

U.S. Nuclear Policy in the 21st Century

A Fresh Look at National Strategy and Requirements

Executive Report

July 1998

PREFACE

The security challenges facing the United States today are as complex as at any time in our nation's history. The confluence of revolutionary political, economic, and technological changes has made defense calculations less predictable and the maintenance of peace no less difficult than in the past. Recognizing the need for a fresh, long-term look at national strategy and requirements, and specifically at U.S. nuclear policy in the 21st Century, the Center for Counterproliferation Research at the National Defense University and the Center for Global Security Research at Lawrence Livermore National Laboratory brought together a group of experts with extensive experience in national security and military affairs. This report is the product of their collective efforts, which were based on a shared perception of the need for a thorough review and greater understanding of the role of nuclear weapons in U.S. national deterrence policy.

The participants examined the broader trends in the international environment and considered how the United States could both shape and respond to them. A forward-looking paradigm for the nuclear dimension of U.S. security policy emerged that builds on the lessons of the past while addressing the opportunities and challenges of the future. The core of this paradigm is that nuclear weapons will continue indefinitely to play an indispensable role as a hedge against uncertainties, to deter potential aggressors who are both more diverse and less predictable than in the past, and to allow the United States to construct a more stable security environment. Thus, the United States needs a credible nuclear deterrent posture, broadly defined to include forces-in-being; capabilities for weapon system design and production; and the ability to assure the safety and reliable performance of the nuclear stockpile— a fundamental challenge in the absence of underground testing. Because this posture must be both adaptable and responsive to new threats, the national deterrent infrastructure must be treated as a strategic resource. The posture must also integrate the growing role of defenses in our deterrence calculations. All of this requires trained and motivated people, as well as new ways of thinking and considerable agility and foresightedness on the part of U.S. leaders.

The more than forty study participants and government observers included present and former policymakers, military officers, scientists, and academics. The Project Report reflects their research, analysis, and intensive discussions that took place during the winter and spring of 1998. This Executive Report contains the key judgments of the study. The individual subgroup papers included in the Project Report -- policy, operations, infrastructure, and stockpile -- provided the foundation for these judgments. The views expressed in all of the reports and papers are those of the participants. These views may not be shared by all members or observers, and do not necessarily represent official U.S. government policy.

While this report was undergoing final editing, India and Pakistan each conducted a series of nuclear tests. The participants did not have the opportunity to consider the implications of these events. These

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events do, however, support our judgment that, whether we like it or not, nuclear weapons will be an integral feature of the world security environment for the indefinite future. These recent tests also reinforce the need for a broader national understanding of the role of nuclear weapons in U.S. deterrence policy. This report is intended to contribute to that understanding.

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Introduction

Sweeping changes are occurring in the international system, presenting the United States with both opportunities and challenges. The East-West strategic rivalry that dominated the global security environment for over forty years has been fundamentally and, in a number of critical ways, irreversibly altered. Yet the world continues to be unpredictable and dangerous. Relations with Russia and China have improved dramatically in the last ten years but remain uncertain. Both states continue to emphasize and modernize their nuclear arsenals. In other regions of vital interest to the United States, potential adversaries increasingly have at their disposal advanced conventional and unconventional capabilities, as well as weapons of mass destruction and the means for their delivery. Together, these and other factors, such as the ongoing revolution in military technology, have engendered major adjustments in U.S. national security policy and in the strategy and forces that support U.S. security interests.

A series of U.S. government analyses, including the Nuclear Posture Review and the Quadrennial Defense Review, has guided the restructuring of U.S. conventional forces and provided the basis for the late 1997 Presidential Decision Directive on nuclear weapons policy. Further analyses and adjustments will certainly follow. As a contribution to this dynamic process, this report assesses the rationale and requirements for U.S. nuclear weapons, and the infrastructure and people that are critical to their sustainment, in the current and future security environment. By so doing, the report is intended to promote greater understanding of the issues and the measures that will be necessary to sustain deterrence in an uncertain future. The American public and its leadership in both the Executive and Legislative branches must remain informed, involved, and supportive. Absent concerted and continuing high-level attention to the policies and programs supporting its nuclear forces, the U.S. deterrent posture will erode, thereby undermining the ability of the United States to prevent war in the future. Nuclear deterrence is not self-sustaining.

In conducting this examination, the participants:

- Explored the past role of nuclear weapons in U.S. national security strategy and relevant "lessons learned" from that experience.
- Evaluated the changes in the international environment, including advances in technologies, and the implications of these changes for U.S. deterrence objectives, specifically for nuclear weapons policies, force structures and programs.
- Examined the nature of the contemporary and projected military threats, and the consequent rationale and requirements for deterrence into the future.
- Assessed the strengths and identified emerging gaps in the areas of nuclear operations, the supporting infrastructure, and the weapons stockpile that must be addressed to sustain deterrence

as a key element of the overall U.S. security posture.

This report presents the key judgments of the project based on the insights of the participants in four critical areas: policy and strategy; operations; military-related infrastructure; and the nuclear weapons stockpile. Each of these areas is addressed in detail in the final Project Report.

Nuclear Weapons and Deterrence in the 21st Century

Looking to the future global environment and to the ability of the United States to shape and respond to that environment, the project participants developed a paradigm suited to the new and uncertain security setting of the next century. Taking into account the understandings and experiences from the past, this paradigm envisages a dynamic, adaptable approach to the security challenges of the future. The paradigm recognizes the continuing need for deterrence in a complex world and for the retention of nuclear weapons as an essential component of the U.S. national security strategy. Yet, the role that these weapons will play in the early 21st Century, and the consequent requirements for the U.S. nuclear deterrent posture, will differ from the past. The paradigm is based on a number of elements:

- *Nuclear weapons will continue to play a unique and indispensable role in U.S. security policy.* The bilateral "nuclear balance" that occupied center stage in the past no longer dominates the strategic calculations of the United States or Russia. The number of nuclear weapons deployed by both sides has declined dramatically. Yet, U.S. nuclear weapons serve as a vital hedge against an uncertain future and contribute to deterrence of a wider and less predictable set of potential adversaries, including those armed with weapons of mass destruction. Nuclear weapons are also essential to ensure U.S. security guarantees to friends and allies, providing greater stability in the international environment and promoting U.S. non-proliferation goals.
- *Whether we like it or not, nuclear weapons will be part of the global security setting.* The knowledge to build them will continue to exist; they cannot be disinvented. Moreover, in some regions – notably South Asia and the Middle East – the value ascribed to demonstrated nuclear prowess has been increasing. The Indian nuclear tests in May 1998 and the rapid Pakistani response demonstrated the resolve of these governments, backed by domestic public opinion, to risk international censure for stated security reasons. The Indian and Pakistani tests may anticipate a long-term trend that could significantly increase the number of de facto nuclear weapons states. The emergence of more "declared" or "demonstrated" nuclear states may be inevitable. This trend points to a more, not less, nuclear world.
- *Even if the United States were to divest itself of its nuclear arsenal, other states would be unlikely to follow suit.* To the contrary, some would gain additional incentives to retain or acquire nuclear weapons against a conventionally superior but nuclear-free United States. Even if nuclear weapons were somehow eliminated, a serious deterioration of the international environment would engender strong incentives for nuclear rearmament. A rapid, competitive, multilateral race to rebuild nuclear arsenals could increase prospects for a devastating war. A century ago, no one foresaw the rise of Hitler, of Mussolini, or of Communism. The rise of similar leaders or ideologies in the future, coupled with a race to rearm with nuclear weapons, could be catastrophic.
- *In the changing security setting, the nuclear weapons infrastructure -- broadly defined to include both the operational and the development/production capabilities that can maintain current capabilities and bring new forces into being when needed -- takes on a heightened strategic*

prominence. This prominence will require a greater attention to adaptation and reconstitution. Greater flexibility in both planning and maintaining forces is also essential. Together, this requires "total posture planning," which recognizes that the credibility of deterrence, as well as the capabilities that form its basis, is the product of the totality of the U.S. nuclear posture – forces-in-being, research/development infrastructure and production potential, reserves, stocks of material, skilled manpower -- and their integration with non-nuclear capabilities. Because changing the nuclear posture in response to a changing world will take time, total posture planning must look well into the future.

