum.

Option Two would offer a new beginning and also discourage linkage to other issues. Placing negotiations under the IAEA Board of Governors would avoid the procedural and political difficulties of establishing a new international forum, engage national delegations already familiar with nuclear nonproliferation issues, and provide a forum of (barely) manageable size. Moreover, there may be a useful precedent in that the Additional Protocol was negotiated after the first Gulf War by a working group under the IAEA Board of Governors.

Nevertheless, Option Two could generate international controversy, given the long (if fruitless) history of the FMCT in the CD. Critics would argue that the change would move away from a truly multilateral negotiation to one dominated by the P-5 and other leading industrial states. Such criticism might be tempered if the negotiation took place under IAEA auspices, given the organization's substantive expertise and likely role in any FMCT implementation. Further, moving such a negotiation to the IAEA, given the past tension between the United States and that organization, would be consistent with the Commission's Interim Report finding that "Stronger financial, technical, and political support for the IAEA by the United States could enhance its ability to perform its unique and important mission." Care would need to be taken, however, to prevent FMCT negotiations from diverting scarce IAEA personnel and financial resources from more urgent safeguards tasks.

Conclusions

Consistent with the Commission's avoidance of overly detailed recommendations regarding future U.S. strategic force structure, it is recommended that any Commission position on FMCT be quite general, while highlighting major points of difference from, or commonality with, earlier U.S. positions.

The Arms Control Tiger Team and Counterproliferation Expert Working Group are in general agreement that the Commission should support:

- Negotiation on a legally-binding FMCT;
- Definition of "cut-off" as a ban on further production as of a set date;
- Treaty open to all states;
- Transfer of negotiating forum to a dedicated venue, perhaps within the IAEA.

The first three elements would reaffirm Bush Administration policy. The fourth element would be new; neither the Bush nor Clinton Administration appears to have questioned the desirability of keeping FMCT negotiations in the CD.

Tiger Team and Expert Working Group views differ on two other important FMCT elements:

- Definition of "fissile material." Most members support retaining the traditional definition of "fissile material for nuclear weapons or other explosive purposes." Others favor a ban on production of all fissile material.
- Verification. Most members support seeking measures that could effectively verify an FMCT (as that concept was defined during the Clinton Administration). Others would reaffirm Bush Administration policy—arguing that an effectively verifiable FMCT is not feasible and should not be pursued.

U.S. support for an effectively verifiable FMCT, combined with the other changes outlined here, would enhance the chances of initiating FMCT negotiations within the next few years. They would also improve the odds of successfully concluding those negotiations. However, those odds—while better—would still not be very good, for several reasons. For example: China probably would balk at any treaty that denied it the ability to increase fissile material stocks for weapons purposes; Russia and China would almost certainly oppose transparency into their weapons and weapons material stocks; the United States, France and the United Kingdom would also have difficulty with providing required information and access.

Even if an FMCT were successfully negotiated, chances are low that the four non-NPT parties would sign and ratify it. Iran and North Korea would do so if (but only if) international efforts finally succeeded in persuading them to abandon their nuclear weapons programs. It is harder to imagine circumstances that would persuade India, Pakistan and Israel to adhere to an FMCT.

Most Tiger Team and Expert Working Group members believe that the poor prospects for an actual FMCT should not deter the United States from supporting the treaty and pressing for its negotiation. In their view, that support would be politically important, not least in the run-up to the 2010 NPT Review Conference. Others argue that the near-term U.S. arms control and nonproliferation agenda is too full and too important to allow attention to be diverted to a negotiation with so little chance of success. All agree that, under any circumstances, the United States should be cautious in paying a substantial cost (regarding FMCT or other issues) to win the opening or conclusion of FMCT negotiations, given the risk that the corresponding benefit will not be realized.

