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Report No. 8
February 1990

The Future of Nuclear Weapons: Final Study Report

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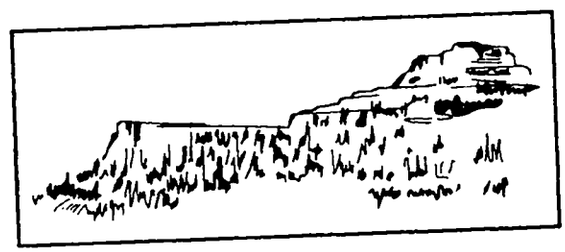

CNSS
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SUMMARY

This report summarizes the findings of a three-year study by the Center for National Security Studies (CNSS) that evaluated the long-term (thirty-year) future of nuclear weapons. The Future of Nuclear Weapons (FNW) Study sought (a) to identify and analyze the key long-term political, military, and technical trends that will influence the future of nuclear weapons in order (b) to provide a basis for analyzing the impact of these trends on future Department of Energy/Los Alamos programs and activities.

The FNW Study was not intended to predict which specific nuclear weapons systems that the United States will deploy in the year 2020. The FNW Study was instead designed to develop insights rather than specific and detailed conclusions about the future of nuclear weapons. These insights are offered to challenge the reader and identify the appropriate issues for further consideration, and not to predict that a particular future nuclear course is preordained.

The **political-strategic insights** derived from the study suggest the following:

- The structure of international politics will no longer be dominated by U.S.-Soviet competition, although that competition will likely remain an important factor. The international system will become more complex and will be characterized by the relative increase in power of today's second- and third-tier states. There will be many regional instabilities, which are likely to be complicated by the diffusion of comparatively high-technology military capabilities.
- A major part of the changes that can be expected in the international environment stems from potential shifts in Soviet goals and policies. There are great uncertainties about the ultimate course and effect that Gorbachev's (and his successors') reforms might take. In all probability, the Soviets will be relatively less able to compete economically over the next thirty years and may well pose less of a global military threat to Western security. Nevertheless, the relative decline in Soviet power might be offset, and new opportunities for Soviet expansion may emerge, if there is disorder in the international system (e.g., caused by economic nationalism or the weakening of the U.S. alliance structure).
- The character of the U.S. alliance system can be expected to evolve significantly over the next thirty years, to account for alterations in the relative power of nations, emerging allied interests, and altered threat perceptions. In many or even all cases, for example, U.S. alliances may no longer have containment of the Soviet Union as their primary rationale.

- If current trends continue, arms control will become a progressively more important mechanism for the regulation of military force structures—and political relationships—of all kinds. On the other hand, it is arguable that the pace and importance of arms control may be reduced if East-West relations improve to the point at which the military competition is no longer the central issue between the blocs or if the complexity of negotiations beyond the Strategic Arms Reduction Talks (START) and Conventional Forces in Europe (CFE) imposes an effective barrier to further progress.
- Decisions to modernize nuclear weapons will likely be even more complicated in the future by public concerns about economics, stability, safety, and environmental security.

Among the most important military-technical insights gained from the study are the following:

- There does not seem to be any single, well-defined "technology imperative" that will dominate nuclear force structures and applications over the next thirty years. Rather, those structures and applications will be determined by (a) political considerations (the roles assigned to nuclear weapons and other military forces by the national leadership) and (b) how the various military technologies are integrated and employed.
- The most important advances in military technology will likely take place in "information systems" (sensors, computers, communications). Other potential developments of note include new nonnuclear destructive concepts (e.g., directed-energy weapons), stealth technologies, and advanced delivery systems. The most potentially significant developments in nuclear weapons technology itself involve directed-energy and tailored output concepts.
- Over the near and mid-term, attacks against the other side's nuclear capability should become technically less attractive if both sides make reasonable improvements in weapon and C^{3}I survivability. If this trend continues, the ballistic missile-nuclear weapons combination will cease to dominate the "strategic" environment as it has for the past several decades. Over the long term, however, new technologies could be applied in a variety of ways to (a) restore offensive counternuclear potential, (b) develop defensive counternuclear potential, and (c) improve counter-general purpose force targeting capabilities.
- The incorporation of advanced information technologies into future weapons systems will make the future battlefield more transparent and more lethal. Conceivably, some, if not all, military roles that have previously been assigned to nuclear weapons can be allotted to conventional systems. Theater/tactical nuclear weapons will continue to have an irreplaceable political and psychological value for deterrence, but over time they may become less and less integrated into U.S. military plans and

operations. As a result, theater/tactical nuclear weapons will have to "compete" with conventional weapons in a way that they have not done before.

The FNW Study reached four conclusions about how nuclear roles and requirements might change over the long term.

First, there are maximum and minimum bounds that we can fairly confidently place on the roles and requirements of nuclear weapons over the next thirty years. Nuclear weapons will not disappear: there will be no complete political solution (i.e., no disarmament, no formation of world government), and there will be no complete technical solution (i.e., no perfect defenses, no invention that transcends nuclear weapons). By the same token, with respect to possible new roles and requirements, the United States will not come to regard nuclear systems as "just another weapon."

This first conclusion left the FNW Study with the judgment that over the next thirty years the United States will maintain a nuclear stockpile that is quantitatively and qualitatively "sufficient"—not just in terms of the severity of the U.S.-Soviet competition but in the context of an increasingly multi-power world in which a number of nations, friendly and hostile, possess nuclear systems and other weapons of mass destruction.

The second conclusion is that, within this basic context, there is a high probability the United States will attempt to reduce its political and military reliance on nuclear weapons. here are especially strong political-strategic trends that suggest this shift, most notably the evolution of the international system, pressures for change in the U.S. alliances, perceptions of a reduced Soviet threat, increased international interest in ensuring stability, and the limits of public support for more ambitious deterrent policies. The United States would be more inclined to stress the role of nuclear weapons in deterring war between major states and especially in deterring the use or threatened use of weapons of mass destruction. The United States would be less inclined to place nuclear weapons at the center of its overall national security policy and military strategy. The United States would either abandon or greatly qualify the current policy of extending a nuclear guarantee to its allies. Nuclear weapons, it should nevertheless be stressed, would continue to play an important role in U.S. national security policy. One of the most important roles would be that of a "hedge" against sudden, adverse shifts in the political or military balance.

Third, the trends pointing in the direction of a less ambitious deterrent policy, although strongly evident at present, cannot be considered inevitable. The United States has the option to exploit new weapons technologies and new operational concepts in order to provide the United States with enhanced military-technical leverage. In the most probable case, this option would involve the exploitation of strategic defenses and long-range conventional systems, as well as advanced nuclear technologies. Such a more demanding deterrence policy would most likely be adopted as a response to a clearly

increased threat over the long term, and this policy is unlikely to be pursued in the near and intermediate terms.

Finally, despite the probability that any major shift in U.S. nuclear policy will be evolutionary rather than revolutionary in character, it is impossible to rule out the possibility that significant discontinuities might occur over the near and intermediate terms. The case for an evolutionary development in nuclear roles and requirements rests on the fact that the institutions and hardware that currently characterize the United States nuclear force structure will remain intact for some time and on the fact that the Soviet Union will continue to be a major political-military threat for the foreseeable future.

Nevertheless, there are circumstances that might cause a more rapid and radical shift in the American and allied view of nuclear weapons: for example, a serious nuclear accident or use by a "third party;" the collapse or dramatic resurgence of the Soviet state; or a fundamental change in the political climate of key American allies. The recent events in Eastern Europe and the Soviet Union have heightened the prospect that the future of nuclear weapons may follow a revolutionary rather than evolutionary path. We also sound a cautionary note over the possibility that, if present trends continue, nuclear weapons might become excessively "discounted" in the political arena over the short and intermediate terms, well in advance of any corresponding decline in their strategic or military value.

PREFACE

This report summarizes the findings of a three-year study by the Center for National Security Studies (CNSS) that evaluated the long-term (thirty-year) future of nuclear weapons. The Future of Nuclear Weapons (FNW) Study was originally undertaken at the request of the Associate Director for Nuclear Weapons Technology at the Los Alamos National Laboratory. He, other senior managers at Los Alamos, and the other weapons laboratories and their sponsoring agencies bear the responsibility to plan this nation's nuclear weapons program within a national policy framework, and to develop the science and technology base that will be used to meet requirements for future weapons. The views expressed herein are an attempt to capture some of the insights gained during the FNW Study in order to assist these decision-makers. They do not necessarily represent the views of the management of the Los Alamos National Laboratory, its sponsoring agencies, or the study participants.

The FNW Study consisted of two major phases. The first phase involved a series of meetings organized by the Washington Defense Research Group. These meetings systematically investigated a plausible range of future international environments and U.S. security policies, to identify at least the general shape and character of future nuclear weapons roles and requirements. The FNW first phase activities were directed by Steven A. Maaranen and William G. Davey.

The second phase of the FNW Study focused on identifying and analyzing the key factors that will influence the U.S. nuclear weapons program over the next thirty years. To examine these key political, military, and technical factors, the Center commissioned fifteen papers from a variety of Los Alamos and external experts. A number of these papers were presented at a CNSS conference in June 1988. The proceedings of the conference are summarized in *The Future of Nuclear Weapons: The Next Three Decades* by Patrick J. Garrity, Robert E. Pendley, and Robert W. Selden, CNSS Paper No. 16, LA-11399-MS (Los Alamos, New Mexico: Center for National Security Studies, Los Alamos National Laboratory, July 1988).

CNSS acknowledges the following individuals for their assistance during the FNW Study: Stephen Cambone, John Gaddis, Daniel Goure, Craig W. Hartsell, Joseph Howard, Fredric M. Leykam, Larry Madsen, Carolyn Mangeng, Edward Palanek, Denny Roeder, John Ruggie, Joachim E. Scholz, Leon Sloss, and Peter A. Wilson. CNSS participants in the FNW Study included William Davey, Patrick Garrity, C. Milton Gillespie, John Hopkins, Steven Maaranen, Robert Pendley, Robert Selden, John Weltman, and Paul White.

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The Future of Nuclear Weapons: Final Study Report

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I. INTRODUCTION

The CNSS Future of Nuclear Weapons (FNW) Study was intended to survey the possible thirty-year evolution of the roles of and requirements for U.S. nuclear systems. The study sought (a) to identify and analyze the key long-term political, military, and technical trends that will influence the future of nuclear weapons in order (b) to provide a basis for analyzing the impact of these trends on future Department of Energy/Los Alamos programs and activities. The FNW Study was not intended to predict which specific nuclear weapons systems that the United States will deploy in the year 2020.

To deduce significant long-term trends, the FNW Study identified and explored a number of major factors, or "drivers," that might have a major impact on the future of nuclear weapons. These drivers included

- the evolution of the Soviet political and military threat
- the future global security environment, with a focus on Europe and East Asia
- U.S. alliance commitments
- prospects for arms control
- the proliferation of nuclear weapons and advanced military systems
- the impact of public opinion
- U.S. nuclear doctrinal alternatives
- the perspectives of the military services
- the evolution of military operations
- future nuclear weapons technology
- the prospects for advanced command, control, communications, and intelligence systems
- the future of nonnuclear weapons technologies.

For the purposes of this report, the major (and alternative) trends that emerged from this analysis are divided into two general categories: political-strategic trends, which indicate broad issues such as the nature of the international environment and national objectives; and military-technical trends, which are concerned with more narrow subjects, such as how nations structure and plan to use their armed forces. These trends are discussed in Sections II and III.

Section IV considers the implications of these trends for future nuclear roles and requirements. Although a continuation of "business as usual" is conceivable, the study suggests that a significant change in nuclear roles and requirements is more plausible. Section V suggests the major issues that the nation and the nuclear weapons community will face if there is any significant shift in those roles and requirements over the next thirty years.

We should note that the FNW Study was conducted before the remarkable developments that have occurred over the past several months in Eastern Europe and the Soviet Union. Nevertheless, we have not substantially revised the text of this report, on the grounds that our analysis already in principle accounted for these developments—and because the long-

term outcome will not be known with certainty for some time.

If present trends continue, however, the familiar contours of the post-World War II era could be reshaped far more rapidly than anyone had hitherto anticipated. Soviet troops could be largely, or even completely, withdrawn from Eastern Europe, and the nations of that region could enjoy a considerable degree of political self-determination. The two German states seem well on the way to formal reunification. The characters of the North Atlantic Treaty Organization (NATO) and the Warsaw Pact will be significantly transformed, and one or both of these alliances could disappear entirely. Reductions in the nuclear and conventional forces of both sides could be accelerated, possibly even transcending the formal arms control negotiating process.

The future of nuclear weapons will be profoundly affected by whether, and on what time scale, these changes actually take place. In particular, there are vast uncertainties about the security concepts and institutions that might replace those that have dominated international relations over the past several decades and about the role the United States may choose to play in the emerging strategic environment. This report is therefore designed to develop insights rather than specific and detailed conclusions about the future. These insights are offered to challenge the reader and identify the appropriate issues for further consideration, and not to assert that any particular course is preordained.

II. THE FUTURE POLITICAL-STRATEGIC ENVIRONMENT

This section reviews the traditional political-strategic roles that the United States has assigned to its nuclear weapons and identifies the most important factors that may influence those roles during the next three decades. The FNW Study suggests that the evolution of the political-strategic environment through the year 2020 will probably lead to a fundamental change in the way the United States now views nuclear weapons and nuclear deterrence.