- *Increased and sustained engagement with other nuclear weapon states is required to foster non-adversarial relationships and to develop and strengthen the stability of nuclear postures.* With Russia, the United States must move beyond the corrosive Cold War posture of mutual vulnerability and build on cooperation to enhance mutual confidence, such as in the area of early warning. The United States will need to broaden today's discussion to encompass total nuclear capabilities (not just deployed strategic forces) and active defenses in order to enhance stability and permit the United States to meet its global security responsibilities and defend against the growing missile threat. The United States will also need to increase engagement with China, a state that presents even greater uncertainties than Russia. In a different context, it is necessary to sustain cooperative relationships with allies -- nuclear and non-nuclear alike -- to maintain the essential sense of security that flows from extended deterrence.

The paradigm recognizes that the fundamentals of deterrence have not changed: effective deterrence will continue to depend on both real capabilities and the perception of a national will to respond to aggression. Yet, there is an opportunity and need for a more balanced relationship among the three traditional elements of deterrence -- retaliation, denial, and dissuasion. During the last half-century, each of these elements supported the overall U.S. security strategy. Although the relative importance of each changed over time in response to evolving political, military, and technological considerations, deterrence relied principally on a ready capability to retaliate with deployed nuclear forces. While robust and credible nuclear forces-in-being will remain essential, the United States can place greater emphasis on deterrence by denial through active defenses, and deterrence through dissuasion. Dissuasion is the term we use to characterize the impact of the total U.S. deterrent posture, including infrastructure, in shaping the security environment, and specifically in shaping the calculations of potential adversaries. A brief overview of how these elements operated in the past can help to anticipate how they may work in the future.

Retaliation: The central element of U.S. deterrence policy throughout the Cold War was the prospect of a prompt and unacceptable level of retaliation in response to nuclear or conventional aggression. The objective of U.S. nuclear forces was to prevent war by convincing the Soviet Union that it could not win any military conflict it initiated. The logic of deterrence required that the United States be able to destroy those targets that it believed the leadership of the Soviet Union most valued. These included conventional and nuclear forces, leadership, and industrial facilities that supported military strength and the power of the state. To be credible, particularly after the Soviet Union acquired nuclear weapons and the ability to strike the United States, the threat of retaliation had to be backed by responsive, effective, and survivable forces. After the early 1960s, the U.S. strategic force was embodied in the TRIAD-- bombers, intercontinental ballistic missiles (ICBMs), and submarine-launched ballistic missiles (SLBMs) -- which complicated Soviet planning and ensured that even if for technical or other reasons one leg became vulnerable, the vitality of the remaining legs would deny the Soviet Union any advantage from a first strike. Further flexibility was provided by theater nuclear weapons (also called "sub-strategic" or "non-strategic") integrated with combat forces to enhance deterrence against massive conventional attack. Because of the magnitude of Soviet conventional and nuclear forces, and the immediacy of the threat they posed, the United States could not rely solely on mobilization of resources

after the onset of a crisis, as it already had done twice in the 20th Century.

Denial: Denying an adversary the ability to achieve his goals through military means, that is blunting or negating the effectiveness of his forces, was another means of strengthening deterrence during the Cold War. Before the advent of ICBMs, air defenses against Soviet bombers played a large role in the U.S. deterrent posture. Passive defense, in the form of civil defense measures, was also seen as enhancing deterrence. With the advent of large numbers of long-range ballistic missiles -- and the adoption of the mutual assured destruction doctrine and its successors -- defenses were given a much-reduced role. In the context of assuring the effectiveness of offensive retaliatory forces, the 1972 ABM Treaty codified strict limits on strategic defenses and thereby accepted the vulnerability of the U.S. population to Soviet nuclear attack. From the mid-1980s until the early 1990s, in an effort to move beyond this vulnerability, the United States greatly expanded research and development aimed at giving active missile defenses increased weight in the deterrent concept.

Dissuasion: During the Cold War, in addition to military forces-in-being, the United States possessed a range of other capabilities that, collectively, helped convince potential adversaries of the ultimate futility of large-scale military aggression. For example, in addition to U.S. economic strength and political leadership, the highly visible research and development, production, technology, and industrial base of the United States enabled it to deploy forces that would deter nuclear attack, and to portray a national commitment to counter any threat. This posture conveyed not only the existing capabilities of the United States, but its overall long-term potential, that is, what the United States could develop and deploy in the future. This helped shape Soviet views of their bleak longer-term options and prospects. Former Soviet officials have cited intermediate-range nuclear missile deployments, the Strategic Defense Initiative, the computer revolution coupled with export controls, and the expanding Western economy as factors that helped convince the Soviet leadership that sustaining the strategic competition for an indefinite future would ultimately

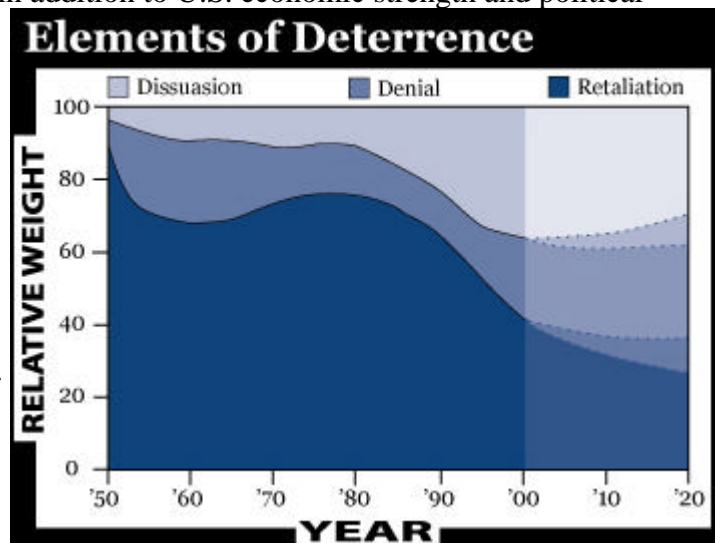


Figure 1. A notional representation of the changing contribution to deterrence of retaliation, denial, and dissuasion. The data are purely illustrative.

result in a situation they would find untenable. Recognizing the decay and near bankruptcy of their own industrial and societal base, these leaders understood the need to transform the Soviet system fundamentally, a process that, once begun, unleashed the forces that would bring down the Soviet state.

The relationship between and among retaliation, denial, and dissuasion in the security setting will continue to evolve. The United States will need to deter actors who may not respond to deterrence in the same way as the former Soviet Union. Effective retaliatory forces will always be a central requirement for and the ultimate foundation of deterrence -- we place no credence in "virtual deterrence." Forces-in-being provide a critical hedge against other nuclear weapon states, and serve to deter major aggression more broadly, including the use of chemical and biological weapons (CBW). Yet, in this new security environment the United States must be prepared to adjust to the way it structures deterrence, relying less on the threat of retaliation and more on denial and dissuasion.

One challenge of the future will be to take advantage of denial capabilities. Technological advances and sound policy (such as a decision not to accept mutual vulnerability relationships with other states) will surely increase the perceived utility of active defenses. The emergence of regional adversaries armed with CBW and increasingly longer-range ballistic and cruise missiles has already created a new emphasis on denial in theater warfare, placing additional value on theater missile defense (TMD) and on other improved active and passive measures. Development of even longer-range capabilities by such states will increase the importance of national missile defense (NMD).

Another important challenge will be to articulate and enhance the role of dissuasion as a fundamental element of U.S. deterrence, to continue to develop effective tools of dissuasion, and to integrate them into deterrence policy. Some of the capabilities that bolster dissuasion and relate specifically to this study include the requirement to sustain a flexible nuclear posture, to embrace a visibly active planning process that encompasses the total posture, to broaden intelligence efforts that support deterrence, and to sustain an infrastructure capable of meeting any threat. The total posture must be planned so that it will be responsive both to new threats and to new opportunities to attenuate threats. The importance of sustaining a national deterrent infrastructure that provides the flexibility to respond in time to military threats against the United States and its allies will be fundamental.

Key Judgments

The United States faces two major foreign and security policy challenges as it moves into the next century: *first*, to create and use opportunities to achieve a more peaceful and prosperous world order and, *second*, to manage and discourage potential conflicts across a broad spectrum, many of which may engage the United States directly. Both of these challenges will require the United States to define the role that deterrence will play in national security policy. As in the past, deterrence will require a broad range of capabilities. In this context, a number of key judgments can be drawn.

Judgment: Nuclear weapons will remain indispensable to U.S. security.