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1. "Plutonium" covers all plutonium except that with 80 percent or more PU-238. "HEU" is uranium enriched to 20 percent or more.
2. "Effective verification" is a standard used through the Clinton Administration that implied the capability to detect a militarily significant violation in time to respond effectively and, in some formulations, to deny the violator the benefits of violation. As noted below, the Bush Administration used a more stringent definition.
3. The Conference on Disarmament has 65 members, currently including Algeria, Argentina, Australia, Austria, Bangladesh, Belarus, Belgium, Brazil, Bulgaria, Cameroon, Canada, Chile, China, Colombia, Cuba, North Korea, Congo, Ecuador, Egypt, Ethiopia, Finland, France, Germany, Hungary, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Japan, Kazakhstan, Kenya, Malaysia, Mexico, Mongolia, Morocco, Myanmar, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Peru, Poland, South Korea, Romania, Russia, Senegal, Slovakia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Syria, Tunisia, Turkey, Ukraine, United Kingdom, United States, Venezuela, Vietnam, and Zimbabwe.
4. The IAEA Board of Governors has 35 members, always including the P-5 and with several members elected by regional groups. For 2008–2009, the Board is composed of Algeria (Chair); Afghanistan; Albania; Argentina; Australia; Brazil; Burkina Faso; Canada; China; Cuba; Ecuador; Egypt; Finland; France; Germany; Ghana; India; Iraq; Ireland; Japan; Lithuania; Malaysia; Mexico; New Zealand; Philippines; Romania; Russia; Saudi Arabia; South Africa; Spain; Switzerland; Turkey; United Kingdom, United States; and Uruguay.

Appendix: Report of the Defense Science Board Task Force on Nuclear Deterrence Skills[1]

Executive Summary

The Defense Science Board Task Force on Nuclear Deterrence Skills was chartered to assess all aspects of nuclear deterrent skills—military, federal, and contractor—and to recommend methods and strategies to maintain a right-sized, properly trained, and experienced workforce to ensure the viability of the U.S. nuclear deterrent through 2020.

As long as anyone in the world has or can acquire nuclear weapons, America must have nuclear deterrence expertise competent to avoid strategic surprise and respond to present and future challenges. There are many kinds of threats that demand national leadership, but no threat can put the nation's existence at risk as quickly and as chillingly as nuclear weapons. To say this is not to dismiss the seriousness of other threats. It simply acknowledges that since the dawn of the nuclear age, security from nuclear attack has been in a class of its own, and major national decisions on nuclear deterrence issues have been reserved for the President of the United States.

Nuclear deterrence expertise is uniquely demanding. It cannot be acquired overnight or on the fly. It resides in a highly classified environment mandated by law, it crosses a number of disciplines and skills, and it involves implicit as well as explicit knowledge. Nuclear weapons expertise is necessary to design and build nuclear weapons, to plan and operate nuclear forces, and to design defense against nuclear attack. It is also necessary to analyze and understand foreign nuclear weapons programs, devise nuclear policies and strategies, deal with allies who depend on the American nuclear umbrella, prevent and counter nuclear proliferation, defeat nuclear terrorism, and—in the event that a nuclear detonation takes place by accident or cold, hostile intent—cope with the catastrophic consequences.

America's nuclear deterrence and nuclear weapons expertise resides in what this study calls the "nuclear security enterprise." This enterprise

1. Report of the Defense Science Board Task Force on Nuclear Deterrence Skills. Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics: Washington, D.C. September 2008.

includes nuclear activities in the Department of Defense (DOD), Department of Energy, Intelligence Community (IC), and the Department of Homeland Security.

During the Cold War, the bulk of the nuclear security enterprise consisted of the U.S. nuclear weapons program and force posture devoted to deterring the Soviet Union. The skills acquired for those activities provided a robust base from which the United States not only could conduct nuclear deterrence, but also could devote expertise with nuclear proliferation and nuclear terrorism issues. However, nuclear deterrence was the principal focus.

Today, deterrence of major power nuclear threats and the prospects of global war have receded in national priority while nuclear proliferation terrorism and defense have become urgent concerns. Today's nuclear security enterprise devotes the energy and attention to proliferation and terrorism issues that once were reserved for nuclear offensive forces. It is in that context that this task force reviewed nuclear deterrence expertise.