A. Traditional U.S. Political-Strategic Roles for Nuclear Weapons

For the past forty-odd years, the United States has sought to ensure American national security through the creation of a prosperous, stable, and pluralistic international system. The central obstacle to this objective in the eyes of American policymakers has been the threat posed by Soviet expansionism; that is, the danger that the Soviet Union would use political coercion or military aggression in an effort to construct a world order dominated by the USSR. In short, the Soviet Union aspired to become the global "manager" of international security, whereby no decision of consequence could be taken without Soviet consent. The United States has therefore attempted to contain Soviet expansion in order to buy time for the emergence of a stable international regime and for the eventual mellowing of Soviet strategic ambitions.

Over the past forty years, American officials have used the U.S. possession of nuclear weapons as an active means for shaping the international environment, and the U.S.-Soviet competition within that environment, in a manner that favors the long-term objectives of the United States and its allies. The United States has therefore adopted a policy of what this paper refers to as "active deterrence." (The current version of this policy is generally referred to as "flexible response.") By active deterrence, we mean that the United States expects nuclear weapons to provide it with positive political and military leverage over friends, enemies, and neutral states in peacetime, during crises, and even in war, and not just to dissuade the Soviet Union from taking extreme actions (i.e., going to war).

To be sure, the United States has relied upon nuclear weapons first and foremost to deter war: the threat of nuclear escalation makes resort to major warfare so costly—and its outcome so unpredictable—that military aggression should in principle cease to be a viable instrument of Soviet policy. The United States seeks to deter not only the Soviet use of nuclear weapons but the employment of any kind of

Soviet military power against American allies and overseas interests.

But in addition to deterring war, nuclear weapons have been thought to constitute essential "strategic leverage" for the United States in the peacetime (and crisis-time) competition with the Soviet Union. That is to say, American nuclear weapons are intended to do more than simply deter all-out war, however important this might be. Long-range nuclear weapons allow the United States to act as if it were a part of the Eurasian landmass: the United States can, in principle, interpose itself strategically at any point between the centrally located, potentially dominant Soviet bloc and the apparently weaker states along the Soviet periphery. The United States—again in principle—can hope to influence events at critical points in Eurasia, irrespective of the state of the local military balance or even whether American forces are present on the ground.

U.S. strategic nuclear forces, combined with theater/tactical nuclear forces located on or near critical points in Eurasia, have also made it possible for the United States to support politically its global alliance structure. Although the United States could unilaterally attempt to deter Soviet expansion by interposing its strategic forces between the Soviet bloc and its neighboring states, the United States has chosen to address the Soviet threat largely in the context of a political-military alliance structure. The United States has traditionally offered an implicit or explicit nuclear guarantee to friendly nations as part of its alliance commitments. The American "extended deterrence" guarantee is also intended to discourage nuclear proliferation by those nations that might otherwise desire nuclear forces to preserve or advance their own regional security interests.

In addition to deterrence of Soviet aggression, the extended deterrent guarantee must offer "reassurance" to allies that their respective national interests are protected by participation in the U.S.-led coalition—to reassure them that their security and survival will not be jeopardized by rash and aggressive U.S. policies or actions or by U.S. abandonment in the face of Soviet attempts at political intimidation and coercion.

Nuclear weapons have offered a cost-effective way for the United States to deter war, exercise peacetime/crisis-time influence, and support its alliance structure. Reliance upon nuclear weapons as the foundation of American national security policy means that the United States does not have to deploy or have in reserve the enormous conventional forces that would be necessary to defeat the Soviet Union on the ground in Eurasia—an undertaking that might ruin the American economy. Nor does a nuclear-oriented policy require the United States to negotiate forward basing rights in all areas of potential combat, develop a massive logistical infrastructure in every key overseas region, or create the domestic manufacturing capability to support an extended conventional war.

Finally, in the event deterrence fails, the United States has conceived of using nuclear forces in a strategically meaningful fashion to preserve vital American interests. Within the context of U.S. strategy, the role for nuclear strategic forces is to alter favorably the political-military situation existing at the time of their use. The objective of nuclear use is not to defeat or destroy an enemy's military forces for the purpose of invading and occupying his territory, although nuclear employment could have decisive military effects. The U.S. strategic objective is rather to bring about the termination of a conflict under terms acceptable to ourselves and our allies, at the lowest level of violence practicable.

It is important to note that the American policy of active nuclear deterrence has never been absolute, that nuclear weapons do not represent the *deus ex machina* of U.S. national security. The United States has never regarded nuclear weapons as just another instrument of war and statecraft, despite rhetoric to the contrary in the 1950s. The United States has not employed nuclear weapons against third parties (e.g., in Korea or Vietnam) during wartime, preferring instead to accept and support a tradition of "nuclear nonuse." Finally, the United States has come to place great emphasis

on the concept of a nuclear/conventional firebreak: because of the enormous destruction that could accompany even limited nuclear use and the risks of uncontrollable escalation, the United States is prepared, and indeed prefers, to wage a major East-West war without the immediate resort to nuclear weapons. (The United States does not now assume that it could necessarily terminate such a war without eventual nuclear escalation, however.) These limitations on the role of nuclear weapons have meant that more traditional, conventional instruments of military power have retained considerable importance in the nuclear age.

Especially over the past three decades, American policymakers have begun to introduce a new conceptual element that places limits on U.S. active nuclear policy: stability. There are three aspects of stability that are commonly cited:

- **Strategic (first-strike) stability**: a strategic situation in which neither side can expect to derive decisive, that is, war-winning, political and military advantages from the use of nuclear weapons. Strategic stability is generally taken to mean that neither the United States nor the Soviet Union could, by executing a surprise nuclear attack, destroy a sufficient amount of the opponent's retaliatory (second-strike) capability to limit damage to acceptable levels.
- **Crisis stability:** a strategic situation in which the respective nuclear forces and operational postures do not create a premium for either side to strike first during a crisis in order to improve relative position or outcome, even if such a strike could not guarantee that the war would be won. Under a crisis-stable environment, neither the United States nor the Soviet Union would feel undue pressure to "use or lose" its strategic forces, especially if one or both sides was uncertain about the other's military intentions during a crisis.
- **Arms race stability:** a strategic situation in which there is no incentive to increase the quantity or improve the quality of strategic forces in order to achieve a major political/military advantage. Arms race stability benefits from a degree of military transparency and predictability concerning the adversary's force structure and strategy. Because military planners tend to base their calculations on worst-case assumptions, any significant uncertainty about an opponent's future plans will generate arms race pressures and concurrent political tensions.

The United States became concerned about stability in part because of fears that the characters of Soviet and American nuclear force structures and their means of operation might increase the likelihood of war caused by accident, technical pressure, or political miscalculation. Perhaps more importantly, American officials have become convinced that

- U.S.-Soviet relations have improved to the point where unrestricted development of nuclear weapons is seen to be neither necessary nor prudent;
- the Soviets share a mutual interest in avoiding war by accident, miscalculation, and technical pressures;
- the common Soviet-American concern over technical instabilities in the nuclear balance might be broadened into a common concern over political instability, which is in fact the most likely cause of war; and
- the deployment of "stable" nuclear systems is much easier to defend to public opinion and allied governments than that of "destabilizing" systems.

To avoid or alleviate any potential instabilities, the United States has been willing to accept some military-technical constraints on the number and capabilities of its nuclear forces. Such constraints raise clear questions about the future direction of U.S. nuclear deterrence policy. There are clearly tensions, if not outright contradictions, between the military-technical requirements of active deterrence and the political desire to stabilize the East-West competition and maintain domestic and alliance consensus. The future political-strategic roles of nuclear weapons will therefore be determined in large part by how the United States decides

to resolve this tension between nuclear utility and stability.

The FNW Study identified several political-strategic issues that will be crucial for the United States as it formulates its nuclear policy and force structure over the next three decades. The most important single issue appears to be the evolving structure of international politics, which includes the serious prospect of a qualitative change in the Soviet threat. The direction of public opinion in Western societies and the increasing importance that arms control may play in the regulation of military force structures of all kinds also represent key factors. These critical issues are discussed below.

B. The Evolution of the International Environment

The most important trend identified by the FNW Study that will affect the long-term future of nuclear weapons is the changing character of the international environment. This trend has three significant and related components: the rise of new economic, political, and possibly military powers; the evolution of the Soviet strategic threat; and a change in character of the U.S. alliance system. These components will be explored in turn.

1. Diffusion of Power

For the past forty years, the structure of international relations has been dominated by a bipolar pattern of political-strategic competition between the United States and the Soviet Union. The Soviet-American conflict became bipolar for three critical reasons:

- The United States emerged from World War II as the world's dominant political and economic power while the USSR emerged as the dominant military power on the Eurasian continent.
- The two nations had fundamentally different conceptions about their respective security interests and the proper nature of the post-World War II security order. The United States sought to foster a pluralistic, liberal economic and social international system that eventually would incorporate a mellowed Soviet Union and transcend the bipolar conflict that emerged after 1945. The Soviet Union at various times seemed to prefer (a) a global condominium between the two superpowers based on explicit delineations of spheres of influence and (b) effective control of the international security environment in which the Soviets would possess a "veto" over emerging threats to Soviet security.
- The other major European and Asian powers were too weak to create stable regional systems that were independent of the two superpowers, much less offer an alternative vision of international security.

Over the next three decades, the international system is likely to be marked by a continuing evolution of the international system away from the bipolar pattern of political-strategic conflict between the United States and the Soviet Union. It is most important to emphasize that the transition of the international system away from bipolarity has actually been taking place since the late 1940s. This transition toward a different international system will probably continue to be gradual and uneven; however, as recent events witness, it is not possible to rule out more rapid and unpredictable changes. The dynamic of the U.S.-Soviet conflict is too powerful and deeply ingrained to disappear overnight, but thirty years is a sufficiently long time for that conflict to be resolved or superseded. (This is intended to be an observation, not a prediction.) With these points in mind, the FNW Study was able to identify several probable characteristics of the emerging security environment.

A "Multipower" International System. The United States and the Soviet Union, once the two dominant geopolitical centers, will continue to decline in power relative to other rising states. The emerging international system is not likely to become "multipolar" in the nineteenth-century sense, where five European powers were considered to be of the first geopolitical rank. The international system of the early twenty-first century might more appropriately be characterized as "multipower" or

"multidimensional," wherein the major states interact and compete on more equal terms over an increasing range of issues. There will continue to be important disparities among nations in terms of technological, political, economic, and military strength, however. The United States is still likely to b the most powerful nation measured by any of these criteria and is likely to be the only nation with a first-ranking across all these determinants of national power.

The tendency toward a breakdown of bipolarity has been greatly accelerated by the recent political changes in Eastern Europe, which greatly weakens the traditional Soviet alliance system. If the USSR substantially withdraws from Eastern Europe, the position and role of the United States in Western Europe must also surely change—and possibly even end. The separation of the two great peripheral powers from the center of Europe will allow (or force) a considerable rearrangement of power among the other European powers. The most important aspect of this rearrangement will be the issue of a reunited Germany.

A Complex Security Environment. Although the Soviet-American security competition will probably persist over this period, the United States is likely to place relatively greater emphasis on other threats to its national security. The United States and the other major powers are becoming increasingly aware of the need to maintain security through their general economic and technological competitiveness. They can be expected to face serious environmental and health problems throughout the twenty-first century. New issues such as the global warming trend or AIDS may expand the political agendas of many advanced nations, at the expense of attention to the more military-oriented concerns that marked the post-1945 era.

As the international security environment becomes more complex and less dominated by the U.S.-Soviet competition, economic and trade rivalries that have been at least partially submerged over the past forty years could reemerge in the form of political rivalries. At an extreme, the FNW Study notes the prospect that the international economic order might be broken down or placed under enormous strain because of the formation of hostile, competing economic blocs. Even if the next thirty years do not witness widespread trade wars or another great depression, all the major powers will be engaged continually in the race for national economic and technological advantage. The FNW Study indicated that the United States will be steadily confronted by the efforts of key nations such as Germany (or a European entity), Japan, and China to use their growing political and economic leverage to redefine the rules of the "post-bipolar" game.

Regional Instabilities. In addition to the emerging multi-power relationships among the major nations or groups of nations, certain smaller states will aspire to play even more important roles within their respective regions. As the aspirations of these states come into conflict, the FNW Study projects a continuing pattern of political unrest and periodic military conflicts in what we have in the past called the Third World, and perhaps even in regions such as Eastern Europe that have been geopolitically stable since the late 1940s. These conflicts may be characterized by the efforts of competing regional powers to establish local political and military dominance (as we have recently witnessed in he Iran-Iraq war); by the use of comparatively advanced military systems; and quite possibly by the use of chemical, biological, and radiological weapons.

The Shadow of New Military Powers. The current second-tier powers (Japan, China, Germany/Europe, and perhaps others), as they grow in economic and political strength, must decide whether they wish to translate that strength into enhanced military capability. The FNW Study concluded that, in the most likely case, none of the major non-Soviet nations that are capable of creating an independent, superpower-quality military force, will do so over the next thirty years.

Nevertheless, the prospect of such a development will continue to represent an important factor in international politics, as nations that might feel threatened by such a development—or simply by the political and economic strength

of the rising states—look for reassurance or a hedge against the X power. In addition, the attractiveness of creating such an independent military power by a second-tier state will grow if the emerging international system should break down because of American decoupling from present U.S. strategic commitments or because of economic rivalry or uncontrollable regional conflicts.