Nuclear weapons were first developed during a major conventional war that claimed the lives of tens of millions of combatants and civilians. The only employment of nuclear weapons to date was in that conflict, when this "absolute" weapon was used, not as a deterrent, but as a means to defeat Japan's will to fight, end World War II, and avoid the high human costs of an invasion of the Japanese mainland. Based on the number of casualties from Okinawa and the fire bombings of Tokyo and other cities, the decision to use nuclear weapons against Hiroshima and Nagasaki is often credited with having saved many more lives, allied and Japanese, than it took.

Despite this legacy, nuclear weapons today are most commonly viewed as tools of deterrence -- tools that were instrumental in maintaining a long-standing "balance of terror" shaped by the political, military, and technological dynamics of the Cold War when both the United States and Soviet Union managed an adversarial "coexistence" primarily through the prism of nuclear weapons. For the United States, these weapons were for decades seen as critical in deterring war, particularly a massive Soviet conventional attack in Central Europe that could include the use of nuclear and chemical weapons. No one doubted the terrible destructive power of these weapons or the incalculably horrific consequences of nuclear war. It was the very certainty of such knowledge upon which the policy of deterrence was based.

The United States is no longer concerned with what was for many years a grave and urgent prospect of large-scale armed conflict in Europe. Today, the threat of war between the United States and Russia has

been greatly diminished, as relations have improved politically, economically and militarily. The capabilities of this former opponent have changed fundamentally.

The positive changes in the relationship between the United States and Russia are apparent in the U.S. military posture. Conventional forces in Europe have been reduced by two-thirds and restructured for regional conflicts. On the nuclear side, most U.S. theater nuclear roles – those that required atomic demolition munitions and artillery-fired atomic projectiles-- which were relied on to offset Soviet conventional superiority, have been eliminated. In fact, U.S. theater nuclear forces have

Figure 2. Wartime fatalities as a percentage of population have declined significantly in the 50 years since the nuclear era began.

declined by over ninety percent. At the strategic level, through formal arms control agreements and mutual actions, the United States and Russia have each reduced from

about 12,000 to 6,000 deployed strategic warheads accountable under START I. If START II is implemented, these levels will be reduced to about 3,000 to 3,500 on each side. The levels under discussion for START III would bring this down even further to about 2,000 to 2,500 accountable warheads. The corresponding reduction in U.S. megatonnage, a common measurement of destructive power, has exceeded the decline in the number of delivery vehicles, reaching over ninety percent.

Promoting Strategic Cooperation With Russia

Since the end of the Cold War, the United States and Russia have made significant progress in addressing problems in critical areas of nuclear safety and security. Cooperatively, the two countries are working, with some success, to improve the overall security of former Soviet nuclear facilities, promote fissile material control and accountability, and support the dismantlement of some Russian nuclear forces.

There remain other areas of concern that could benefit from expanded cooperation. One candidate is the possible sharing of early warning data to enhance command and control and to increase stability in peacetime as well as during potential crises. The United States and Russia began preliminary high-level discussions on the possibility of cooperating on early warning in the summer of 1992, in the context of U.S. and Russian proposals for establishing global protection against ballistic missiles. At that time, it was becoming clear that Russia would experience a loss of radar coverage from sites that, following the break-up of the Soviet Union, would be located outside its territory. Consequently, among other things, the discussions explored ways that could fill gaps in the Russian early warning system. It was anticipated that such cooperation would be particularly useful on the southern periphery to provide better early warning against states that were acquiring weapons of mass destruction and ballistic missiles as a means of delivery. These promising discussions were discontinued.

The United States and Russia should resume high-level discussions on early warning. The prospects for mutual benefits from such cooperation remain valid today. A combination of several approaches could be pursued. One approach may be for the United States to provide Russia with selected technology that facilitates the indigenous rebuilding of its early warning systems. Another approach might be to share early warning data in a transparent framework. In addition to the obvious benefit for Russia, there is likely to be

substantial value for the United States to have access to Russian information, because it might provide tracking or confirmation of launch locations from another azimuth, as well as useful data about missile launches from Asia. A third approach might be to establish a direct link between command centers to allow for resolution of ambiguous indications.

Positive changes have occurred in the security setting. However, the world remains uncertain and dangerous. The United States should continue its efforts to prevent proliferation, but must recognize that other states will continue to retain nuclear weapons, and still others will try to acquire them.

U.S. nuclear weapons serve to protect against an uncertain future with Russia and China, states that continue to value nuclear weapons for both political status and, in Russia's case, to overcome what it sees as a growing conventional inferiority. In fact, nuclear weapons appear to play a growing role in the security strategy of Russia, both in declaratory policy and defense planning. The retention of between 10,000 to 15,000 (and perhaps many more) theater nuclear weapons, the recent deployment of the new SS-27 ICBM, and a continuing investment in its overall nuclear infrastructure, especially hardened command and control facilities and the extensive nuclear weapons production complex, indicate how important these weapons are to Russian military and political leaders. The strategic uncertainties with China are perhaps even greater than those with Russia. As an emerging global power, China also highly values its own modest but capable nuclear forces, as demonstrated by its tests of a new generation of nuclear weapons before signing the Comprehensive Test Ban Treaty.

The United States also requires the means, both conventional and nuclear, to deter aggression and control escalation by regional and rogue states armed with nuclear weapons. States such as North Korea and Iran either have or are aggressively pursuing the acquisition of nuclear weapons. Evidence demonstrates that, despite the important contribution of international non-proliferation regimes and norms, a determined proliferator will likely succeed. Such states do not seek nuclear weapons because the United States has nuclear weapons. Rather, their motives for acquiring nuclear weapons are numerous and overlapping, ranging from status, to regime survival, to use as tools of aggression against neighbors. Key among these incentives is deterring the United States from intervening with conventional forces in regions in which these states seek to achieve their goals through the use of force. In this context, one principal lesson of the Gulf War was that such states currently cannot compete with the United States on the conventional battlefield and therefore must threaten to use asymmetric strategies to discourage U.S. intervention. U.S. nuclear weapons contribute to the prospect that any such attempts to deter us will not succeed.

As other weapons of mass destruction -- chemical and biological -- spread to potential adversaries in regions of vital interest to the United States, and as the likelihood of the use of these weapons increases, U.S. nuclear forces become an even more important factor in deterring attacks on U.S. forces and population, as well as on those of friends and allies. Because of their unique character, nuclear weapons have long served as an expression of the U.S. capability and determination to deter a broad range of threats to vital interests. These weapons may, in the future, provide the clearest and most visible statement of the national will to deter chemical and biological attacks. The new circumstances associated with the spread of CBW, as recognized in national guidance, have expanded the role of U.S. nuclear weapons as a deterrent against such use.

The real world example of Iraq's behavior in the Gulf War is instructive. While it is impossible to determine with absolute certainty why Iraq did not use its chemical or biological weapons against the U.S.-led coalition in 1991, Iraqi statements have emphasized that U.S. nuclear weapons played significantly in their calculations. Furthermore, U.S. policymakers sought to convince the Iraqis that they could not discount the possibility of a U.S. nuclear response to Iraqi use of chemical weapons.

Some of these policymakers later stated that nuclear weapons would never have been employed. However, they make this statement not to deny the deterrent value of nuclear weapons, but to emphasize that there was no operational role for these weapons given the rapid victory of the coalition's conventional forces. Had Iraq used CBW, this judgment could have been quickly reevaluated.

U.S. nuclear weapons have also formed an indispensable basis for achieving stability through extended deterrence. U.S. nuclear weapons remain important to assure our friends and allies that their security is linked as fully as possible to that of the United States. The U.S. nuclear arsenal was designed and deployed in a way that provided credible security guarantees to allies. The United States extended deterrence by making it clear that it would, if necessary, use nuclear weapons in response to a Soviet nuclear or conventional attack on allies, especially in Europe and Japan. Although the United States, together with its NATO allies, sought to deploy a conventional force posture that could avoid an early resort to nuclear weapons to halt a potential Soviet advance, the Alliance did not forgo the option for "first use" of nuclear weapons, if needed, in a conflict in which the Soviet Union employed only conventional forces. Indeed, U.S. doctrine was "no first use of force," while reserving the right to respond to the use of force by others by drawing on the full range of available and appropriate capabilities. In this sense, U.S. strategy held nuclear weapons to be essential for deterring the use of conventional and chemical weapons, as well as nuclear use by the Soviet Union. The extended deterrence concept, which underscored the "coupling" between U.S. security and that of the allies, existed in a strategic setting in which the United States had an explicit security guarantee with allies, backed by vast nuclear and conventional military capabilities and the forward deployment of hundreds of thousands of U.S. troops and their families in Europe and Asia.