Principal Observations

The task force is concerned that adequate nuclear deterrence competency will not be sustained to meet future challenges. A national strategy for the nuclear security enterprise has not been emphasized and, as a consequence, there is disillusionment within the workforce that could lead to decline in the remaining critical skills. Existing and emerging weapons of mass destruction (WMD) threats and adversary intentions are not well understood. Intelligence assessments lack the needed focus and expertise.

The perception exists that there is no national commitment to a robust nuclear deterrent. This is reflected in the downgrading of activities within Office of the Secretary of Defense (OSD) policy and the Joint Staff, U.S. Strategic Command (STRATCOM), the U.S. Air Force, and congressional action on the Reliable Replacement Warhead (RRW).

Management and the workforce in the defense industry and in nuclear weapon contractors believe that "sustainment" programs (e.g. life extension programs) will not retain the skills necessary to completely solve major problems with existing systems or to initiate new programs should the need arise. Pessimism exists about follow-on nuclear deterrence systems becoming a reality, thereby leading to loss of opportunity to train the next generation of nuclear weapon system experts. Priorities have shifted strongly, and to a degree appropriately, but the pendulum has swung too far. Now the nation is faced with about $100 billion of decisions (RRW, Complex Transformation, land-based strategic deterrent, sea-based strategic deterrent), with an eroded capability to think about these issues and with attention focused on other priorities.

Findings

In the absence of a strong national commitment to sustaining the nuclear security enterprise and visible leadership starting at the senior levels, it is difficult to keep the rigor and focus needed at all levels to meet the demanding proficiency standards that are indispensable for nuclear deterrence activities. It also is difficult, absent such a strong national commitment, to retain the best of the younger workforce. Words are not enough. There must be evidence of commitment that manifests itself in both strong leadership and real, meaningful work.

Today's nuclear weapons expertise generally is of high quality, although we are unable to assess the capability to design, develop, and produce new weapons or weapon systems through the entire cycle, as the nation has not done so for over 15 years. The challenge for the future is to preserve nuclear weapons expertise across the entire spectrum of requirements, ranging from today's priorities to a possible return, best intentions and efforts notwithstanding, of international relations dominated by major power nuclear confrontation.

The task force is concerned about the future of America's nuclear deterrence expertise. A significant part of the current workforce in the national laboratories and production facilities is at or nearing retirement age. New people must be hired and trained. This need is complicated by resource issues in today's environment. More fundamentally, however, the task force does not find adequate planning for dealing with the problem. The situation is further affected by the general decline in the numbers of U.S. citizens acquiring graduate degrees in science and engineering. Citizenship remains a prominent requirement in the highly classified world of nuclear weapons work. With our current course, the end state will not provide for a safe and reliable stockpile or for a responsive infrastructure.

The technical expertise required for dealing with the nuclear dimensions of proliferation, terrorism, and defense is closely related to nuclear weapons skills. Indeed, a significant part of the intellectual capital derives from expertise and knowledge acquired by working with nuclear weapons and related technologies. The nuclear experts drawn from the weapons program are needed in counterproliferation and counterterrorism.

The problems the task force identified are not insurmountable. The United States retains the capacity to step up to the most difficult challenges, given commitment and leadership. Sustaining nuclear weapons expertise is such a challenge.

Recommendations

Based on these and other related findings discussed in this report, the task force has arrived at twenty-three major recommendations, categorized as dealing principally with leadership, organization, strategic planning, and capabilities and competencies.