What implications do all of these changes in the international environment portend for the future of nuclear weapons? Arguably, nuclear weapons fit very well into the postwar bipolar order. Indeed, the pattern of bipolarity was strengthened by the dominant nuclear position of the two superpowers, which set them apart from allies, lesser enemies, and neutral states.

Nuclear weapons may be expected to fit differently in a more complex, multi-power international environment. Most importantly, the United States will increasingly desire flexible, "usable" political and military instruments that can have leverage in a variety of situations below the threshold of global military confrontation. The United States has assumed, since at least the 1960s, that nuclear weapons did not provide much advantage for the United States in issues that did not directly involve American security with respect to the Soviet threat. Assuming that this view endures, nuclear weapons will continue to provide a necessary floor for the conduct of American policy in a much more diverse international order, but they will not be viewed as providing positive political or military leverage under most circumstances. Given the tremendous uncertainties and complexities in the emerging international environment, American national security policy will likely place the general political concept of stability at the top of its list of objectives. This emphasis on stability is likely to hold for nuclear weapons as well.

2. Qualitative Changes in the Soviet Threat

As noted above, the post-World War II period was dominated by the U.S.-Soviet competition, in which each side pursued fundamentally different conceptions about their respective national and interests and about the proper nature of the international security order. Both sides "employed" nuclear weapons as a critical instrument in their efforts to gain the maximum leverage within that competition and to aid in their attempts to structure the international order along favorable lines.

Over the past several years, Soviet leaders have been under strong pressures to change their approach to national security issues and nuclear weapons. These pressures include a growing recognition that the foreign policy and military doctrine pursued under the Brezhnev regime were becoming ineffective, if not counterproductive; changes in the Soviet view of the nature of the international system; and the ongoing, broad-based scientific-technical revolution in military affairs. Complicating the ability of the Soviet leadership to respond to these pressures are the condition of the Soviet economy and changes in the international economic order; the weakened state of the Soviet political system; the disaffection of the Soviet people with the system; and the decline in the credibility of the USSR as a political, economic, or ideological model.

Any long-term projection of Soviet strategic goals and policies, especially given the remarkable events of recent years, must necessarily be highly speculative. There is a wide range of possible outcomes. The following account attempts to highlight some of what seem to be the most signficant trends in the Soviet domestic and international position, without insisting that any or all of these trends will inevitably be realized. The FNW Study did indicate strongly, however, that the United States should be prepared for significant qualitative changes in the means and ends of Soviet policy.

The current reform program of Mikhail Gorbachev is intended to "give socialism a second wind" by revitalizing the Soviet political system, restructuring the Soviet economy, redefining Soviet national interests, and revising Soviet military doctrine. Gorbachev is striving to restore the prestige of the Communist party domestically and the attraction and influence of the Soviet model internationally. In the short term, Gorbachev's efforts are fo-

cused on acquiring a breathing space, particularly by means of foreign policy and arms control initiatives, in order to relegitimize the Communist party and restore the basis of Soviet national power. To assure Soviet security over the longterm, Gorbachev and other Soviet leaders have begun to articulate the New Political Thinking (NPM), a foreign policy strategy that involves a reinterpretation of Marxist dogma as well as new policy initiatives.

The NPM might be characterized as an attempt to create new opportunities for the exercise of Soviet national power arising from changes in the international system and from new opportunities in military technology. The reformulation of the basic definitions of the Soviet world view might enable Soviet foreign policy to be reoriented away from its East-West focus with its consequent emphasis on strategic nuclear power and the existence of competing, militarily oriented coalitions or blocs such as NATO and the Warsaw Pact. This reorientation, based on the demilitarization and denuclearization of international politics, opens up the possibilities for a range of new foreign policy initiatives.

At the same time that the Soviet political leadership has been attempting to come to grips with changes in the international order and the weakness of the Soviet system, the Soviet military has been coming to grips with an expected scientific-technical revolution in military affairs. In particular, the Soviet military seems to be reconsidering the character of a possible strategic nuclear war and the prospects for conducting one successfully. Despite the attainment of strategic parity, the Soviets may have come to accept the view that continual production of nuclear weapons by itself now provides no enduring advantages for the Soviet Union. Consequently, the decades-long Soviet drive to increase nuclear forces, particularly ballistic missiles, may have reached the point of diminishing returns. To be sure, the Soviet military will likely remain intent on maintaining and modernizing a substantial nuclear capability.

This line of argument suggests that the Soviets may focus increasingly on the exploitation of nonnuclear technological advances in such areas as microelectronics and computers, energy and power supplies, composite materials, sensor systems, and bio-engineering. Soviet military analyses focus on the potential for these advanced technologies to act as force multipliers, to the point of rivaling the effectiveness of nuclear weapons. In particular, the Soviets note the impact of new means of reconnaissance; the role of computers and artificial intelligence in surveillance, tracking, and targeting systems; the potential effects of tailored weapons to ensure high single-shot kill probabilities; and systems capable of exploiting the more difficult frontiers of the combat environment, the deep oceans, and outer space.

Soviet views on the character of a future war—its political context as well as strategic dimensions—are also changing. Soviet theorists dispute the long-held idea that a future war between East and West, whether nuclear or conventional, would be a decisive conflict for which the goal would have to be a decisive victory over the opposing coalition. Moreover, they question the traditional assumption that such a war would be over swiftly, with strategic success obtained in the opening hours or, at the conventional level, days. Indeed, the new view holds that wars, even nuclear wars, would probably be protracted and might be fought to less than decisive ends. Indeed, some Soviet writers speak of the potential for future multi-year conventional wars.

The Soviet military has also begun to review its well-established views on the primacy of the offense in military operations. Changes in military technologies, both advanced nonnuclear systems and the evolution of strategic forces towards enhanced passive protection, arguably make a nuclear first-strike or conventional blitzkrieg all but impossible. Moreover, the technologies associated with the scientific-technical revolution in military affairs open up increasing opportunities for defensive operations. Although Soviet military experts have not abandoned the idea of offensive actions, their discussions are focused on the counteroffensive following a defensive operation, conveying an impression that the offensive actions

could be limited in scope rather than directed towards attainment of a decisive victory involving the total defeat of an adversary's forces and the destruction of his war-waging capability. This view is also in keeping with what Western experts believe is a strong Soviet interest in finding ways of exploiting their conventional military power while avoiding the risks of undesirable escalation.

It is, of course, impossible to project with any sort of confidence the relative success or failure of Gorbachev's policies over the next thirty years, or the ability of the Soviets to integrate new technologies into their military forces and doctrine. The Soviets may well remain a political and strategic rival of the United States and will continue to improve qualitatively their military forces. Even if the USSR does follow through and liquidate some of its outstanding commitments in the "outer empire" (e.g., Afghanistan, Angola, Vietnam, and Cuba), the Soviets are unlikely to forego easy opportunities for international advantage.

Because the problems of the Soviet Union are so serious and systemic, however, the USSR will in all probability become relatively less able to compete economically and politically with other major powers. This trend is now evident, and it will continue, whatever Gorbachev's efforts, for the next decade or more. It also suggests that an objective decline in the Soviet political-strategic threat will occur during that period. If current trends continue, the Soviet military presence in Eastern Europe will be eliminated, and its political and economic influence substantially reduced. The USSR certainly can encourage the weakening of the American strategic position; however, the Soviet Union is unlikely to have the political-strategic leverage to elevate itself into a position as global manager of international security over the near and intermediate terms. Instead, the Soviets seem determined to prevent any other power or group of powers from asserting that role, while preserving (or improving) their own long-term ability to compete politically, economically, and militarily with the West.

Of course, over the near and intermediate terms one also cannot rule out the rise of a highly nationalistic/militaristic Russian leadership that, irrespective of the actual weakness of the Soviet Union, is determined to deal with growing domestic turmoil through a much more aggressive international policy. Nevertheless, the Soviet recognition of the failure of the USSR's postwar policies predates Gorbachev; this sense of failure apparently runs very deep in the Soviet establishment, and it is likely to reinforce the current tendency to play a less ambitious game in international politics so as to buy time for domestic reform. Alternatively, the Soviets may retain their larger ambitions, but they will utilize a less military-oriented approach than that used in the past.

This assessment suggests that the Soviets may be forced over the long term, explicitly or implicitly, to abandon their more ambitious efforts to restructure the international system as a whole. In this event, the USSR is likely to focus instead on maximizing its influence over particular regional and functional issues that are deemed to be of special importance to Soviet security and to developing military doctrine and forces that are appropriate to those issues. Such a course will seem especially attractive to the Soviets if the emerging international system is marked by regional turmoil and economic conflict, because of the inherent opportunities that such an unstable environment would present. The Soviets might be cautious about reaching too far even in such a fluid situation, however, because of their own relative weakness and the danger that excessive international instability might spill over and threaten their own core interests.

A pattern of more restricted Soviet military ambitions and behavior certainly seems to make sense for the near and intermediate terms. However, over the long term (thirty years) continuing instability in the international system may create such opportunities—or represent such a threat—that the Soviet Union would decide to remilitarize the East-West competition in a major way and resume its efforts to restructure international politics fundamentally. The Soviet inclination to continue to pursue more ambitious objectives may be facilitated by the leadership's perception that economic

and political reform has made major progress, by the weakening or breakup of the American-led Eurasian security coalition, by significant unilateral reductions in Western military/nuclear capability, or by the rise of new independent military threats on the Soviet borders (e.g., a highly nationalistic Germany or Japan).

What does this highly contingent analysis of the Soviet regime and its international behavior imply for the role of U.S. nuclear weapons? These weapons will clearly remain a necessary deterrent to Soviet aggression because, regardless of its relative decline, the Soviet Union will remain a major military power with significant nuclear capabilities. If the USSR is perceived no longer to represent a global threat to international stability and American security, however, nuclear weapons could become less relevant to the remaining regional and functional disagreements between the United States and the Soviet Union.

Of course, the Soviet strategic threat could increase dramatically over the near and intermediate terms if there should be a change in the leadership and its philosophy or, in the somewhat more likely prospect, if Soviet ambitions surge again over the long run in the wake of a chaotic international environment. According to the assessment of the FNW Study, U.S. nuclear policy over the next decade or so will be asked (a) to account for a sudden expansion in the Soviet threat, even during a period when the perception of that threat may well diminish, but without jeopardizing an improvement in U.S.-Soviet relations and (b) to preserve the option of responding to the longer-term revival of a globally ambitious Soviet regime that has successfully incorporated advanced technologies into its military doctrine and force structure.

3. Changes in the U.S. Alliance System

The FNW Study anticipates that significant changes will occur over the next thirty years in the relationships among the United States, its formal allies, and other friendly nations. Such changes should not be surprising: the year 2020 would mark the 71st anniversary of NATO, the 69th anniversary of the Australian-New Zealand-United States (ANZUS) Treaty, the 60th anniversary of the U.S.-Japan Security Assistance Treaty, and the 48th anniversary of President Nixon's visit to the People's Republic of China. Recent events in Eastern Europe are currently reinforcing a "necessity for change."

The formal U.S. alliance system is likely to change to account for alterations in relative power among the members, emerging allied interests outside the U.S.-Soviet competition, and changing perceptions of the threat. For instance, a key element in traditional U.S. alliance strategy has been to encourage the economic vitality of Western Europe and Japan, even at the expense of narrow American economic interests. The U.S. willingness and ability to make such economic sacrifices for presumed strategic advantage in the East-West conflict is not likely to continue over the long-term future, as the erstwhile junior alliance partners challenge American political and economic leadership.

The restructuring of the U.S. alliance systems could occur in several ways:

- Assuming that the Soviet threat still forms the dominant rationale for the existence of U.S. alliances, the U.S. relationship with its allies could devolve by mutual agreement. By devolution we mean that the United States would forego some of the responsibilities and benefits of alliance leadership in exchange for being able to devote fewer political, military, and economic resources to the maintenance of its alliances. If the Soviet threat is perceived to have declined somewhat, the allies would be comparatively more able to pursue their own regional and global interests without American pressure to conform to the broader requirements of a global anti-Soviet coalition.
- Some U.S. alliances may be reorganized and others newly created to address a broader range of security issues than the Soviet threat. These security issues could be global, regional, or functional in character. The U.S. alliance structure already serves

to provide regional stability (e.g., to set aside the German question and Japan's role in East Asia), as well as to deter Soviet aggression. These secondary alliance functions could well come to the fore as international conditions change.

- Some or all of the U.S. alliance system could come unraveled, with new security arrangements replacing those that previously were dominated by the United States. The United States may remain a player, but with much less direct power and influence. Certain powers may come to dominate regional affairs through their political, economic, or military strength. Some regions may lack any security arrangement whatsoever and may be marked by considerable political and military instability.

If deterrence of Soviet military aggression ceases to be the prime object of critical U.S. alliances (it will surely remain an important objective), the nuclear demands of that alliance may decrease correspondingly. The degree of such a contraction of nuclear roles will depend primarily on whether (and how much of) a military threat from a hostile power is perceived by the alliance in question. Indeed, if a reduced sense of threat leads to a reduction in U.S. and allied conventional forces, nuclear weapons could become relatively more important, especially if the threat should reemerge unexpectedly.