As with the United States, the overall threat to most allies has declined. Yet, from Japan and Korea in the Far East, to Germany and other NATO allies in Europe, U.S. nuclear weapons continue to reassure allies, provide stability, promote peace and, by reducing incentives or eliminating the need for others to acquire nuclear weapons, contribute to nonproliferation goals.

For political and strategic reasons, the United States, as a nation with vital interests around the globe, must maintain conventional and nuclear forces consistent with its security responsibilities, interests, and commitments. There is wide agreement that the global role played by the United States requires continued investment to maintain superiority in conventional capabilities. There is also consensus that the great superiority in conventional forces the United States currently possesses provides a key element of deterrence for a wide range of threats. However, while advanced conventional forces contribute to deterrence, they are not a substitute for nuclear weapons. The United States cannot be certain that all adversaries will be deterred by the U.S. edge in conventional capabilities, especially if these adversaries are tempted to acquire weapons of mass destruction, including nuclear weapons, precisely because of their perceived value in posing an asymmetric threat. Moreover, looking to the future, there is no guarantee that the United States will maintain its qualitative conventional edge in all key areas, either because of funding deficiencies caused by competing national priorities or because other states will supercede the U.S. in key technologies, or adopt effective asymmetrical strategies.

The United States has security interests and requirements different from all other states. The global role the United States plays today imposes unique risks and responsibilities. For these reasons, the United States should not tie its capabilities to those of any other single state, such as Russia, which for a variety of reasons may reduce its strategic nuclear systems to relatively low levels. Furthermore, the United States clearly could not meet its international security responsibilities if it reduced its nuclear weapons stockpile to a level comparable to that of a regional nuclear weapons state, such as China. Finally, the suggestion that the United States could accept very low numbers of nuclear weapons (e.g., on the order of the numbers estimated to be attainable by nations such as India and Israel) reflects more an aspiration for a nuclear-free world than the basis for a sound national security policy and capability.

Such low numbers may even inspire other nations to seek parity with U.S. nuclear forces, with the perceived political status that equality would confer.

In addition to maintaining nuclear forces consistent with national security requirements, U.S. declaratory policy must be tailored to enhance credibility and reinforce deterrence. Proposals that the United States move toward a policy of "no-first use" of nuclear weapons, perhaps by expanding negative security assurances, have been consistently rejected for sound strategic reasons. These reasons remain valid today. To deter credibly, the United States must reserve the right to determine the time, place, and nature of its response to aggression. The United States must be very clear that it will respond decisively to aggression, leaving open the precise character of that response. To do otherwise risks allowing an aggressor to devise strategies that limit the ability of the United States to respond. The very uncertain nature of the potential U.S. response, coupled with an ability to respond overwhelmingly, complicates an aggressor's calculations, contributes to his uncertainty of success, and makes deterrence credible.

In conclusion, although nuclear weapons play a less visible role in U.S. national security calculus than in the past, they continue to make an indispensable contribution to the defense of the United States. Nuclear weapons remain the "ultimate deterrent" -- instrumental in deterring the use of nuclear weapons against the United States, in deterring other weapons of mass destruction, and in deterring future large-scale conventional attack against the United States or friends and allies. Moreover, by enhancing stability and promoting nonproliferation objectives, U.S. nuclear weapons further contribute to U.S. and international security.

Judgment: The U.S. nuclear deterrent force must be structured to counter existing and emerging threats.

The credibility of the U.S. nuclear deterrent must never be open to question. The U.S. nuclear posture today -- both policies and forces -- can be different from those of the past when the United States faced a much larger and more immediate threat. At the same time, based on the lessons of the past and an assessment of the future, it is clear that certain attributes of the nuclear deterrent must endure if the United States is to be perceived as having the capability and will to meet the security challenges it now faces.

To achieve a stable deterrent, experience has demonstrated that U.S. nuclear forces must possess certain fundamental characteristics:

- The nuclear deterrent forces must be *safe and secure*. There can be no relaxation of the extremely high standards of safety that have been achieved.
- The forces must be *responsive* to political control and *effective* against the entire range of potential targets contemplated in the strategy. Both U.S. leaders, and the leadership of the states to be deterred, must have confidence in the ability of the United States to strike when and where it believes necessary.
- The overall forces must be *survivable* so that no adversary perceives vulnerabilities to exploit, thus undercutting stability.

Stories about the possible erosion of Russian nuclear command and control capabilities, even if exaggerated, point to a legitimate concern. Precautions against accidental, mistaken or unauthorized use of nuclear weapons have always been of critical importance. Steps to strengthen precautions should include cooperation between the United States and Russia on enhanced early warning, the restructuring of nuclear forces as provided in START I and II, deployment of missile defenses and, over the longer term, continued support for political and economic reform in Russia.

The concept of de-alerting -- that is, taking nuclear forces off alert status and rendering them incapable of timely response -- has been offered by some as a means to assuage concerns over the deterioration of Russian warning and command capabilities. Numerous schemes have been proposed for de-alerting major portions of the U.S. deterrent forces or to have the United States rely solely on a single leg of the TRIAD. None of these proposals would contribute to U.S. security and most would be harmful. Some de-alerting has been done in the past as a symbolic political gesture to reinforce steps already planned and to encourage continued political movement. However, de-alerting measures that have been proposed in the name of safety and stability concerns would not solve any of the alleged problems for which they are advocated and, in fact, would make many of them far worse, including in the area of basic security of nuclear weapons.

Most fundamentally, the majority of recent de-alerting proposals are unverifiable and some would lead to crisis instability. De-alerting undermines a basic principle of deterrence; namely, the ability to retaliate promptly so as to prevent any aggressor from assuming it can achieve a "fait accompli." In this context, assertions that de-alerting of U.S. strategic forces would eliminate fear of surprise attack have not been demonstrated, and substantial evidence suggests de-alerting would make such an attack more attractive by making an effective first strike possible at very low attack levels. This possibility would only increase tensions on both sides and provide incentives to strike first. Any moves to place nuclear forces back on alert in a crisis (if needed for deterrence or survivability) would be seen as escalatory if taken, and would be destabilizing if not. Finally, de-alerting major portions of the U.S. deterrent force would undermine alliance security guarantees and further exacerbate the disparity in U.S. and Russian theater nuclear force levels.

For these reasons, the United States should not make significant changes to its current alert posture. De-alerting should not be allowed to become a back door to unilateral nuclear disarmament.

The United States should retain the three legs of the TRIAD (ICBMs, SLBMs and bombers). Elimination of any one leg would weaken deterrence. The TRIAD remains valuable for the same reason it always has: the synergy of the three legs. That synergy provides flexibility to our leadership, enhances survivability, and complicates defenses, thus strengthening deterrence. Diverse basing and penetration modes also provide a hedge against both a technological breakthrough by an aggressor and discovery of significant material problems with any one system. Each component of the TRIAD has important qualities.

- ***SLBMs.*** Individual Trident submarines when in their patrol areas remain the most survivable forces in the TRIAD and thereby add significant stability. Yet, having too large a percentage of SLBM warheads in a small number of submarines would incur the risk of catastrophic failure in the deterrent in the event of a breakthrough in antisubmarine warfare capability, or undiscovered deficiencies in the Trident system. Further, strategic submarines are vulnerable in or near their two operating bases. Over time, limiting the U.S. deterrent to a small number of platforms could invite

an adversary to invest in a capability for various forms of attack, including an attack for which it would be difficult to establish cause or blame. Because the losses would not be replaceable, overall U.S. capabilities could be significantly eroded.