Leadership

1. **The Secretary of Defense, working with the Secretaries of State, Energy, and Homeland Security, and the Director of National Intelligence, must lead the development of a clear U.S. vision and strategy for nuclear deterrence capabilities and competencies.**

A new vision is required of what comprises needed nuclear deterrence capabilities and competencies, and how to sustain them. The strategy should address 21st century nuclear deterrence capabilities needed to respond to an uncertain future while supporting the broadly held goal of reduced reliance on nuclear weapons. Advocacy within government requires a comprehensive framework—a widely shared and understood set of concepts for dealing with the national security issues raised by nuclear weapons across the board—American nuclear weapons and their role in deterrence, nuclear weapons and materials in the hands of states, nuclear terrorism, nuclear proliferation, and global/regional nuclear threat reduction.

2. **Senior civilian and military leaders should reinforce the necessity for and value to the nation of the nuclear deterrence mission.**

The administration and senior military leadership, through actions and words, should make a concerted and continuing effort to convey to the nuclear weapons community that their mission is vital to the security of the nation and will remain vital well beyond the planning horizons normally associated with programmatic decisions.

3. **Commander, U.S. Strategic Command, should strengthen the headquarters supervision and involvement in the nuclear weapons program.**
   The STRATCOM Commander (Gen. Chilton) has initiated corrective action this regard.
4. **Air Force and U.S. Strategic Command leadership should restore the rigor and focus necessary to reestablish and sustain the demanding proficiency necessary for nuclear operations.**

Commanders must plan, integrate, fund, train, and staff subordinate commands to ensure effective skills for mission success at all levels. Unresolved waivers of security and other requirements should have corrective action planned and funded. Nuclear bomber alert should be exercised and adequate training incorporated as necessary. Personnel Reliability Program (PRP) requirements should be reviewed to ensure realistic requirements.

5. The Administrator of the National Nuclear Security Administration (NNSA) must reduce the high indirect cost of the nuclear weapon complex. These high costs impede refurbishment of legacy weapons, or authorization or new weapons if proposed, and preclude the work experience needed to maintain competence.

The NNSA laboratories and production facilities must be incentivized to reduce indirect costs to make more affordable efforts to sustain and enhance the skills needed to respond to today's threats and future challenges. Many of the causes of these high indirect costs fall outside the control of the Administrator, but he can, working with the Secretary of Energy and Congress, move to address this increasingly burdensome issue.

Organization

6. The Secretary of Defense should assure that nuclear-weapon-related responsibilities in OSD are at the proper level and are adequately staffed.

Create an Assistant Secretary of Defense for Strategic Weapons as previously recommended by the Defense Science Board Permanent task Force on Nuclear Weapons Surety. Elevate nuclear weapon responsibilities within the Office of the Under Secretary of Defense for Policy to the level of Deputy Under Secretary to ensure high-level attention is focused on development of a national nuclear weapon strategy, and to assure that issues affecting the deterrence posture of the United States are provided appropriate evaluation. Reestablish OSD study and analytic capabilities for nuclear deterrence to support senior decision-makers.

Strategic Planning

7. The Secretary of Defense should establish nuclear requirements for capabilities, including nuclear competencies, force structure, and programs for the timeframe 2009 to 2030, using the next Nuclear Posture Review (NPR), and provide requirements for NNSA planning.

Evaluate the U.S. nuclear weapons capabilities needed as hedges against the uncertain future. Also, as part of the NPR, evaluate the technical feasibility and cost aspects of adding nuclear capability to platforms developed for conventional weapon delivery.

8. The Secretaries of Defense and Energy, with the Director of National intelligence, should urgently identify and act to fill the gaps in the skill base needed to improve assessments of foreign nuclear programs.

Focus requirements on nuclear expertise to monitor, assess, and analyze the global threats posed by nuclear weapon developments, proliferation of nuclear technology, and potential employment of nuclear weapons or "dirty bombs" that could threaten the United States, U.S. forces abroad, or allies and friends. Leadership should challenge current assessments utilizing a peer review process (red teams) to ensure that more of the known and unknown issues are identified and corrective action assigned to competent specialists for resolution.