In any event, U.S. allies will be increasingly inclined to emphasize those political-strategic and military-technical instruments that are under their direct control. In some cases, allies (and third parties) may prefer to retain or develop their own independent nuclear capabilities. In other cases, given a perceived reduction in the military threat, the allies may decide to rely more heavily upon the deterrent effects of local conventional forces, combined with the more distant threat of American nuclear systems that are aimed primarily at deterring enemy nuclear use. This would supplant the notion of an integrated conventional-nuclear strategy such as that indicated by flexible response. (The trend away from an integrated conventional-nuclear strategy would be accelerated if the United States accords greater priority to regions other than Western Europe.) At the extreme it is conceivable that, as we have seen in the case of New Zealand, some nations could make their adherence to a U.S. alliance conditional on that alliance being explicitly nonnuclear in character.

The changing character of the U.S. alliance system implies that the existence of American nuclear weapons will continue to provide the United States with an essential measure of international prestige. Assuming the allies do not perceive a military threat that is immediate and severe, however, any American protective deterrent will tend to be regarded more in the nature of an insurance policy rather than as a primary means of security. Accordingly, it seems that the United States will be more interested in a nuclear policy and force structure that supports the political-strategic requirements of alliance cohesion (reassurance) as opposed to the military-technical requirements for extended deterrence. Such reassurance will be enhanced by a nuclear force that is neither present nor threatening in peacetime, but that is perceived politically as being readily available if circumstances warrant. The East Asian pattern of U.S. extended nuclear deterrence, rather than the NATO model, may therefore become the dominant paradigm for American national security policy.

C. Public Opinion

The precise relationship between mass public opinion and national security policymaking is difficult to define. While democratic political leaders care deeply about public opinion, governments do not look to the public for guidance about the details of military programs, operational strategies, arms control negotiations, and so forth. These specific choices tend to be more the province of the elite and informed public—perhaps 5 percent of the electorate—who tend to be influenced by threat assessments, judgments about national and alliance interests, economic constraints and priorities, and alliance relations. Except perhaps for moments of real or perceived crisis,

mass public opinion seems more likely to have an impact on the general course of policy—for example, the level of defense investment and the articulation of declaratory objectives regarding deterrence and arms control.

The FNW Study arrived at two broad observations about public opinion. First, there is no imminent or inevitable collapse of public support for a general policy of nuclear deterrence among the American mass public. The American public at large does not like nuclear weapons, does not wish to contemplate actually using them, and favors negotiations to control them; but at the same time the public does not trust the Soviets and sees nuclear weapons as being necessary for deterrence. At the same time, there is much less American public support for continuing a policy of employing nuclear weapons to respond to conventional Soviet aggression ("first use") and to defend U.S. allies. In fact, a majority of U.S. and Western publics now assume that their governments follow a no-first-use policy and that the purpose of U.S. nuclear weapons is only to deter Soviet nuclear use.

This generalization about broad Western public support for the concept of nuclear deterrence must be qualified in one important respect. There have been significant changes in West German mass public opinion that may presage a very different kind of German attitude towards nuclear weapons over the next thirty years. (German public attitudes will likely be affected as the unification process continues. We lack reliable data on East German public attitudes toward nuclear weapons.) For example, attitude shifts in the successor generations in the Federal Republic have been more acute than elsewhere, with increasing levels of criticism of U.S. foreign policy, skepticism about the Soviet threat to Western security, and opposition to NATO's nuclear strategy.

Although the views of the West German public on nuclear issues remained relatively stable during the intermediate-range nuclear force (INF) controversy from 1979 to 1983, support for nuclear deterrence has in more recent years markedly eroded in comparison to other Western countries. In 1988, a poll showed 57 percent supporting the proposition that the risk of Soviet pressure against West Germany would not be increased by the removal of allied nuclear weapons; only 22 percent supported the continued presence of allied nuclear weapons in order to avert the risk of Soviet coercion. Roughly half (51 percent) of the West German public currently disagrees with the proposition that nuclear weapons have preserved peace in Europe, and 79 percent favor the removal of all nuclear weapons in Europe.

The second broad observation of the FNW Study identifies a tendency toward a certain "delegitimization" of nuclear deterrence which has emerged in some important sectors of the elite and attentive publics in Britain, West Germany, and the United States. This delegitimization may be defined as reduced confidence in the reliability and safety of nuclear deterrence arrangements and as lessened certainty about the prudence, strategic necessity, and moral legitimacy of posing nuclear threats to adversaries. Since the mid-1970s, a significant proportion of U.S. and Western elites have come to conclude that a deterrence policy based on first use and flexible nuclear response is inherently incredible; that reliance on nuclear weapons weakens rather than strengthens the public will to maintain national and allied security; that East-West tensions are exacerbated by the continued modernization and improvement of nuclear systems necessary to support an active deterrence strategy; and that the Soviet threat is neither so imminent or absolute as to necessitate a prominent role for nuclear weapons.

Again, shifts in the views of the West German political parties have been especially remarkable. Polarization has been evident in the emergence of the antinuclear Greens and in the Social Democratic Party's (SPD) turn toward policies critical of NATO nuclear strategy (e.g., advocacy of a no-first-use policy). Foreign Minister Hans-Dietrich Genscher of the Free Democratic Party (FDP) has increasingly espoused concepts—such as the need to reduce reliance on nuclear deterrence, build East-West cooperative security structures, and overcome

"enemy images"—that are compatible with SPD views. Views critical of past NATO nuclear policies have even been expressed by prominent members of the Christian Democratic Union (CDU) and its Bavarian counterpart, the Christian Social Union (CSU). It is noteworthy in this regard that all the political parties have been devoting more attention to the theme of protecting and promoting German interests in the formulation of national security policy. The depth of antinuclear feeling in the country as a whole and even among the more conservative CDU/CSU supporters is such that there is a reluctance to make any nuclear modernization decisions that could provoke a protracted and intense controversy comparable to that regarding INF in the early 1980s.

Over the past several years, there has been a significant resurgence of elite opinion, especially in the United States, in favor of a continuation of active deterrence in one form or another. This viewpoint was perhaps best represented by the bipartisan Scowcroft Commission of 1983. To gain support, these "mainstream" elites have emphasized stability as the most desirable requirement for nuclear forces. This resurgence of elite support for nuclear weapons suggests that the United States will not abandon active deterrence for the foreseeable future, unless there is a catastrophic nuclear accident or a momentous superpower crisis that greatly strengthens the antinuclear movements.

Nevertheless, because of the increasing elite rejection of the more active forms of nuclear deterrence, it has become harder for the United States to make and to implement decisions about nuclear force modernization and arms control. Specific issues are often politicized and invested with great symbolic importance, and the decision-making process has accordingly become more contentious and prolonged. In some particularly hard cases, such as the U.S. intercontinental ballistic missile (ICBM) modernization program and the implementation of NATO's 1983 Montebello decision, the outcome may be no decision at all. Over the long term, the cumulation of such "no hard decisions" may lead to a force structure that is not appropriate to support a doctrine of flexible response.

In short, unless there is some major upheaval in mass and elite public opinion over the next thirty years, decisions to modernize nuclear weapons will likely be constrained, perhaps severely, by concerns about economics, safety, and stability. Even a major renewal of serious U.S.-Soviet tensions will not necessarily lead to public acceptance of new nuclear programs unless the USSR is seen to be unambiguously at fault. If Western policies are seen to be a contributing factor in the deterioration of East-West relations, there may well be a further erosion in public acceptance of nuclear programs necessary to support a flexible response strategy. Any catastrophic nuclear event—for example, an accidental nuclear detonation, a disastrous incident at a civilian or military nuclear facility—could seriously erode the public's continued acceptance of nuclear deterrence of any kind.

Finally, we should observe that mass and elite public support for programs that support active deterrence may be further eroded if the costs of modernizing and cleaning up the nuclear weapons production complex appear to belie the argument that nuclear weapons are cheap.

D. Arms Control

Over the past twenty years, arms control has become an important foundation of efforts to make safer the political-strategic competition between the United States and the Soviet Union. Arms control negotiations to date, however, have had relatively little direct impact on the military-technical capabilities of the two sides.

If present trends are any indication, however, the role of arms control could become much more comprehensive over the next several decades. The continued regulation of nuclear forces (and the addition of constraints on conventional forces) would at some point come to have important military-technical consequences for the character of future war, and for Eastern and Western force structures and doctrine. These

important military-technical effects of arms control would, in turn, begin to affect the political-strategic relationship in an even more fundamental fashion.

If arms control is to have this kind of effect, the continued reduction and regulation of strategic and theater nuclear weapons must eventually reach and cross three critical thresholds. (These thresholds are not necessarily presented in order of time or importance.)

First, the United States and the Soviet Union will come to the point at which their current operational nuclear plans and goals must change significantly. This threshold will not be reached as a consequence of the proposed START agreement, but another 50 percent reduction (even by START counting rules) could considerably diminish the ability of both sides to cover their opponent's critical target set—at least as that target set is now defined. Both sides could also lose their theoretical ability to operate nuclear forces in a flexible and limited fashion while still retaining a secure reserve force. Proposed qualitative limits on nuclear forces, such as flight test constraints and nuclear test bans, will also lessen military confidence in the effectiveness of nuclear weapons.

Another critical threshold will be reached when the nuclear forces of third parties (currently Great Britain, China, and France) must be included in arms control negotiations. U.S.-Soviet nuclear reductions far beyond START would bring U.S. and Soviet forces down to the level at which the British and French forces, and the forces that China might deploy by that time, would be too large to be ignored. Should that become the case, the United States would need to develop a concept for determining appropriate numerical limits among several nuclear powers. Such limits could be based on a finite, rather than comparative definition of U.S. nuclear weapons requirements. Alternatively, the United States could pursue the idea of establishing relative force sizes, such as existed in Washington Naval Treaty of 1921.

The third critical threshold for the continued reduction and regulation of nuclear forces will be reached when conventional force negotiations fundamentally alter the relationship between conventional and nuclear forces—especially theater/tactical nuclear forces. If conventional arms control, together with unilateral measures such as the withdrawal of Soviet forces from Eastern Europe, can truly establish a stable nonnuclear balance in a given theater—and especially if arms control can assist in establishing a situation of defense-dominance—then the military roles and requirements for U.S. nuclear weapons in theater warfare will be quite different, and probably much less, than under present circumstances.

To be sure, there may well be good political reasons for retaining both strategic and theater/tactical nuclear weapons even in the event that an improved military balance of conventional forces can be brought about. Among other reasons, it is difficult to define a stable conventional balance and even more difficult to keep it so. Nevertheless, the central point remains: NATO's Nuclear Weapons Requirements Study would be a very different exercise and would undoubtedly reach very different conclusions if there were greater Western confidence in the resilience of the conventional force balance.

There is, of course, no way of predicting definitively whether arms control negotiations will ever reach or cross any of these critical thresholds. Taken to its logical extension, the arms control process would lead to the relegation of nuclear forces to a retaliatory deterrent role alone, accompanied by a shift to forces designed to be "stable" above all, even at the sacrifice of attributes useful for current types of military missions. In this case, numerical reductions might be supplemented by qualitative restrictions such as bans on MIRVed (multiple warhead) missiles or ballistic missiles in their entirety. With such an emphasis being placed on stability, both sides could agree to substantial limitations in, if not an outright prohibition of, nuclear testing. It is also conceivable that the two sides could negotiate the deployment of strategic defenses, coupled with offensive force reductions, in a way that would enhance stability and further decrease the military potential of the remaining nuclear weapons.

Before this military-technical change occurs, however, the political-strategic relationship between the United States and the Soviet Union must be altered substantially. As long as events move in the direction of decreased East-West tensions, arms control is likely to become a critical domestic and international process for implementing political change and for managing U.S. strategy, forces, and foreign policy to encourage greater stability. The United States will have further incentive to use arms control as a political means to head off the further proliferation of nuclear weapons and other advanced military systems.

To be sure, the East-West political relationship may never reach this point, and the critical military-technical thresholds may never be crossed. Arms control could reach a dead end, or at least a resting point, as the complexities and uncertainties of post-START and post-CFE negotiations become overwhelming. Conventional arms control may become irrelevant because of domestic pressures for unilateral reductions. The complete abandonment of nuclear arms control seems plausible only (1) in the presence of such complete relaxation of tensions among the major powers that it is not needed or (2) in the presence of threats of central war so great and over such a protracted period that the United States would commit itself to a nuclear war-winning strategy. But the arms control process could be slowed by a number of factors, including a more aggressive shift in Soviet behavior.

Perhaps the least predictable but most important factor for the future of arms control involves the interests and goals of third parties. If, for example, the international environment deteriorates substantially, neither the Soviet Union nor the United States may be willing to eliminate or reduce specific types of military forces in the face of unregulated growth in those same forces elsewhere. (This is now true in the case of the INF Treaty, in which only U.S. and Soviet ground-launched ballistic and cruise missiles with ranges between 500 and 5500 kilometers will be eliminated.) On the other hand, the superpowers may be confronted by third parties that are determined to close themselves off from the East-West nuclear competition through the establishment of nuclear-free zones, the banning of nuclear-armed and nuclear-powered ships from their ports, and the like.

III. THE FUTURE MILITARY-TECHNICAL ENVIRONMENT

Since the end of the Second World War, American national security policy has placed a considerable premium on technological innovation to offset the mass-oriented Soviet military force structure. For a time and especially for the first two decades of the postwar era, nuclear weapons, their delivery systems, and their supporting infrastructure represented the cutting edge of American technological superiority. Over the past two decades, the United States has shifted its emphasis toward technological innovation in the conventional forces arena, but it remains committed to qualitative excellence in nuclear weapons as well.