- *ICBMs.* As Russian nuclear forces are reduced, the U.S. single-warhead, silo-based ICBMs are of increasing value in deterring large-scale attack. First, any attack on U.S. ICBMs would necessarily have to be large and unambiguous; any potential attacker would have to assume substantial retaliation. Second, to conduct a large-scale attack on the U.S. ICBM force with high confidence, an adversary would need to commit a large fraction of his forces, probably by using at least two warheads to attack each silo. Even if such an attack were successful, the result would be that the United States would retain (in the SLBM and bomber forces) a very large advantage in the number of remaining operational warheads, a position no adversary would likely find acceptable. In this way, the elimination of ICBMs with multiple warheads will change the perception of ICBMs from being considered de-stabilizing (because a small number of multiple warhead ICBMs can threaten a larger number of missiles in silos) to being considered stabilizing (because the attacker would need to expend far more warheads than would be destroyed and because the nature and source of an attack would be unambiguous). Further, if there were no U.S. ICBMs, an adversary might, during time of great crisis, be tempted to conduct a limited surprise attack (for example, from a single ship at sea) against the small number of U.S. bomber bases and submarine support facilities. Such an attack--which could be portrayed as the work of a rogue crew even if it were not -- would have a devastating effect for an extended period on the U.S. ability to respond. The decision to retaliate might be difficult, given the ambiguity of the attack and the forces remaining to the adversary. The existence of significant numbers of single-warhead ICBMs greatly reduces the potential gain from such a small, ambiguous attack.
- *Bombers.* The United States will continue to require bombers for their conventional capabilities. The issue is whether these bombers should also be nuclear-capable. There are strong reasons to retain the bomber leg of the TRIAD. Given the continuing conventional contingency mission of the bomber force, the low incremental cost of maintaining its nuclear capability will remain a bargain. Further, bombers can be restored to full alert in a relatively brief period; and doing so could be a powerful signal of U.S. resolve, which does not in itself pose a first strike threat. Finally, without bombers, the United States would be left with a single penetration mode (ballistic missiles), thus simplifying an adversary's problem of defending against a retaliatory strike and leaving the United States with no hedge against the emergence of effective ballistic missile defenses in China or Russia.

In addition to strategic forces, the United States requires theater nuclear forces that can couple U.S. capabilities closely and visibly to the security of friends and allies. The United States should retain the nuclear capability currently deployed in NATO Europe. In designing a posture to deter regional states that possess weapons of mass destruction, the United States should also maintain the capability to deploy nuclear forces with a range of capabilities swiftly into other regions. From an operator's perspective, strategic forces can strike targets anywhere on the globe, and strategic aircraft can be deployed outside the United States. However, there may be circumstances when the best deterrent will be a visible and more proximate deterrent force. The ability to bring theater nuclear forces into any region in a time of crisis and to use such forces, if necessary, could provide the most credible deterrent. There may also be circumstances where the deployment of nuclear forces to a region would send a powerful message of coalition political solidarity in a way that U.S.-based forces might not. This policy rationale supports the long-term retention of dual-capable tactical aircraft and nuclear-armed sea-launched cruise missiles. To retain this capability, the United States must maintain effective delivery means. This can be accomplished by ensuring that currently projected aircraft (such as the Joint Strike Fighter) are capable of performing both conventional and nuclear missions, and by assuring that the

option to use a naval nuclear land-attack cruise missile is available.

Command and control of nuclear forces is critical for assuring deterrence. There must be no perception of vulnerability that could invite attack. There must be no doubt that U.S. forces can strike when and where directed by national authorities. Strategic command and control -- like all command and control -- will continue to evolve. In the coming decades, the ongoing revolution in commercial capabilities, coupled with secure encryption techniques, will offer new possibilities. Hardened data rather than hardened systems is an important concept for future command and control systems. In the future, military communications will consist of military data flowing over many commercial networks, just as financial or any other data will. A related shift in focus will be in the transmission of data. Strategic command and control data will flow through two systems: a flexible day-to-day family of networks and a survivable, dedicated military element for absolute assurance of delivery of critical messages from the National Command Authorities.

There are some important caveats to these concepts. The United States must not further shrink its current nuclear command and control capabilities until commercial systems are proven to be as secure as the existing system. Encryption techniques that are designed to replace existing authentication procedures must be carefully assessed. Moreover, the issue of reliably communicating complex data relevant to flexible attack of targets anywhere in the world must be addressed. Further, commercial networks must be thoroughly tested to determine their vulnerabilities to disruption before they are used for communication of complex targeting information

The various elements of nuclear planning must be integrated to ensure that plans are responsive to national policy guidance. There continues to be a shift in relative emphasis from large plans to limited, more flexible plans that apply to new threats. The future nuclear planning structure will need to combine effectively both pre-planning and ad hoc planning. The growth of knowledge-based systems will directly affect the planning process, making it possible to create options in near-real time. Flexibility and responsiveness incorporated into a well-trained and exercised force, will be essential for deterrence. The planning process itself is crucial because it trains each generation of planners, decisionmakers and operators.

The readiness of nuclear forces – the capability to plan and execute nuclear missions when required – is a crucial component of deterrence. Today, the tasks of operating, maintaining, securing and supporting nuclear forces in the field and at sea are being performed in a highly professional manner. Nevertheless, the continued declining focus on U.S. nuclear weapons is forecast to result in critical expertise shortfalls in the key areas of planning, weapons technical issues, command and control, arms control, and operational test and evaluation. In addition, the career military today generally view the various nuclear career fields as out of the mainstream and offering uncertain futures, which poses significant obstacles to the ability to recruit and retain the necessary nuclear expertise. While the Department of Defense and the Services are cognizant of these factors, it is imperative that senior-level attention be given to these issues today to avoid critical deficiencies in nuclear expertise in the near future.

Judgment: A confluence of factors is leading toward a greater role for denial capabilities in the U.S. deterrent strategy.

Because of the increasing threat of missile delivery of nuclear, chemical, and biological weapons, combined with technological advances in missile defenses (against both cruise missiles and ballistic

missiles), the United States should pursue active defenses as a major component of deterrence. The perpetuation of the Anti-Ballistic Missile Treaty constrains the ability to implement technological advances as they occur. Nevertheless, over the next ten to twenty years, advanced missile defenses are likely to play an increasing role in U.S. deterrence policy and strategy.

In addition to the current emphasis on developing and deploying theater missile defenses, the United States requires an effective missile defense against the emerging threat from rogue states armed with long-range missiles. States such as North Korea and Iran are acquiring these capabilities as a delivery means for weapons of mass destruction. To ensure the ability of the United States to resist blackmail threats, as well as the viability of U.S. alliances, the United States must have high confidence in its ability to defeat at least several dozen reentry vehicles aimed at its cities.

Moving Beyond Vulnerability

A policy that holds American society totally vulnerable to nuclear attack is not in the security interest of the United States or Russia. Emphasis on a policy of mutual vulnerability inhibits the long-term positive evolution in the relationship between these two states. Moreover, the United States should not allow a mutual vulnerability relationship to emerge with other states, either intentionally or otherwise. The ability of the United States to develop and deploy effective defenses against smaller-scale attacks will establish a firmer foundation for deterrence in the future and provide protection for forces and populations.

The specific attributes of deployed defensive systems will be strongly influenced by the political-military dynamics that unfold from technological advances. A number of factors apply:

- **It will be feasible to field effective systems, though considerable testing remains to be conducted before any particular system can be designated as ready to make a meaningful contribution. Of course, improvements in offensive systems can make the defensive task harder, and point to the need for continuing improvements in missile defenses after they are deployed and as new technologies for defensive systems are developed.**
- **The ABM Treaty, while allowing limited strategic defenses, prohibits deployment of a nationwide ballistic missile defense and inhibits development of new technologies. The ABM Treaty was amended in 1974, but further changes to permit effective defenses, as proposed by the United States in 1992, were not accepted by Russia. Multilateralization of the Treaty, as proposed, would make such amendments even more difficult to achieve.**
- **Whatever happens to national missile defense in the near term, theater missile defenses will be developed at a deliberate pace with reasonably robust deployment of a land, and/or air, and/or sea-based system, which could build on the foundation that already exists.**
- **The deployment of a replacement for the Defense Support Program satellites (currently termed SBIRS-High) is essential. Although it is unclear whether SBIRS-Low (infrared detector in a low earth orbit) will be deployed, it is currently funded in the Air Force budget, and support in the Congress is strong. SBIRS-Low is needed for a truly effective theater defensive system.**
- **Networks capable of reliably transmitting data rapidly from space-based and other sensors to warfighters and TMD/NMD platforms—such as the Cooperative Engagement Capability**

architecture that includes SBIRS-Low—should provide the possibility of significantly increasing the area covered by any given defensive unit.

There is a clear need for U.S. missile defenses to have boost-phase intercept capabilities in order to defeat enemy offensive ballistic missiles that possess enhanced countermeasures. Therefore, development of boost-phase intercept systems that can respond to these threats should be undertaken. The Air Force is working now on an airborne laser. In the longer term, as technologies evolve, there will be a revolution in space-based architectures that will greatly enhance the prospects for effective defenses.

Judgment: The U.S. nuclear deterrent infrastructure must be capable of maintaining current forces, as well as sufficiently adaptive to provide new capabilities when required.