9. **The Assistant Secretary of Defense for Strategic Weapons (when appointed) and Administrator, NNSA, must maintain critical weapon design, development, production, integration, and surveillance skills by exploring follow-on nuclear weapon system designs, including prototyping (even without commitment to production).**

Development of new systems (of any kind) requires certain skills that are different from those needed to sustain existing systems. A program of exploration of follow-on nuclear weapon system design should be re-established at some level that is decided by balancing the real risks. With regard to future life extension programs, dual revalidation of nuclear weapon refurbishments should be required not only to ensure the weapons remain safe, secure, and reliable, but also to improve the workforce expertise.

The full range of real and engaging work is the only validated mechanism for sustainment of unique skills. Some provision must be made for skills not used today but possibly needed quickly in the future. Sustainment and dismantlement programs cannot be relied upon to exercise and maintain the total competencies required. DOD and NNSA must work with the Congress to ensure an annual workload that is reasonably stable yet can accommodate design, development, and production rate changes and avoid interruptions that compromise long-term mission design and production competence. The production rate must provide the basis for surge should it be necessary.

10. **The Administrator, NNSA, should make the development of capabilities and competencies an explicit part of NNSA planning consistent with the next NPR.**

The Administrator should establish and implement a strategy and plans on a priority basis for the next generation of nuclear stewards, identify and implement strategies and tools for recruiting and retaining essential weapons employees, and adopt a comprehensive strategy for knowledge transfer and training that emphasizes the essential contribution of hands-on work.

11. **Cognizant organizations throughout the nuclear enterprise—within government and the supporting contractor base—should maintain**

selected nuclear skills by managing their application in related non-nuclear applications where appropriate.

Careful coordination of requirements to describe the minimum set of capabilities needed and thoughtful cost allocation are required to fully leverage activities that are technically similar to nuclear work.

12. **Cognizant organizations that comprise the nuclear security enterprise (to include NNSA/DOD/IC/DNDO [Domestic Nuclear Detection Office]) should develop a human capital management system(s) to identify current and future needed capabilities and manage so personnel can move from one part of the nuclear security enterprise to another as needed.**

Capabilities and Competencies

13. **The Secretary of Defense should require the periodic participation of senior civilian and military leadership in exercises that involve the use of adversary and/or U.S. nuclear forces.**

    Training these senior leaders in nuclear weapon-related scenarios is important for competent decision-making.

14. **The Secretary of Defense should establish Department of Defense requirements for understanding foreign cultural and behavioral factors related to nuclear issues.**

Potential adversaries generally do not have the same views of their nuclear weapons future as the United States. Deterring future adversaries will require greater understanding of the goals, culture, values, social characteristics, government limitations, leadership decision-making, and motivations of nations and non-state actors. Such an understanding is an essential component of intelligence needed for competent conduct of U.S. foreign policy. Better training and education are needed for personnel at all levels to include senior personnel and those charged with developing U.S. assurance, dissuasion, and deterrence positions, pronouncements, and use of "red lines."[2] The overall connection between communications and deterrence requires improvement and greater use of red-team activities to improve executive decision-making. The Secretary of Defense should urge the President to take similar steps government-wide.

15. **The Secretary of Defense should direct a review of war college core courses of instructions for nuclear strategy and operations to strengthen the preparation of senior military officers for future responsibilities.**

2. A "red line" in this report is a boundary that, if crossed, will trigger punitive action against the offender.

If nuclear weapons are used against, or employed by, the United States, senior personnel need to understand the ramifications and basic requirements.