The evolution of future U.S. nuclear roles and requirements will depend heavily upon whether and how the United States, the Soviet Union, and perhaps other powers attempt to pursue this qualitative military-technical competition. The FNW Study concluded that there does not seem to be any single, well-defined "technology imperative" that will dominate nuclear force structures and applications over the next thirty years. Rather, there is a wide range of military-technical choices for the United States, its allies, and its potential adversaries to maintain or alter their current requirements for nuclear weapons.

A. Traditional U.S. Military-Technical Requirements for Nuclear Weapons

In general terms, current U.S. nuclear strategy (flexible response) seeks to deter nuclear conflict by developing and maintaining the capability to deny Soviet political-military objectives and thus deny the USSR a "victory" under any conceivable terms. In order to

achieve this deterrent goal, U.S. nuclear offensive weapons must be capable of placing at risk the full spectrum of Soviet high-value targets. If deterrence should fail, the United States desires the ability to respond to Soviet aggression in a fashion that creates some political-military advantage, so as to provide leverage for termination of the war at the lowest possible level of violence and on terms acceptable to the United States and its allies.

In practice, this U.S. nuclear doctrine of flexible response translates into specific military-technical requirements for both strategic and theater/tactical nuclear weapons. In very general ways, these requirements include the following:

Survivability and Endurance. The minimum basic requirement for U.S. strategic and theater/tactical nuclear forces and their supporting infrastructure is that sufficient retaliatory capability must survive a Soviet attack even under day-to-day alert conditions. (Sufficient is defined here as being the minimum quantity and quality of forces necessary for the United States to execute controlled, limited, and militarily effective nuclear strikes against the full range of Soviet targets.) In addition, the United States requires that some percentage of U.S. strategic forces must be withheld from any initial nuclear use so as to constitute an enduring, secure reserve force. Survivability and endurance are regarded as a key to both stability and escalation control because they ensure that the United States is not placed in a use-or-lose situation.

Flexibility. U.S. nuclear forces and C³I must be able to respond to the entire range of situations that may confront the United States in wartime. Further, the United States requires the ability both to execute either preplanned options and to respond on short notice to changing circumstances. Flexible (and limited) nuclear options are intended to convince the enemy that further escalation will result not in the achievement of its objectives but rather in the imposition of additional costs. The enemy is to be left with sufficient highly valued military, economic, and political resources still surviving but clearly at risk, so that he has a strong incentive to seek an end to the conflict.

Military Effectiveness. As noted above, the United States does not plan to use nuclear weapons to create the conditions for victory. Rather, it plans for the controlled use of nuclear weapons, along with other appropriate political and military actions, to provide leverage for the negotiated termination of the fighting. This goal requires a certain degree of military effectiveness; how this effectiveness should be measured is a long-standing issue.

The most critical military mission associated with U.S. nuclear forces has traditionally been the destruction of enemy nuclear assets, for the purposes of limiting damage to the United States and its allies and coercing the enemy into terminating the war. The United States has also sought to target enemy general purpose forces at fixed locations (with strategic and longer range theater nuclear forces) and in the field (with shorter range tactical nuclear forces). The United States has always targeted enemy industrial facilities, a target set that has been refined in recent years to focus on industries the destruction of which would have a direct and adverse impact on enemy military operations. Finally, the United States has emphasized the targeting of enemy command and control facilities because this threat to political control is a potent deterrent and because counternuclear strikes could disrupt ongoing military operations and deny ultimate Soviet success in war.

These military missions require that U.S. nuclear forces be capable of inflicting significant levels of damage on a Soviet target base that is composed of fixed, active and passively defended, and increasingly mobile or movable targets. The requirement for effectiveness against such a wide range of Soviet targets has led the United States to emphasize military characteristics for nuclear weapons systems such as range, speed, reliability, accuracy, maximized explosive and nuclear effects, and assurance of arrival to target.

Minimize Collateral Damage. The United States places formal restrictions on collateral weapons damage to facilitate war termination, to minimize the consequences of nuclear weapons use on or near friendly territory, and to send a signal of restraint to the enemy while leaving

critical assets still at risk. This can be achieved through such factors as the proper choice of weapon, its yield and other characteristics, and the location of its Desired Ground Zero (DGZ).

Safety, Security, Command, and Control. The United States, in recent years, has placed considerable emphasis on ensuring that nuclear weapons will not detonate or spread radioactive material by accident and that they cannot be used without official authorization. These attributes are critical to the U.S. military, which without such assurances would not be allowed to operate nuclear systems as part of their "ordinary" force structure and operations. Also, a nuclear accident would have a devastating effect on the political viability of nuclear deployments both within the United States and overseas.

B. The Military Roles and Missions of Theater/Tactical Nuclear Weapons

Much of the public discussion about nuclear weapons focuses on strategic systems—that is, ICBMs, submarine-launched ballistic missiles (SLBMs), long-range bombers, and air- and sea-launched cruise missiles. Another class of nuclear weapons, what we term here theater/tactical systems, receive much less attention, despite the fact that they constitute a considerable percentage of deployed U.S. nuclear weapons.

Many of the military-technical roles and missions for U.S. theater/tactical nuclear weapons have been driven in large part by two factors. First, because the United States assumes that the Soviet Union will be the aggressor in theater warfare, it also assumes that the Soviet Union will enjoy the inherent advantage of the offense at the outset of the war. Second, given the Soviets' presumed numerical superiority and shorter lines of communication to the critical Eurasian theaters (especially Europe), it has seemed reasonable that the Soviets would retain the offensive initiative for some time. In short, the United States has traditionally been pessimistic about the prospects of defeating local Soviet aggression without resort or threatening resort to nuclear weapons.

During the 1950s, the United States thought that it might be able to use theater/tactical nuclear weapons to offset its local conventional weakness along the Eurasian periphery. (At the same time, U.S. strategic forces would destroy the foundations of Soviet power in the USSR itself.) Tactical nuclear weapons could destroy masses of tanks, key logistical chokepoints, enemy airfields, and the like in a way that conventional weapons could not, thus potentially changing the nature of theater warfare that otherwise seemed to favor the Soviet Union. The U.S. Army went farthest in this direction with its Pentomic Division and with the deployment of nuclear artillery shells, atomic demolition munitions, antitank weapons (the Davey Crockett), short-range ballistic missiles, and nuclear surface-to-air missiles. The Air Force (tactical nuclear gravity bombs) and the Navy (especially with nuclear anti-submarine weapons) also moved toward a "nuclearization" of the tactical battlefield.

The United States has walked backward considerably from this position over the last thirty years. Administrations since 1961 have chosen to place much greater emphasis on improved conventional forces as part of a policy of flexible response and to engage in military actions where the use of nuclear weapons was not appropriate (e.g., Vietnam). Theater/tactical nuclear weapons retain a role in flexible response, although that role is much more ambiguous than it was during the 1950s when tactical nuclear use was thought by many to be capable of creating decisive military advantage—the conditions for victory in the theater.

Theater/tactical nuclear weapons today serve to raise the prospect of escalation, that is, to link American military activities in the theater with U.S. strategic nuclear forces. If employed, tactical nuclear weapons would be used for their ultimate political effect—to convince the aggressor that it is in his interest to cease and desist. To be sure, tactical nuclear employment would be designed to have decisive military results—to bring about a tactical or operational pause in the conflict, during which time the aggressor could take stock of the changed political-military situation and seek to negotiate the termination of the war.

There are several reasons why the United States has rejected the nuclearization of its general-purpose forces. First, because it lacks confidence that tactical nuclear use can be controlled before there is a strategic nuclear exchange, the United States has for decades stressed the necessity to enforce and broaden a firebreak between conventional and nuclear use. From a political standpoint, the deployment and planned use of tactical nuclear weapons is controversial, especially among some allied governments and publics. The enhanced radiation weapon controversy of the mid-1970s, the debate over the INF deployments in the early 1980s, New Zealand's refusal to permit the visits of U.S. Navy ships that might contain nuclear weapons, and the growing dispute over modernization of the Lance missile, are recent examples of these pressures.

The military services themselves, at least since the early 1960s, have not been enthusiastic advocates of tactical nuclear weapons. The U.S. military as a whole has for some time been ambivalent to negative about the purely military advantages of nuclear weapons. According to prominent studies, nuclear use by both sides during a theater campaign will not provide lasting advantages to the defender unless nuclear use is so massive that the territory cannot be physically occupied. Instead, if the side with the larger number of forces (i.e., the Soviets) can resume its attack after a tactical nuclear exchange, the attacker may have even greater advantages over the defender than before simply because of the immense attrition caused by nuclear weapons.

In addition, the tactical nuclear specialty in each service is not given much prominence, and there is a widespread assumption that nuclear specialization apart from strategic weapons in the military is a "career-stopper." None of the services have been able to integrate tactical nuclear weapons fully into their force structure or operational doctrine, and they tend to regard the "care and feeding" of nuclear weapons as a drain on manpower and time. Finally, the services tend to doubt that they will receive timely release and employment authorization for nuclear weapons—and they may well receive no authorization whatsoever. The U.S. Navy as a whole (as opposed to particular parts of that service), in particular, is dubious about the value of tactical nuclear weapons, especially those that might be used for sea control.

However, because American national security planning has been based on the bipolar/global warfare contingency, the U.S. military, especially at the level of the Joint Chiefs of Staff (JCS) and the regional and functional Commanders in Chief (CINCs), does accord a prominent role to nuclear deterrence and nuclear weapons at the theater level. The JCS and the CINCs assume that the United States will have to fight outnumbered in critical theaters, that the Soviet Union will possess the tactical initiative (and possibly strategic surprise) at the outset of conflict, and that the United States lacks the mobilization infrastructure that would be necessary to fight a protracted conventional conflict. Tactical nuclear weapons offer a "solution" to these problems, at least prospectively: for example, nuclear weapons have desirable "virtual" effects in planning and executing a conventional war (e.g., by forcing the enemy to disperse its forces and therefore weakening the potential force of the attack).

Most significantly for planning purposes, the prospect of nuclear escalation has traditionally bounded the size and duration of any conflict, so that the U.S. military need not plan and equip itself to fight several protracted theater campaigns along the lines of World War II. In addition, as a matter of policy, the United States has always been interested in hedging against a sudden and unexpected increase in the threat, and these hedges in the theater have necessarily included nuclear weapons. Of the military services, this relatively favorable view of tactical nuclear weapons is probably held most strongly by the Army.

C. The Technical Revolution in Military Affairs

There are a number of foreseeable advances in military technology over the next several decades that could have a dramatic impact on

the nature of the strategic and theater/tactical battlefield. A full survey and analysis of all potential military technology is beyond the scope of this report; the FNW Study has instead sought to identify those areas that could have the greatest impact on the future characteristics and role of nuclear weapons.

Perhaps the most important advances will take place in what might be called *information systems*. There is no single technology that one can associate with information systems; rather, it is a suite of technologies that would, in principle, allow for much improved surveillance, tracking, and targeting of enemy military systems. Such technologies include improved sensors that will be able to detect signals from cluttered or noisy backgrounds, using a wide spectrum of technologies (infrared, optical, radar, and directed energy). Advanced computing capabilities—architecture, hardware, and software—could provide better signal processing for various types of sensors; permit more effective tactical, operational, and strategic command and control systems; and eventually lead to the development of truly autonomous weapons systems. Enhanced guidance technologies should lead at some point to a cheap, perfectly accurate (zero circular error probable-CEP) capability for a full range of delivery vehicles. Improvements in communications systems may provide inexpensive and resilient means to transmit large amounts of data.

One of the most important impacts of information systems will be in strategic and theater/tactical targeting: in principle, it will become relatively easier to "see" mobile or concealed military targets on land, in the air and space, at sea, and possibly underwater and underground. If targets can be located with fewer false detections and if the information can be distributed meaningfully and rapidly, the battlefield will become more transparent and potentially more lethal than it is at present. Of course, improvement in information systems will lead, in turn, to a series of countermeasures intended to suppress the gathering, processing, and dissemination of information. Attempts to detect/reduce the signature of major combatants (tanks, manned aircraft, cruise missiles, remotely piloted/autonomous air vehicles, surface ships, and possibly ballistic missiles) will be an especially important measure/countermeasure dynamic.

The Soviets in particular have expressed an interest in the future development of *weapons based on new physical principles*. The most publicized of these weapons are directed-energy systems—lasers and particle beams—with applications in advanced ballistic missile defenses. Such systems may also come to play a role on the tactical battlefield with respect to air defense and the suppression of enemy sensors and electronics. Area effects weapons, such as explosively driven microwave generators, could likewise be used in electronic warfare. Electromagnetic rail-guns could have a variety of tactical applications.

Even less exotic technologies such as fuel-air explosives and conventional munitions configured for special purposes (e.g., airfield "runway busting" and armored kill) should greatly contribute to the lethality of the battlefield. The development of familiar and unfamiliar kill mechanisms, especially if they are combined with the sophisticated information systems described above, could reach the point where nonnuclear weapons systems will rival the *military* effectiveness of nuclear weapons for at least some missions.