The infrastructure needed to keep current forces operational and to meet future challenges encompasses the science and technology base; the industrial base; weapon systems; command, control, and communication systems; and the people who make it all work, including management structures that provide oversight and support in both the U.S. government's policy and acquisition organizations. The strength, flexibility, and responsiveness of the nuclear weapons infrastructure play an important role in deterrence. A healthy infrastructure is essential to making clear to any adversary that the United States could adjust and respond to any emerging threat, even with new forces or capabilities if necessary, more rapidly than the threat could be mounted. In this context, the infrastructure must be sufficiently flexible and robust to respond – in technology, numbers, and management perspective – to sharp departures from the expected security environment.

The Need for a Comprehensive Plan

The United States currently lacks a comprehensive roadmap to guide efforts to support the full range of capabilities needed to have confidence in the deterrent forces up to and beyond the lifetime of currently deployed systems. The existing approach is piecemeal. There is no overall plan or commitment to provide the funding necessary over the next decade. The Department of Defense should develop a companion plan to the Department of Energy's still evolving Stockpile Stewardship Program, the program that guides the entire DOE effort over the next decade to keep nuclear weapons safe and reliable. Such a plan would not only meet DoD's needs but also provide a requirement basis for DOE's efforts.

The absence of a Department of Defense (DoD) plan for the sustainment of nuclear deterrence draws attention to the lack of a management focus for nuclear weapon system matters. In the past, a near continuous involvement of senior civilian and military leadership in strategic force modernization plans, arms control activities, capability reviews, and exercises brought coherence to the activities associated with nuclear weapons policy and programs and thereby contributed to overall readiness. Because almost all U.S. nuclear force modernization programs have been canceled or curtailed with the end of the Cold War and the downsizing resulting from arms control agreements, nuclear force matters no longer demand the continuous involvement of senior leaders. In fact, the current reorganization schemes within the DoD leave it unclear which, if any, organization is the focal point for nuclear issues.

Within the acquisition structure there is no one with full-time responsibility for the oversight of all nuclear weapon systems, the coordination of command and control systems procurement in support of nuclear weapon systems, or the coordination with the Department of Energy (DOE) for support for those systems. Serious consideration should be given to the creation of a position that would exercise oversight for all nuclear-related matters in the acquisition structure. This individual would work with other DoD components -- including Policy, the Joint Staff, the Services and the military commanders responsible for nuclear forces -- to create a DoD Nuclear Forces Program Plan. This individual would also support the Undersecretary of Defense for Acquisition and Technology in his capacity as chairman of the Nuclear Weapons Council to ensure the coordination of DoD and DOE nuclear weapon program planning.

The key initial challenge for the DoD nuclear weapons infrastructure is that it must be able to maintain the operational status of current forces through their currently expected lifetime. To be cost effective, this will require refurbishment, using as much technology from commercial applications and non-nuclear weapon systems as possible. However, technologies unique to nuclear weapon systems will have to be sustained as well. The character and disposition of today's U.S. nuclear forces are the result of the drawdown from the historic U.S.-Soviet competition. The United States is planning to maintain the current generation of missiles and aircraft and their associated warheads well into the next century. There are no replacement programs under way for any of today's nuclear forces. The U.S. nuclear deterrent posture will continue to be made up of the Minuteman III ICBMs, SLBMs deployed aboard Trident submarines, an air-breathing force of B-52 and B-2 long-range bombers, dual-capable tactical aircraft, and air-launched and sea-launched cruise missiles.

Several programs are under way to sustain the effectiveness of current forces. Sustainment programs include replacing the propellant and guidance systems of Minuteman III missiles during the next decade and refurbishing of Minuteman III silos and launch control centers to keep the system operational through 2020. The B-52 strategic bomber will be operational through 2040 with planned modernization and sustaining engineering programs. The Navy has extended the lifetime of the TRIDENT ballistic missile submarines to 2030. TRIDENT II missiles will be retained for thirty years, with individual missiles reaching the end of their life beginning around 2015.

Keeping the current nuclear weapon systems operational over their predicted lifetime poses several challenges. Many subsystem components will exceed their service lifetimes before the systems themselves reach their end of life. These subsystems will have to be replaced. In most cases, especially where electronics are involved, the production lines that once produced the original components will no longer be available because of technological obsolescence. New subsystems, using state-of-the-art technology, will have to be designed, tested, and fabricated. To minimize the cost of refurbishment, it will be necessary to look for commonality with conventional weapon systems and make maximum use of commercial-off-the-shelf (COTS) technology. However, some components and some requirements are unique to nuclear weapon systems. Special efforts will be required to ensure that the industrial base is maintained so that the replacement components are available when necessary and nuclear stockpile safety, reliability, and performance can be maintained.

Greater attention needs to be paid to sustaining the nuclear capability of theater weapon systems—dual-capable aircraft and sea-launched cruise missiles--that can be forward deployed to regions of potential conflict. Theater systems are not receiving the same attention as the TRIAD. Specifically, the United States has no current plans to ensure dual capability in the next generation of tactical aircraft, and there is no planning for a next generation of a sea-based

nuclear land-attack missile. A decision to preserve these important capabilities will be required in the near term if the United States is to maintain the requisite nuclear-specific infrastructure to field these delivery capabilities in the future.

The nuclear weapons infrastructure must be able to provide replacement delivery systems when the current ones are no longer able to perform their missions. In addition, the infrastructure must be prepared to respond sooner if political and technical changes occur that diminish the effectiveness of the U.S. nuclear deterrent. Prolonging the time before replacement systems will need to be designed, tested, produced, and fielded will raise serious questions about whether industrial competence and professional expertise will exist to perform modernization when it is required.

Even before current nuclear weapon systems reach their end-of-life, the need could arise to replace one or more systems because their contribution to deterrence has become questionable. For example, the United States could lose confidence in the ability of aircraft or cruise missiles to penetrate to target because of more capable air-defenses. Changes in target hardness or concerns about collateral damage in some situations could lead to the need for capabilities such as new reentry vehicles. Some systems might fail to retain their current survivability

The United States must ensure that, when new nuclear weapon systems are ultimately needed, the infrastructure will be in place for their design, development, testing, and production. In 2020, when the Minuteman III reaches the end of its life, it will have been more than forty years since the latest ICBM, the Peacekeeper, was designed. The replacement for the TRIDENT D5 missile will be needed twenty-five to thirty years after its predecessor was designed. When the TRIDENT submarine fleet reaches the end of its life, it will have been more than fifty years since designers took up the task of designing a ballistic missile launching submarine. Without specific and sustained attention, there is no assurance that the United States will possess the requisite technological and industrial infrastructure for the task of replacing these capabilities. On the other hand, while the air-breathing systems will also need replacement long after they were first deployed, the existence of an infrastructure for the production of commercial aircraft as well as tactical military aircraft should be able to provide the basis for successor nuclear weapon delivery systems. Nevertheless, even these systems have nuclear-mission unique requirements which must be met, such as the need to operate in nuclear environments and the need to incorporate command and control features that ensure that nuclear weapons can be used only when authorized.

Sustaining personnel competence in nuclear matters will be difficult without modernization programs and in an environment in which nuclear force matters have a much-diminished visibility and perceived importance. In selected areas there are concrete programs designed to keep parts of the nuclear forces infrastructure active. Two examples in this area, critically needed by both the Navy and the Air Force, are the Reentry Systems Application Program, designed to sustain unique reentry technologies for the Navy and Air Force, and the Guidance Applications Program, designed to sustain critical inertial guidance technologies. However, these and other activities are currently inadequately funded, despite their modest resource requirements.

In conclusion, when new systems are needed, whether because of aging or new security requirements, the entire infrastructure--industrial base and personnel, military and civilian--will be involved. The U.S. strategy for sustainment must be designed to fit within the likely budget constraints of the next decades. To do so will require effective approaches to sustaining critical expertise, including system and subsystem engineering and integration, and new strategies for reducing the dependence on "deterrence-unique" technologies and processes. For instance, there is a potential opportunity for increased commonality among SLBM, ICBM, and space-launch systems. In the past, the bulk of U.S. research and development (R&D) investment was aimed at

achieving increased performance. In the future, priority must be given to reducing production costs, while balancing costs and performance and preserving safety and reliability. The general approach must include increased reliance on commercial and non-nuclear weapon system technologies. To achieve this objective, the DoD needs a comprehensive plan and dedicated, sustained management focus on nuclear infrastructure issues.