16. **Commander, U.S. Strategic Command, should review errors made in recent years by the operating forces and examine implementation of requirements for command and control of nuclear weapons to determine if more effective procedures can be devised.**
17. **Commander, U.S. Strategic Command, should review with the Director of National Intelligence and strengthen reconnaissance planning for the nuclear dimension of the global strike mission.**
18. **Commander, U.S. Strategic Command, should strengthen competence to identify consequences of targeting actions (battle damage assessments).**
19. **The Secretary of the Air Force and Secretary of the Navy should fund advanced development programs to technically evaluate potential replacement systems to maintain and renew necessary skills in anticipation of the end-of-life of U.S. nuclear-capable delivery systems.**

    In particular, the task force strongly believes an advanced development program for ICBM application is needed to evaluate concepts that might be applied to any follow-on to Minuteman III. Secretary of the Air Force should review the nuclear weapons systems and weapons effects capabilities and expertise to determine if re-establishment of the Air Force Weapons Laboratory or other options are needed.
20. **The Assistant Secretary of Defense for Strategic Weapons (when appointed) and Director, Defense Threat Reduction Agency (DTRA) should rebuild the capabilities to define and update the range of nuclear threat environments that U.S. forces may face in deployed operations and in the homeland.**
21. **The Chairman of the Joint Chiefs of Staff and service chiefs should require that the competencies of military forces operating in nuclear environments be rebuilt.**

The Chairman and service chiefs should direct that joint education, training, and exercises include aspects of such operations. The Secretary of Defense should assign DTRA responsibility for technical support to exercising, gaming, education, and system/network response assessments related to nuclear survivability.

22. **Service chiefs; Director, DTRA; and Administrator, NNSA, should grow a new technical design and development skills base for the nuclear weapons effects enterprise.**

Identify skills base essential to sustain the current systems and to design, develop, and operate replacement systems. Rebuilding this capability should entail modeling and simulation capability analogous to that for weapon design. A minimum "national" nuclear weapons effects simulator enterprise should be defined to maintain the unique expertise necessary to operate ranges and test facilities. An exchange program should be implemented between DOD, Department of Energy (DOE), and NNSA laboratories to ensure remaining talent stays in the field. This community should be charged with teaching operations, system design, code development, simulator advancement, and hardening innovations. A long-term plan for growing and maintaining talent should be developed that is connected with a sustained research and development program in all agencies to ensure a career path for professionals.

23. Congressional oversight of the nuclear weapons program should be reinvigorated.

Historically, the Congress took a major role in overseeing and supporting the nuclear weapons program. Focused and structured oversight is important today to strengthen the program, as well as the public's perception that the program is indeed a matter of supreme national interest. Focused and structured oversight should also provide the basis for the Congress to establish a multi-year fiscal commitment to the program. This would provide essential fiscal stability and assurances to those personnel working on the scientific and technical challenges of the long-term support of their missions. Finally, the Congress needs to provide positive, explicit reinforcement of the public service character of the mission to maintain a safe and reliable nuclear deterrent.

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**Indicates that the author is currently an employee of the U.S. government but was not at the time of writing.*

In the Eyes of the Experts

Twenty years after the end of the Cold War, nuclear weapons are once again at the forefront of international affairs as events from far-flung regions of the world ramp up the debate on the objectives and direction of America's strategic posture. In May 2009, the Congressional Commission on the Strategic Posture of the United States, led by Chairman William Perry and Vice-Chairman James Schlesinger, presented its final report to the President and Congress. As a companion volume to the final report, "In the Eyes of the Experts: Analysis and Comments on America's Strategic Posture" is a collection of papers and ideas that commission experts submitted to the commissioners over their many months of deliberation. This team of experts has extensive knowledge of national security, defense policy, nuclear engineering, nuclear arms control and nonproliferation, and intelligence. Their papers provided comprehensive and thoughtful analysis to the commissioners on pressing matters of national and international concern.

To better inform the public discussion of America's strategic posture, this timely compilation offers an in-depth view into the material presented to the Commission as it formed its conclusions. A guide for the expert and layman alike, "In the Eyes of the Experts" explores the gamut of strategic issues, including deterrence, strategic infrastructure, arms control and nonproliferation, that will shape the discussions and decisions of America's leadership.

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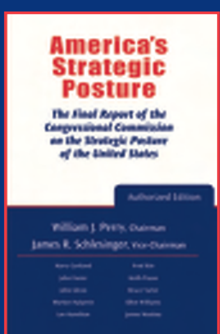

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