Improvements in composite materials and ceramics, aerodynamics, energy systems applied to propulsion, and electronics could lead to the development of new *advanced delivery systems* that are substantially different from those currently in service. These technologies could be integrated to make possible the development of lighter, stronger, and less detectable (i.e., stealth) aircraft and missiles. These delivery systems could have extended ranges, unusual flight profiles and relatively high velocities (e.g., boost-glide and hypersonic vehicles). The integration of these and similar technologies into naval platforms could likewise have a considerable impact on the next generation of surface and subsurface vessels.

Military systems deployed in space may well have a critical impact on the future strategic

and theater/tactical battlefield. Highly effective ballistic missile defenses, based on both directed-energy and kinetic-energy kill mechanisms, could be deployed in space within the next three decades. A number of nations are now in the process of developing space systems whose sensing capability (optical, IR, radar) may provide critical targeting information for terrestrial air, sea, and land combat. One also cannot rule out the deployment of weapons in space that could be employed directly against targets on the ground. In any event, lacking an effective arms control agreement, one or more sides may wish to exercise control over space—or deny it to an adversary—through various anti-satellite (ASAT) systems and techniques.

Will improvements in *nuclear weapons technology* have any significant effect on the future military-technical environment? There does not seem to be any single revolutionary development in the near or intermediate terms that will have the impact of the early fission weapons or of thermonuclear weapons. This observation does not deny the usefulness of evolutionary developments—for example, the deployment of low-yield nuclear weapons, which, combined with very accurate means of delivery, permit reduced collateral damage; the use of insertible/separable nuclear components to increase deployment options; and nuclear weapons that can sufficiently penetrate earth, ice, and water to destroy buried or concealed targets. Similarly, a variety of measures can be taken to increase the safety, security, command, and control features of new and upgraded nuclear systems; to ease the maintenance and extend the service lifetime of deployed weapons; and to minimize the use of special nuclear materials (SNM) and tritium.

Nevertheless, there is a set of advanced nuclear design concepts that, over time, could have a major impact on the military-technical environment. These involve the use of nuclear weapons to drive a laser or otherwise direct energy against a target and to create specific tailored outputs such as high-altitude electromagnetic pulse (HEMP) or microwaves. Nuclear directed-energy technologies could be employed, for example, against ballistic missiles/warheads as part of a strategic defense system. Tailored output devices, with their potential for widespread area effects ("soft kill") against electronics, might offer a solution to the targeting problem posed by mobile missiles and other imprecisely located targets.

For nearly the past forty years, the United States has faced essentially no material constraints on the design and deployment of nuclear weapons—the Atomic Energy Commission/Department of Energy production complex could provide enough SNM and tritium so that the weapons design could be optimized and so that the nation could deploy as many weapons as required. That production complex is now in need of modernization and cleanup, and it will be required in the future to meet high standards of environmental safety. This modernization process will be expensive and controversial. In the future, some administration may be interested in pursuing the idea of SNM/tritium production controls as a means of limiting the number of nuclear weapons. Although it is impossible to predict the future in this regard, the United States may face, by choice or inaction, a shortage of SNM and tritium that will force it to rethink the size and design of its nuclear weapons stockpile.

To sum up, the future evolution of the military-technical environment, along with the place of nuclear weapons in that environment, is one of considerable uncertainty. It is not clear whether, how, and for what purposes advanced technologies of any sort will be brought to bear on the battlefield of the future. In particular, the pace and direction of technological development and deployment will depend upon such factors as

- the degree of threat which the major powers perceive to their national security and interests
- the levels of funding devoted to military spending, in general, and research and development in particular
- developments in science and technology and especially any breakthroughs by one nation

- the ability to incorporate improved technologies into operational systems in a cost-effective and militarily effective fashion
- the outcome of the measure/countermeasure dynamic
- the ability and willingness of the armed forces to introduce advanced military technologies into existing or revised service doctrines.

These issues are explored in more depth below for both strategic and theater/tactical nuclear weapons.

D. Strategic Nuclear Issues

The United States has for some time regarded the threat of global war with the Soviet Union as the ultimate contingency against which it structures and deploys its armed forces. U.S. strategic nuclear forces have become the principal means of deterring such a war with the Soviet Union and of terminating that war should deterrence fail. The United States has traditionally anticipated that global war would not be decided by the outcome of particular theater campaigns in Eurasia but rather by the use, or threatened use, of these long-range (strategic) forces.

The most important of these strategic forces over the past thirty years has been the weapons system represented by the integration of thermonuclear weapons and ballistic missiles. In principle, the ballistic missile/nuclear weapon combination has offered the United States and the Soviet Union a militarily effective instrument with the attributes of short time of flight, accuracy, high levels of damage expectancy, and assured penetration to target against the adversary's homeland and military infrastructure. (The development of MIRVed ballistic missiles with high accuracy in the 1960s and 1970s made the ballistic missile an even more cost-effective weapon.) Such effectiveness is especially important against time-urgent military targets, notably opposing nuclear forces.

The strategic regime dominated by the military effectiveness of the ballistic missile/thermonuclear weapon combination may be seriously challenged over the next thirty years. First, as suggested in the political-strategic section above, the threat of a global war with the Soviet Union may cease to be the principal standard by which deterrence and military capabilities are measured. The United States may be more interested in forces that can operate in regional contingencies, whether against the Soviet Union or against third powers, without resort to threats of strategic nuclear escalation.

Second, over at least the next decade, counternuclear strikes will seem to be technically less attractive—assuming that both sides continue programs aimed at improving the survivability of their strategic offensive systems. The percentage of survivable nuclear forces will increase as both sides retire large numbers of fixed, silo-based ICBMs in favor of mobile systems and place relatively greater importance on SLBMs and air-delivered weapons. Command and control systems will arguably be made more survivable over this period as well. This trend toward survivability may be increased if there is an arms control agreement that reduces the warhead-to-launcher ratio significantly (i.e., de-MIRVing). The ballistic missile/thermonuclear weapon combination will not provide nearly the military advantage in this kind of environment as it did when it could perform substantial and prompt counternuclear operations—unless it is given another unique, high-leverage mission.

Third, the military effectiveness of ballistic missiles/nuclear weapons is prospectively held hostage to the application of advanced technologies (e.g., sensors coupled with active discriminators, and directed energy weapons) to strategic defenses. Depending on their effectiveness and survivability, these defenses could neutralize the counternuclear effectiveness of the ballistic missile or, more ambitiously, lead to a defense-dominant regime, in which the offense could not carry out any effective and limited military action (as opposed to an assured destruction attack).

Fourth, there are innovative concepts of offensive delivery vehicles and operations that might overshadow if not supplant the ballistic missile/nuclear weapon combination. For

example, a combination of composite materials, electronic countermeasures, and airframe/power plant design could lead to a fast, truly stealthy air-breathing vehicle that might rival the ballistic missile in military effectiveness. Range-independent precision guidance (zero-CEP), coupled with cheap, long-range delivery systems and effective, specialized nonnuclear munitions, could make conventional weapons feasible for at least some strategic missions.

But the case for the withering away of the ballistic missile/nuclear weapon system is not conclusive. Over this same time period, information system technologies and new destructive concepts, harnessed to the ballistic missile, could conceivably permit the development of a real-time offensive counterforce capability against mobile ICBMs, bombers in flight, and (much less likely) submarines at sea. Advanced sensors could track mobile and concealed targets; the information could be processed and relayed to provide in-flight targeting updates; and tailored nuclear weapons could provide area destruction effects and compensate for any location uncertainty. Such an application could restore the supremacy of the ballistic missile and the viability of counternuclear operations—and, by traditional standards, significantly reduce strategic stability.

In short, the character of the long-term military-technical environment is very unpredictable. It could be marked by the slow decline of the military effectiveness of the ballistic missile/nuclear weapon combination and an emphasis on stability; or the ballistic missiles/nuclear weapon systems could be supplanted by some new combination of offensive and defensive systems; or innovative technologies and targeting combinations might revitalize the ballistic missile/nuclear weapon combination.

In the face of this military-technical uncertainty, the United States will, at a minimum, retain an interest in deploying survivable and enduring strategic weapons systems/C^{3}I in light of conceivable improvements in Soviet offensive counternuclear capabilities. Over the near and intermediate terms, this Soviet threat could come from some combination of sea-launched cruise missiles and highly accurate SLBMs fired on depressed trajectories. The most likely Soviet counternuclear improvement over the long term would come from enhanced military-technical means to target mobile ICBMs and bombers as they escape their bases; the most dangerous new Soviet threat would be the ability to target the U.S. strategic submarine fleet. The latter problem is very unlikely to emerge in the near and intermediate terms, but it cannot be completely excluded in the long term. This is a critical issue because the United States will otherwise be inclined to respond to threats to its land-based (bomber and ICBM) forces by moving additional nuclear assets to sea.

The United States will also remain interested in developing offensive nuclear technologies to suppress and penetrate hostile defenses. The degree of emphasis that is placed in this area will depend upon the existence or probability of enemy defensive deployments. The United States and the Soviet Union are already engaged in a stealth-counterstealth dialectic with respect to air defenses that will continue to influence the design of U.S. strategic aircraft beyond the B-2 bomber and cruise missiles beyond the advanced cruise missile. Such a dialectic could take place with respect to ballistic missiles and any future Soviet air-, sea-, ground-, and space-based ballistic missile defense (BMD). It is arguable that the prospect of a measure-countermeasure game in the BMD arena will virtually tend to devalue the importance of ballistic missiles even if defenses are never deployed.

In almost any case, the United States will continue to face military-technical problems with respect to the employment of its strategic nuclear forces. The most significant problem will be created by a constantly changing Soviet target base: for example, increased mobility, concealment, deception, hardening, and proliferation. The United States might face new strategic target sets in the air or in space, at sea or on the ocean floor, or in very deeply buried, imprecisely located protective structures.

These U.S. targeting problems will be the most challenging with respect to the ability to

hold Soviet nuclear forces at risk. There are two distinct U.S. responses to this targeting problem. First, the United States could undertake a massive effort aimed at finding, fixing, and attacking mobile targets, particularly mobile missiles. Second, the United States could give lower priority to counterforce as a mission. The U.S. choice in this critical matter will have very different implications for future nuclear systems design and development.

Finally, the United States may be required to design its nuclear forces in anticipation of or in response to a major new military threat—country X. (The analysis in Section II indicated that such a threat was unlikely, but it cannot prudently be ruled out altogether.) The emergence of a new threat would not necessarily require the United States to maintain two separate nuclear force structures, one for X and one for the Soviet Union, although it would probably increase somewhat the required total number of strategic nuclear weapons. The United States would probably be interested, however, in maintaining as much flexibility as possible in its nuclear force structure to account for the additional contingency. In addition, there may be peculiar nuclear requirements if X's target base differs significantly from that of the Soviet Union; if the military force structure and operations of X are unique; or if the X political leadership is much less cautious and rational than has been our experience with the Soviet leadership.

E. Theater/Tactical Nuclear Issues

In evaluating the theater/tactical requirements for U.S. nuclear weapons over the next thirty years, three possible changes in the military-technical environment must be taken into account.

First, the FNW Study projects that advanced nonnuclear weapons systems will pose a major military-technical challenge to the dominance of the tank and the tactical aircraft in Europe and similar theaters. (By implication, this challenge also exists to the aircraft carrier and other large surface naval vessels). The combination of accurate, real-time targeting data and lethal weapons effects against ground and air targets could imply a considerable reduction of mobility on the battlefield—possibly to the point of tactical and operational defense dominance, wherein it is militarily advantageous to defend rather than attack.

The military effects—both actual and virtual—of these conventional weapons systems can thus be expected to increase remarkably over the next three decades. Advanced conventional weapons may be able to "compete" with tactical nuclear systems in a way that was not previously possible, even if they cannot precisely duplicate the effects of nuclear weapons.

If this military-technical development occurs, advanced conventional systems will probably change the battlefield environment in a way that tactical nuclear weapons never quite achieved. This kind of future battlefield would not seem to favor large armored fighting vehicles or tactical aircraft that must operate from fixed bases and penetrate to their target. It would seem to favor long-range standoff weapons that permit the concentration of firepower rather than forces. Stealthy cruise missiles, remotely piloted vehicles (RPVs) and autonomous air vehicles, and tactical ballistic missiles (if permitted by arms control agreement) would all seem viable weapons system candidates. At the same time, there could be an advantage to moving troops and hardware by air rather than on the ground. Electronic warfare (to confuse and protect sensors) would take on vastly increased importance.

To be sure, these kinds of advanced conventional technologies have been vastly oversold during the 1980s, and their introduction will probably be uneven, time-consuming, and expensive. Also, it is possible that a substantial perceived reduction in the Soviet threat and the outcome of conventional arms control agreements could forestall a dramatic change in today's theater/tactical environment. Political factors may drive the tactical battlefield of the future in the direction of a low-technology, low-readiness "defensive defense" of the kind envisioned by the European left.

Second, the European theater may not be the military-technical focus of U.S.-Soviet com-

petition thirty years from now, as it has been over the past four decades. To be sure, Europe will undoubtedly remain a vital political-strategic interest of the United States for the indefinite future, but there is no certainty that the American contribution to European security will continue to be a direct and substantial military presence on the continent itself. The United States originally conceived its role in the defense of NATO Europe as consisting of air and sea power. Such a role may again be attractive and feasible if there is a substantial reduction of tension on the continent or if the West Europeans are able to take on a relatively greater responsibility for regional defense. (Unless there is a considerable resurgence in the perceived Soviet threat, at least some degree of U.S. disengagement is likely in any event for budgetary reasons.)