Judgment: Retaining the safety, reliability, and performance of the nuclear weapons stockpile in the absence of underground nuclear testing is the highest-risk component of the U.S. strategy for sustaining deterrence.

In 1995, President Clinton stated "As part of our national security strategy the United States must and will retain strategic nuclear forces sufficient to deter any future hostile foreign leadership with access to strategic nuclear forces. In this regard, I consider maintenance of a safe and reliable nuclear stockpile to be a supreme national interest of the United States." The fundamental change in the international security environment resulting from the collapse of the Soviet Union, the impact of strategic arms control agreements, and the decision by the United States to sign and seek ratification of the Comprehensive Test Ban Treaty (CTBT) have significantly affected the ability of the United States to sustain its nuclear weapons stockpile.

U.S. nuclear weapons were not designed for indefinite stockpile life, and when the anticipated and unknown impacts of aging on the weapons in the stockpile will occur is uncertain. No program that could substitute for nuclear testing was validated before the 1992 testing moratorium. Building confidence in the emerging program will require time. There is no guarantee that some underground nuclear tests will not be vital in the future.

The average age of the weapons in the stockpile is fourteen years; higher than it has ever been. The environment within a nuclear weapon is unique and unlike any natural phenomena. The requirement for the indefinite retention of nuclear weapons may produce weapon-aging characteristics that are beyond the experience of the U.S. nuclear weapons R&D and manufacturing complex. The unknown effects of an intense radioactive environment on both nuclear and non-nuclear components and subsystems over an indefinite period of time pose the risk that an entire class of weapons will fail.

In the past, nuclear testing was an integral part of the assessment of the consequences of stockpile aging on safety, reliability, and performance. Nuclear testing is no longer permitted by policy and may be prohibited by treaty in the future. To mitigate this loss, the DOE science-based Stockpile Stewardship Program (SSP) has been proposed. Because the SSP will evolve and is unlikely to be completed before 2006, the ability to sustain confidence in the nuclear stockpile in the long-term is uncertain. In fact, this dimension of the U.S. nuclear deterrent posture is exposed to a higher risk than any other.

Additional critical factors affecting the safety, reliability, and performance of the nuclear weapons stockpile are diminished stockpile diversity; the medium and long-term issues related to retaining personnel with required expertise; and the ability to undertake new or modified nuclear weapon designs.

U.S. efforts to sustain deterrence during the Cold War period led to a continuous process of nuclear weapon design, modernization, and replacement. Well over two dozen different weapon

types were in the active nuclear weapons inventory in the 1980s. The reduction in the military missions for nuclear weapons and the implementation of strategic arms limitation accords have significantly reduced the number of weapon types. Current planning would retain only eight weapon types (plus one in reserve).

Decisions about safety, reliability, performance and refurbishment of stockpile weapons have depended on the judgments of a core staff of experienced nuclear weapon design and test personnel. Senior weapon designers with underground test experience are within a decade of retirement. The transfer of this expertise to the next generation of specialists responsible for the nuclear weapon stockpile is a difficult undertaking fraught with risk.

The requirement to sustain nuclear deterrence over an indefinite period makes it plausible that some modifications or design changes to the existing weapon inventory may be required. To retain the expertise needed to undertake such design changes or component refurbishment, there must be an enduring process for developing new or alternative designs and manufacturing techniques by the nuclear weapons establishment.

The Stockpile Stewardship Program is the minimum effort required to offset the risk of a loss of confidence in nuclear weapon stockpile safety, security, and reliability caused by the abandonment of underground nuclear testing. The SSP remains a high-risk endeavor because its conclusions cannot be validated by underground nuclear testing.

The SSP has two major components. The first--surveillance, manufacturing, and operations--focuses on monitoring the condition of the existing stockpile, and providing the capability to refurbish, rebuild, or modify the warheads if necessary to sustain confidence in their safety, reliability, and performance. The second provides for the assessment and certification of the nuclear weapon stockpile. The SSP includes a number of analytical and experimental facilities to assess the impact of aging on the nuclear weapon stockpile. Separate diagnostic and experimental facilities and processes focus on various phases of the nuclear detonation cycle. The analytical and experimental facilities and processes are linked through the Advanced Strategic Computing Initiative. This initiative seeks to develop very high performance computational tools with validated critical elements of nuclear weapon code based on past nuclear test data, experimental data from SSP facilities, and first-principle calculations. SSP analytic and experimental facilities are highly diverse, and vary from table-top instruments to large and unique experimental facilities. Nevertheless, because the consequences of extreme aging on nuclear weapons is beyond U.S. experience, more advanced diagnostic, analytic, and experimental processes and facilities may have to be developed in the future to sustain the safety, reliability, and performance of the nuclear weapon stockpile.

The U.S. manufacturing complex is no longer able to support the serial production of nuclear weapons. As a result, there is no immediately available hedge against the failure of an individual weapon type. This risk can be mitigated to some degree by retaining weapon types withdrawn from the active stockpile as a form of reliability reserve, or "virtual manufacturing."

The ability to serially produce nuclear weapons is an important hedge against the failure of a specific weapon type in the nuclear stockpile. As this capability has not been retained, other hedges that can provide time for the reconstitution of such a capability are desirable. The retention of some nuclear weapon types being withdrawn from the active inventory can diminish the risk without the cost of retaining a serial production capability.

Reconstitution of tritium production is necessary to sustain the nuclear weapons stockpile. The ability to recycle this material from the weapons being dismantled is limited, and the relatively short half-life of tritium makes it necessary that a production facility be put in place during the next decade.

Tritium is a limited life material that must be replaced periodically to ensure that warheads will detonate reliably as specified. The United States is currently producing no tritium, and is dependent on recycling tritium from weapons being retired. If the United States waits longer than a decade to resume tritium production, it will lose the ability to maintain its inactive stockpile, which represents an important reconstitution capability. Thus, a decision to resume production should be made soon.

The risk inherent in the SSP can be mitigated by an increase in resources to accelerate the availability of the SSP elements. Further, increasing the scope of permitted experiments, and implementing a "virtual manufacturing" strategy could diminish some of the high-risk dimensions of the SSP. If the SSP fails, the United States must be able to resume testing.

The SSP risk can be mitigated by increasing funding for SSP elements to ensure the early arrival of the complete SSP. By increasing the scope of permitted experiments, some of the confidence lost by the absence of underground nuclear testing could be regained, especially in the area of nuclear weapon safety and reliability. Finally, conducting weapon dismantlement in a way that retains key components can mitigate the effects of the decline in manufacturing capacity, and thereby provide a hedge against new weapon requirements in the future.

Judgment: The nuclear arms control approach should be transformed. The United States and Russia should move from the long-standing focus on mechanically reducing deployed strategic weapons to an engagement encompassing the broad spectrum of total nuclear capabilities, taking into account the different security requirements of the United States and Russia.

U.S. interests and overall international security would best be served by a new, more comprehensive approach that would take into account total nuclear capabilities, including forces-in-being, infrastructure, and reconstitution capabilities. The analytical foundation and broad policy cohesion needed for this approach has not yet matured, but important considerations are becoming increasingly clear:

- The United States no longer views Russia as an enemy. U.S. and Russian nuclear roles, requirements, concerns, and priorities differ and are less linked to the forces of the other than in the past.
- At reduced levels of strategic forces greater attention must be given to theater nuclear weapons. As deployed strategic forces are reduced, the very much larger number of Russian theater nuclear forces – which have been excluded from arms control agreements – becomes increasingly stark and assumes substantial strategic importance.
- Russia and the United States share many objectives, such as reducing the cost of defense and insuring the safety, security, and control of their weapons, but they have different security concerns, requirements, capabilities, and vulnerabilities.
- Russia maintains a much larger nuclear weapons infrastructure and an active warhead production base to support its nuclear warhead requirements, whereas the United States relies primarily on backup warheads and stockpile stewardship. At reduced levels,

asymmetries in infrastructure capabilities and non-deployed weapons become increasingly significant. Reconstitution capabilities can provide a desirable hedge. However, if not managed properly, such capabilities can also lead to undesirable competition and dangerous instabilities.

Over the long term, support for political reform in Russia and strengthened U.S.-Russian ties will be undermined by arms control arrangements that imply adversarial relationships, impose rigidity where flexibility is needed, or emphasize mutual vulnerability rather than cooperative approaches to defense. Immediate obstacles, such as limited resources and ratification difficulties, frustrate continued cooperation, but should not be allowed to deny both countries the benefits of agreements previously reached nor distract them from taking on difficult tasks together which might offer real improvements in security.