If these trends continue, the United States probably will also be reluctant to take on substantial land-force commitments in the other regions now deemed vital to its security (Middle East/Southwest Asia, Western Pacific/Northeast Asia, Caribbean Sea/Central America). American military force structure and doctrine may focus on maintaining sea and air lines of communications to vital areas of the Eurasian littoral and on establishing tactical air superiority to permit the resupply of U.S. allies and the insertion of intervention forces. In this event, there would also be an increasing U.S. military-technical emphasis on low-intensity conflict and counter terrorist activities.

Third, the high-intensity battlefield of the future may not be confined to the U.S.-Soviet competition. A number of regional powers, some friendly with and others hostile to the United States, can be expected to acquire substantial quantities of advanced weapons and the means to deliver them accurately over long ranges. These regional powers can also be expected to acquire chemical and biological weapons capabilities and, in some cases, nuclear weapons. Thus, the military-technical requirements for the United States to intervene in regional conflicts, either to support an allied state or oppose a hostile power, may be almost as stressing as those required to oppose Soviet aggression in some third world regions.

Although it is impossible to predict with confidence how theater/tactical nuclear requirements might evolve given this changing military-technical environment, the following observations may be useful.

- For the high-intensity air-land battlefield of the early twenty-first century, (a) there will be a military-technical requirement for fewer numbers and types of tactical nuclear weapons; and (b) it may be desirable to store tactical nuclear weapons outside the theater and then "insert" them during the conflict if necessary. Alternatively, the United States could use air- and sea-launched cruise missiles (ALCMs and SLCMs) based outside the theater for tactical missions. In an environment dominated by advanced information systems and new destructive concepts, tactical nuclear weapons will not be needed as much for their virtual effects (e.g., forcing the dispersion of tanks) or for their immediate military effects (e.g., shutting down Warsaw Pact main operating air bases).
- The United States must develop a declaratory policy, operational doctrine, and force structure that anticipates the use of nuclear weapons (and other weapons of mass destruction) by hostile regional powers. The United States obviously wishes above all to deter such attacks and will almost certainly not adopt a nuclear first-use policy of its own against regional adversaries. Nevertheless, the United States must think through how its force structure and operations should be configured for a "nuclear-scared" regional theater, as well as its retaliatory (second-use) requirements if nuclear deterrence fails.
- Tactical nuclear weapons will still undoubtedly play a role as long as the United States contemplates high-intensity theater combat against a nuclear-armed opponent. Tactical nuclear weapons can serve as a deterrent against the opponent's first use of nuclear weapons. Also, even in a defense-dominant, high-technology conventional war against the USSR, the United States

and its allies may well be the first to suffer from attrition—and tactical nuclear weapons, as they do today, offer a way to signal "cease and desist" without immediate resort to a strategic nuclear attack. Finally, advanced conventional weapons, no matter how destructive, can never duplicate the psychological deterrent effects of nuclear weapons.

- Institutional military views of theater/tactical nuclear weapons could change significantly over the next thirty years. The JCS, the CINCs, and the services strongly support the principle of nuclear deterrence in light of current U.S. national strategy and international commitments, but they may well not offer significant resistance to a shift to a less prominent role for tactical nuclear weapons if U.S. strategy, force structure, and commitments should change to take into account a less hostile international environment.
- In Europe and possibly elsewhere, there are likely to be major unilateral and negotiated reductions in East-West conventional forces. Although these reductions could improve the military balance from the Western perspective, they may also complicate the ability of the West to offer a coherent defense if the threat should reemerge at a later time. In this case, the West may be relatively more dependent on nuclear weapons to deter or respond to a Soviet breakout or rapid mobilization.
- Even a smaller (in numbers and types) theater/tactical (T/T) nuclear weapons stockpile will require modernization. Air-delivered systems, and especially stand-off weapons, have the best chance of being retained and modernized. If the United States continues to deploy forward land-based systems, modernization may be driven more by safety and security concerns than by new military requirements. On the other hand, new T/T nuclear capabilities—for example, low-yield, tailored nuclear output—may be more interesting if the United States pursues a more unilateral national security policy that is less affected by alliance political constraints.

IV. FUTURE NUCLEAR POLICIES AND REQUIREMENTS

To assist the Laboratory in understanding how the changing political-strategic and military-technical environments might affect long-term nuclear roles and requirements, the FNW Study postulated three alternative U.S. nuclear policy and force structure responses: (a) a business-as-usual case, in which the United States would attempt to maintain its current "active" role for nuclear weapons; (b) a passive deterrent case, in which the United States would reduce over time its present level of reliance on nuclear weapons; and (c) a mixed deterrent case, in which the United States would exploit a range of advanced technologies, including nuclear weapons, to maintain control over the future strategic environment.

Clearly, the kind of nuclear policy and force structure that the United States chooses for the year 2020 will be determined in large part by the broader choices that must be made about American interests, security policy, and military strategy. The FNW Study concluded that the United States would not become truly isolationist, in the sense of abandoning all of its international commitments and making no significant effort to control or influence events overseas. However, the FNW Study also noted that it is impossible to determine the precise level of U.S. activity abroad over the next thirty years; the relative priority which the United States might accord to various geographic regions; or the respective roles that will be assigned to American political, economic, and military instruments in U.S. national security policy.

Although the three deterrent cases described below are designed to be as insensitive as possible to these larger issues, each case tends to rest upon different assumptions about the future political-military context.

These alternative projections are intended not to represent definitive predictions but to serve as a means of thinking about the range of future nuclear requirements. Given the thirty-year scope of the study, it would be imprudent not to consider contrary trends and a number of reasonable outcomes. The FNW Study did

reach several general conclusions about the future of nuclear weapons, including a judgment about which alternative U.S. nuclear policy is most likely. These assessments are discussed in Section V.

A. The Business-as-Usual Case: Maintaining Active Deterrence through Flexible Response

For nearly the past thirty years, the relatively stable character of the political-strategic environment has led the United States to adopt a fairly constant set of nuclear roles and requirements. Based on the long-standing success of this approach, the United States could attempt to maintain the current political-strategic advantages of active nuclear deterrence and the military-technical capabilities required by flexible response. These advantages and capabilities include

- deterring war, especially the use of nuclear weapons by hostile powers;
- providing essential strategic leverage for the United States in the peacetime (and crisis-time) competition with the Soviet Union;
- supporting politically the U.S. global alliance structure by reassuring allies through a policy of extended deterrence;
- offering a cost-effective way for the United States to deter war and exercise peacetime/crisis-time influence;
- providing the United States with an instrument, should deterrence fail, for terminating the conflict at the lowest possible level of violence and on terms acceptable to the United States and its allies.

The long-term viability of active nuclear deterrence and flexible response depends to a large extent on the existence of an international environment that does not change in any dramatic fashion. *In particular, the continuation of current U.S. nuclear policy would probably depend on the existence of a traditional U.S.-Soviet competition at moderate levels and on the endurance of an anti-Soviet alliance structure centered on Western Europe (NATO).*

The centerpiece of such a steady-state policy would be an ongoing modernization program focused on offensive nuclear systems, with strategic defenses, if any, playing a complementary role. Based on current requirements, the most important part of the strategic modernization program would focus on (a) the ability to hold Soviet nuclear forces, especially mobile ICBMs and Soviet nuclear ballistic-missile submarines (SSBNs), at risk; and (b) ensuring the survivability of American nuclear forces against probable Soviet counterforce threats. U.S. tactical nuclear forces would be configured to respond to ongoing changes in Soviet military doctrine (e.g., increased Soviet reliance on C^3I, greater rear-area dispersal and echeloning). The United States would be prepared to accept temporarily the inevitable strategy-force mismatches that occur as the Soviet target base changes, but would strive to close or eliminate those mismatches.

The maintenance of active deterrence based on flexible response assumes that the United States is willing to devote the same or more resources to modernizing its nuclear systems and production complex; that other types of weapons (e.g., advanced conventional munitions) do not become truly competitive with nuclear systems for fundamental political and military purposes; and that American arms control policy does not limit the ability of the United States to modernize its nuclear forces. Nuclear testing presumably would continue at least at current levels in terms of number and yield.

The most challenging aspect of maintaining active deterrence would involve rationalizing the ambitious military-technical requirements needed to support flexible response, with the political-strategic pressures that will tend in the opposite direction. For example, holding Soviet offensive forces comprehensively at risk will require expensive technical solutions that are at odds with the projected constraints imposed by public opinion and by other U.S. policy goals (e.g., stability). By the same token, efforts to modernize NATO theater nuclear forces could come into conflict with emerging allied national interests (e.g., in a united Germany).

Because the traditional roles of and requirements for nuclear weapons are relatively well understood, the FNW Study focused primarily on the two departures from the business-as-usual case, which are described below.

B. The Passive Deterrent Case

As an alternative to maintaining traditional U.S. nuclear force objectives and capabilities, the United States could choose to reduce the political and military emphasis that it places on nuclear weapons. Such a policy could be characterized as one of "passive deterrence," distinguishing it from the "active deterrence" based on flexible response of the past forty years. Of course, American nuclear capabilities would still continue to distinguish the United States from other powers that do not possess nuclear weapons or that possess less capable nuclear forces.

The shift to a passive deterrence policy would be based on the assumption that the qualitative change in the Soviet threat as well as the devolution of the postwar U.S. alliance structure, the growing importance of regional states, the possible rise of new global powers, the proliferation of advanced military technologies, and a highly competitive economic environment will result in novel U.S. security interests and threats that are less amenable to traditional nuclear policies. The United States would continue to rely on its nuclear weapons to deter major hostile actions by other states, particularly to deter nuclear use. The United States would accept a gradual decline in the relative military-technical capability of its nuclear forces, however, as a means of accommodating U.S. national security policy to a changing political-strategic environment.

Such a shift in U.S. nuclear policy would lead to a relatively greater priority being placed on stability (i.e., preventing the deliberate or accidental use of nuclear weapons). The United States would assign relatively lower priority to maximizing the peacetime and crisis-time advantages of nuclear weapons in the U.S.-Soviet strategic competition and would substantially reduce the requirement that nuclear weapons create political-military advantages in wartime. American policymakers may be further inclined in this direction because of public and elite pressures to accelerate the denuclearization of American foreign and military policy.

A passive deterrent policy would depend on the ability of the United States to find means other than nuclear weapons to bridge the gap between its resources and its international interests and commitments. If the Soviet threat does decrease, the United States would be inclined to decrease the level of resources now committed to the traditional Soviet challenge. The United States could further reduce the resource-commitment gap through one or a combination of the following policies: (a) reaching a political accommodation with the USSR that lessens pressures in the military arena; (b) shifting the responsibility and burden for regional defenses to its allies—or abandoning certain commitments altogether; and (c) reducing and restructuring its military establishment to deal primarily with less-than-all-out threats, while using the prospect of a competition in advanced military technology to discourage and, if necessary, control a renewed strategic competition with the Soviets.

In addition, the United States may well regard threats to its security in the year 2020 as emerging primarily in the economic and political arenas rather than from any high-threat military-technical competition. Substantial requirements will continue to exist for the U.S. military, of course, but these requirements will focus more on the flexibility and mobility required to meet regional contingencies, than on the more traditional, nuclear-oriented missions involving a global conflict or a strong military-technical competition with another major power.

Arms control would likely play a critical role in U.S. policy under a passive deterrent policy, as the United States seeks to regulate the quantity and quality of the nuclear forces of the major nuclear powers (including France, Great Britain, and China). The purpose of such regulation would be to ensure that no party either possessed or could develop nuclear systems that threatened stability. This course

could include restrictions on the number, yield, and possibly the purpose of nuclear tests, if not a comprehensive test ban.

The Scope and Purpose of U.S. Nuclear Forces. The United States would emphasize much more strongly the political-strategic limitations of nuclear weapons in the emerging international system rather than attempt to pursue any important military-technical advantages. In this case, the fundamental, overriding function of U.S. nuclear weapons would be to deter nuclear use by another power. The United States would apply the nuclear sufficiency criterion in a somewhat more relaxed fashion; it would continue to stress the tradition of nuclear nonuse and would more explicitly exclude the first use of nuclear forces against third parties; and it would take steps to strengthen the political-military firebreak for conventional and nuclear weapons.

Under passive deterrence, stability would become the single most important criterion determining the size, quality, and operations of U.S. nuclear forces. The United States would be less interested in preventing deliberate aggression (because the Soviet threat would be seen as much less significant) and more concerned with preventing a war that was initiated because of accident, misperception, or technical/operational pressure. The U.S. nuclear force structure would ideally be configured to eliminate as many characteristics as possible that placed use-or-lose pressure on either side, even at the expense of traditional measures of nuclear effectiveness (e.g., prompt hard-target kill).

The United States might no longer base its military planning on a "global 1-1/2 war" or a "Soviet invasion of Western Europe" scenario. Instead, planning would be concerned primarily, although not exclusively, with the necessity to deal with a variety of non-European regional and localized conflicts that might or might not involve the Soviet Union. In this event, the United States would value flexible and mobile conventional forces, with nuclear weapons reserved to deter nuclear, chemical, and biological use by the Soviets or hostile powers in that region.

The United States might explicitly or tacitly adopt a policy of no-first-use of nuclear weapons. The United States would then seek to strengthen the conventional-nuclear firebreak and would deploy and operate its conventional forces on the assumption that nuclear weapons would not be used. The retaliatory use of nuclear weapons would be directed first and foremost at war termination and not at creating decisive military advantage.