Russia and the United States may benefit from a new approach to nuclear arms control which would retain the stabilizing measures agreed to in START I and II, such as the elimination of MIRVed ICBMs and the retention of diverse forces, and might also provide:

- A ceiling on total deployed warheads, both strategic and theater, which might also provide a cap on deployed strategic warheads.
- An overall limit on total stockpile warheads, both strategic and theater, including deployed and non-deployed warheads.
- Controls on net production and total numbers, so that warhead dismantlement could actually reduce inventories rather than simply be symbolic.

The verification challenges for this approach will be enormously difficult. If these challenges are overcome, such an integrated approach to strategic and theater nuclear weapons would give Russia and the United States greater freedom to adjust their own forces to their own needs consistent with basic principles of stability, such as those included in the previous START Treaties. In addition, both states would have greater confidence in the other and in the arms reductions negotiated. Similarly, Russia has traditionally shown great interest in missile defenses, but today feels resource constrained and technologically disadvantaged. The security of both nations could be enhanced by reopening a dialogue with Russia in this area as well as cooperating on early warning.

This new approach will require careful explanation. To many in the public, the overall limit on total stockpiles of nuclear warheads will appear to allow for greater numbers of weapons than past agreements. In fact, because these agreements counted only deployed strategic warheads, the levels they established did not reflect the much larger number of weapons retained by both sides. The perceptual problem of a higher ceiling can be overcome with a well considered public education initiative.

Summary

In summary, while much has changed, nuclear weapons will remain indispensable to U.S. security for the foreseeable future. On this basis, this study sets forth several conclusions and priorities for action.

The Changing Nuclear Environment

Past	Present/Future
<ul style="list-style-type: none"> • Superpower confrontation • Nuclear weapons at center of relationship • Bi-polar nuclear balance • Mutual vulnerability codified • Retaliation-based deterrence • Net conventional parity • Nuclear weapons were U.S. asymmetrical strategy • Large, central employment plans • Dedicated C2 – expensive, reliable • Large, dedicated infrastructure • Nuclear testing • Hedge is having large forces-in-being • Arms control focus on deployed strategic • Senior-level advocacy • Effective nuclear-specific organization • People matter 	<ul style="list-style-type: none"> • Broader basis for engagement • Nuclear weapons less central; major reductions • Proliferation of WMD and missiles • Vulnerability increasingly questioned • Defenses play greater role • U.S. conventional dominance • WMD are adversaries' asymmetrical strategy • Ad hoc, adaptive planning • Increased reliance on commercial • Flexible total posture planning • Science-based Stewardship • Hedge is having reconstitution capabilities • Arms control focus on total nuclear posture • Senior leaders less engaged • Nuclear responsibilities diffused • People matter even more

Despite calls from some quarters for radical reductions or elimination, the United States will need a nuclear deterrent well into the 21st Century. There will be opportunities to adjust the size and composition of the nuclear force. For deterrence, the United States should be able to rely less on retaliation and more on denial and dissuasion. However, given the complexity and diversity of the actors that need to be deterred, a credible U.S. nuclear posture must be based on a TRIAD of ICBMs, SLBMs, and bombers, as well as deployable theater nuclear forces. A significant portion of this force must be maintained in a ready status. A "virtual" or token nuclear deterrent has no credibility.

The United States can build on the positive trends with former adversaries. In its relationship with Russia, the United States should attempt to move away from the corrosive policy of mutual vulnerability. The United States should seek to broaden its nuclear dialogue with Russia. Greater emphasis should be placed on cooperative attention to common concerns, such as reliable early warning of attack. The United States should engage China in a similar dialogue to the extent possible. In this process, symbolic measures that do not contribute to security—such as dealerting—must be avoided, for they are unlikely to solve the problems they seek to remedy, and may well exacerbate them.

The United States must be capable of accomplishing its deterrence mission in a reliable and affordable way. The United States needs to hedge against unexpected reversals in relations with other states that currently possess nuclear forces. Therefore, the maintenance of an adaptable nuclear infrastructure is critically important to ensure that the deployed force is modern, safe, and reliable, and to permit a timely response to new security challenges in an uncertain and dangerous world. This will require total posture planning, that is, integration of all the elements

that contribute to the ability to design, manufacture, maintain, and operate nuclear forces. The United States must be in a position to respond to emerging threats more quickly than these threats can pose a clear and present danger to U.S. security. Although current nuclear programs meet these goals, the overall trends are disturbing. The most important immediate problem is the lack of sufficient high-level attention to nuclear matters in the Executive Branch and in the Congress, as well in the public as a whole.

Specific concerns highlighted in this report include an aging stockpile, diminished stockpile diversity, a shrinking nuclear weapons production complex, the prohibition on nuclear testing, and the gradual loss of skilled personnel trained in nuclear matters in the military Services, the National Laboratories, and the production facilities. In addition, there is no integrated long-term planning to sustain the nuclear infrastructure. Of critical importance will be the ability to maintain the nuclear deterrent in the absence of nuclear testing. Of all the challenges that the United States will face in maintaining the total nuclear posture, ensuring the safety and reliability of U.S. nuclear weapons without testing may be the most fundamental. The United States has never before carried out such a program and has no firm evidence it will be successful. With or without testing, the United States will need a long-term, ongoing program to ensure the safety and reliability of the nuclear weapons stockpile. In either case, substantial resources will be required. If nuclear tests are not permitted, even the best program will yield subjective, probabilistic judgments on the stockpile that are open to dispute.

Among the recommendations for ensuring a credible nuclear posture in the future, this report highlights the need for several major initiatives:

- The Department of Defense should prepare a long-term plan to develop specific needs for future U.S. nuclear weapons, delivery systems, and the supporting infrastructure. A senior official within the DoD Acquisition structure should be given overall responsibility for implementing such a plan, and for coordinating nuclear matters within DoD and with the Department of Energy and other appropriate agencies.
- Missile defenses will be of growing importance in the years ahead. The United States must be able to deploy effective defenses in regions with important interests and allies, as well as a national missile defense against the growing threat to the United States itself. It is unlikely that defenses will replace the need for a credible nuclear deterrent. Nevertheless, increasingly capable missile defenses can and should be deployed as an important component of deterrence. It is necessary to examine how a transition to greater emphasis on missile defense should take place and how the United States should prepare for it.
- The long-standing U.S.-Russian arms control approach -- focused primarily on negotiating limits on the number of deployed strategic weapons -- needs to be changed. This approach conceals important imbalances in total nuclear postures. It is necessary to move away from the presumption that the goal is "how much lower can we go?" A more sound approach is needed, one in keeping with the new security setting, which recognizes both the reality that different countries require different kinds of deterrent forces, and that theater nuclear weapons should be part of the nuclear dialogue.
- People are the *sine qua non* for the maintenance of a safe, secure, and effective deterrent force. If present trends continue, it will become increasingly difficult to attract and retain the people needed to build, operate, and maintain the nuclear deterrent forces in the future. Therefore, DoD and DOE -- in cooperation with the National Laboratories, relevant industries, and universities -- should develop a program to ensure that personnel with

critical skills in nuclear weapons planning, operations, design, production, and maintenance are retained, and a suitable successor generation is developed before these key skills atrophy or otherwise pass from the scene.

In conclusion, nuclear weapons, although indispensable to deterrence, cannot in themselves ensure the credibility of deterrence. Credibility rests not only on forces-in-being and forces that could be reconstituted in timely fashion. It also encompasses longer-term policies and perceptions about the role of nuclear weapons within the overall context of national security capabilities and strategies. A nuclear force that is not backed by the perceived ability and willingness to maintain and, when necessary, reconstitute important elements will increasingly be seen as a hollow force. To prevent this outcome, the United States requires a new way of looking at the components of nuclear deterrence—from forces-in-being to system design, development, and stockpile maintenance—in an integrated fashion. To achieve such integration, a high level of strategic planning will be necessary within and among the elements of the national security policy and scientific-technological communities—both to have needed capabilities when required and to hedge against an uncertain future. The decisions and actions that the United States takes about the total force posture in the years ahead will shape decisively how both allies and adversaries perceive the credibility of the U.S. deterrent. In turn, this holds important implications for the overall capacity of the United States to shape the security setting at the outset of the new millennium and to provide for the nation’s defense in a world of change and turbulence.

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