It is critical to stress the following point to avoid any misunderstanding: a passive deterrence policy would not necessarily mean that the United States will adopt a minimalist approach to nuclear deterrence ("city busting") although that is a possible outcome. A passive nuclear deterrent strategy would be compatible with a wide variety of force structures and operational concepts, with the United States likely to assign priority to structures/operations that are deemed to be stabilizing.

Technical and Operational Requirements: Strategic Nuclear Forces. The United States might no longer seek to hold Soviet strategic nuclear forces at risk (no counterforce) or, at best, might maintain only a residual capability (slow and limited as opposed to comprehensive and prompt counterforce). Although the United States might simply adopt a minimum deterrent policy and countercity targeting strategy, it is more likely that the United States will inherently retain some nuclear flexibility (for a few limited options) and some countermilitary capability (against general purpose forces).

A passive deterrent strategy would tend to favor the nuclear weapons characteristics of survivability, endurance, safety, security, and control, while placing less emphasis on such attributes as military effectiveness and flexibility. The number of U.S. strategic forces could decline from their present (pre-START) levels, unilaterally or through negotiated arms agreements, perhaps by as much as three-fourths. (Such reductions are more likely to occur incrementally than through dramatic steps.) Submarine deployment will represent the most attractive basing scheme although the United States will likely hedge with some combination of manned aircraft and cruise missiles.

For political and economic reasons, the United States will prefer to upgrade rather than modernize its strategic nuclear forces across the board in the early twenty-first century. Very few, if any, upgrades/modernization will be driven by new military requirements, rather they will be driven primarily by the aging of systems and, at the margin, by the desire to further enhance stability, safety and security, and control.

Although the ballistic missile/nuclear weapons combination will continue to define the military-technical environment for some time, the United States would be interested in alleviating the most destabilizing qualities of this environment. Land-based MIRVed ballistic missiles would be undesirable. So too would new technological developments that called into question the retaliatory capability of either side—for example, advanced strategic defenses, rapid retargeting capabilities, and the like. At the extreme, the United States might pursue the implementation of the Reykjavik formula to the abolition of all ballistic missiles in the name of advancing stability.

Technical and Operational Requirements: Theater/Tactical Nuclear Forces. The number and type of theater/tactical nuclear weapons can be expected to decline steadily, as those systems are generally not modernized under the passive deterrent concept. The most likely candidates for this process of attrition are AFAPs, short-range (Lance-type) ballistic missiles, and naval tactical weapons. Air-delivered systems, especially stand-off weapons, have the best chance of being retained. In some cases, advanced, long-range conventional weapons systems could be employed for missions that are now thought to require nuclear weapons—especially against fixed, deep interdiction targets. The use of such systems would be especially appropriate for regionalized, non-European conflicts. Some number of theater/tactical nuclear weapons would likely be retained for their residual deterrent benefits against the Soviet Union or third nuclear powers; other weapons might be reserved, in a second-use situation, for targets whose quantity or quality simply do not lend themselves for attack by advanced conventional systems.

The U.S. choice about which theater/tactical nuclear weapons to retain may be significantly affected by increasing restrictions on deployment of its nonstrategic nuclear forces aboard ships or on allied territory. American choices may be further restricted by the growth of nuclear-weapon-free zones that cover land, sea, and air and by the preference of allies and third parties.

C. The Mixed Deterrent Case

A second alternative to traditional nuclear policies would involve a determination by the United States (a) that it wishes to devise military-technical means to exercise strategic control over the emerging international environment and (b) that nuclear weapons alone no longer provide such leverage as they have in the past. This case is referred to as one of mixed deterrence, because it would probably be marked by the vigorous exploration and exploitation of several kinds of advanced strategic technologies, including offensive nuclear systems, air and ballistic missile defenses, and advanced long-range conventional systems.

On political-strategic grounds, the United States would be most inclined to move in the direction of a mixed deterrent doctrine and force structure if it were confronted by a resurgence of the Soviet threat and/or the emergence of one or more major new hostile military powers. The United States might also deploy a mixed deterrent force so as to anticipate and forestall a revival of a full-scale Soviet threat: in this event, American policymakers would attempt to deter a Soviet military breakout by confronting the USSR (or another hostile power) with the prospect of a major qualitative arms competition in which the United States enjoyed significant advantages. The military-technical key to a mixed deterrent strategy would be the development of a strategic offensive-defensive posture that could, in complementary fashion, address the current and projected deficiencies in U.S. nuclear policy/forces.

The United States would attempt to use its mixed deterrent capability, in addition to deter-

ring war, for such traditional purposes as providing essential, cost-effective strategic leverage for the United States in the peacetime (and crisis-time) competition with the Soviet Union; supporting politically the U.S. global alliance structure; and providing the United States with an instrument, should deterrence fail, for terminating the conflict at the lowest possible level of violence and on terms acceptable to the United States and its allies.

The adoption of a mixed deterrent policy assumes that the United States would be prepared to devote equal or better resources to the military-technical competition as compared with current levels. The United States would also have to devise means to integrate the mixed deterrent approach into its regional and alliance strategy, given the probable hesitancy and opposition of allies to such a policy shift. (Alternatively, the United States could make mixed deterrence the centerpiece of a more unilateral national security policy that relied less on formal alliances.) Finally, American policymakers would be required to develop sufficient political consensus and public support to make mixed deterrence a viable replacement for the traditional active nuclear deterrence/flexible response doctrine.

The implementation of a mixed deterrent policy and force structure will undoubtedly be constrained by a variety of political and technical factors. For instance, the United States is likely to desire to continue the arms control process with the Soviet Union and other powers and to ensure that future force structure deployments are stable. Indeed, the shift toward a mixed deterrent would probably depend upon the development of an arms control regime and concepts of stability that could accommodate the deployment of advanced strategic systems, including defenses.

The Scope and Purpose of a Mixed Deterrent Force. The United States would attempt to create a mixed strategic force so as to maximize its strategic military-technical capability through a combination of advanced nuclear weapons, strategic defenses, and long-range conventional systems. From this enhanced military-technical capability, the United States would hope to assert its control or influence over the political-strategic environment, as it did through deterrent policies based on offensive nuclear weapons after 1945. The mixed deterrent policy reverses the logic of the passive deterrent case, under which the United States would accept a degradation of its nuclear military-technical capability in order to accommodate to changes in the political-strategic environment.

Such a mixed strategic force would not necessarily be superior to that of the Soviet Union or any combination of hostile powers. The United States would probably instead seek the kind of military-technical advantages that it has desired since the early 1960s: (a) the ability to control the peacetime military competition with the Soviet Union and/or other hostile powers; (b) the ability to conduct limited and strategic operations, with the purpose of changing the political-military conditions of the conflict and terminating the war on terms acceptable to the United States and its allies; and (c) the maintenance of a secure reserve force, which might take on added importance if there is a hostile major power other than the Soviet Union that must be taken into account.

Under a mixed deterrent doctrine, the U.S. military might be required to meet a much wider range of contingencies than under the baseline or passive deterrent cases. These planning contingencies could include not only the standard "global 1-1/2 war" and "Soviet invasion of Western Europe" scenarios but also the possibility of a war that saw the USSR allied with another major nuclear power; a global U.S.-Soviet (or U.S.-X war) that left a major power temporarily neutral; wars against one or more major regional powers that possess advanced conventional and nuclear-biological-chemical weapons; and a wide range of low-intensity conflicts.

If the United States does decide that it must cope with such a high-threat environment, a mixed strategic force would have to be sufficiently cost-effective and flexible so that it could play a contributory, if not decisive, role in many of these contingencies. For example, space-based ballistic missile defenses and

ground-mobile BMD and air defenses, as well as long-range conventional systems, might provide the United States with an important advantage against an advanced regional power. The mixed strategic force should also be sufficiently numerous and robust so that the United States could employ it in a regional or even limited global war without weakening itself unduly with respect to an expanded conflict.

The United States would likely prefer under mixed deterrence to maintain a strong conventional-nuclear firebreak and a tradition of nuclear nonuse, but by emphasizing the nonnuclear aspects of its mixed strategic force (defenses and long-range conventional systems) rather than through political means such as a no-first-use declaration.

Technical and Operational Requirements for a Mixed Deterrent Force. The United States might strongly pursue some means of holding at risk Soviet nuclear forces and those of other hostile powers. There are two technical-operational ways in which the United States can seek to continue its high-priority counterforce operations: (a) through radically new offensive capabilities that are able to operate effectively against mobile land-based missiles and C³I, SSBNs at sea, and perhaps bombers that have just left their bases of operations or (b) through a defensive solution to the counterforce problem—that is, holding Soviet nuclear forces at risk after they are launched by means of ballistic missile and air defenses.

The size of U.S. offensive nuclear forces will depend upon the magnitude of the Soviet and major non-Soviet threats, the extent to which strategic defenses are present (one, both, or many sides), and the technical performance of long-range conventional systems. The number of nuclear weapons might decline, although probably not as far as in the passive deterrence case, if some of the traditional nuclear missions are assumed by different mixed strategic forces. For example, strategic defenses could be tasked to hold Soviet offensive forces at risk while long-range conventional systems are used for low-level strategic options and for targeting some general purpose force assets. The number of U.S. nuclear weapons might not be driven sharply upward even in the face of hostile strategic defenses if the United States reduces the targeting requirements for its offensive forces and if it is willing and able to improve its nuclear systems to penetrate defenses.

The United States will have numerous options for the basing of its long-range nuclear and conventional systems if ballistic missile and air defenses are also part of a mixed force triad. The United States would probably be more inclined to preserve strong land-based missile forces if defenses were deployed, using a fixed shelter or soft-mobile basing scheme. By the same token, the presence of hostile strategic defenses would incline the United States to preserve as wide a range of offensive systems as possible (both ballistic and air breathing) and to pursue innovative technologies such as hypersonic boost-glide vehicles. Sea-based systems would play an important role whether defenses were present or not although they would probably be the most survivable part of the triad if the U.S. does not actively defend its offensive forces.

The development of mixed strategic forces in the context of an active deterrent policy indicates that substantial modernization of U.S. nuclear forces must be considered, although such modernization would probably occur in an incremental rather than a comprehensive fashion. This nuclear modernization would be driven by new or altered requirements for military effectiveness and flexibility and by the need for delivery systems that can penetrate hostile strategic defenses. The offensive nuclear modernization program would be less concerned by the need for stand-alone survivability and endurance, assuming that the United States deploys defensive systems in part to protect offensive forces.

Because it would still be faced with relative or absolute resource constraints even under the active deterrence case, the United States will have considerable incentive to find the most cost-effective and militarily effective combination of offensive nuclear, defensive, and long-range conventional capabilities. The United States would clearly be interested in developing technologies that are common to at least two kinds of mixed strategic forces and, in-

deed, that are common to U.S. military research and development as a whole. These might include sensors/command and control systems, composite materials, and various directed-energy concepts.

Technical and Operational Requirements for Theater/Tactical Weapons under a Mixed Deterrent Policy. The United States would be inclined to retain nonstrategic (tactical) nuclear weapons for special purposes, but it would have to weigh the political and military advantages of such weapons against those of advanced conventional systems. Nonstrategic nuclear systems will be relatively more important if the United States is faced with a "Soviet plus X" threat, if there is a continuing Soviet high-level threat against Western Europe that cannot be met with long-range conventional systems alone, if the offense continues to dominate the defense at the battlefield level, and if the United States requires a hedge against dramatic improvements in hostile military capability across the board. The United States might be inclined especially to use nuclear weapons to hedge against dramatic enemy improvements in advanced-technology weapons—what the Soviets refer to as the new revolution in military affairs (e.g., tactical and theater air defenses, battlefield sensor/C^{3}I, tactical directed energy).

The United States can still expect to have difficulty basing its nonstrategic nuclear weapons overseas and aboard ships, even under mixed deterrence, for political rather than technical reasons. This suggests that, in a high-threat environment, the United States may prefer to design long-range strategic nuclear (and conventional) forces that can be used for "tactical" purposes. The remaining nonstrategic nuclear forces might be based in the United States (especially for air-delivered systems) or on naval platforms that do not require overseas servicing.

V. CONCLUSIONS

The FNW Study reached four conclusions about how nuclear roles and requirements might change over the long term.

First, the FNW Study concluded that there are maximum and minimum bounds that we can fairly confidently place on the roles and requirements of nuclear weapons over the next thirty years. Nuclear weapons will not disappear: there will be no complete political solution (i.e., no disarmament, no formation of world government), and there will be no complete technical solution (i.e., no perfect defenses, no invention that transcends nuclear weapons). By the same token, with respect to possible new roles and requirements, the United States will not come to regard nuclear systems as "just another weapon." In other words, there will be no return to a political or military doctrine of massive retaliation. We further assume that there will not be a major nuclear war, although the possibility of nuclear use at some point cannot be excluded, especially by nations in what has been called the Third World.

This left the FNW Study with the judgment that over the next thirty years the United States will maintain a nuclear stockpile that is quantitatively and qualitatively "sufficient"—not just in terms of the U.S.-Soviet competition, but in the context of an increasingly multipower world in which a number of nations, friendly and hostile, possess nuclear systems and other weapons of mass destruction.

Our second conclusion is that within this basic context there is a high probability that the United States will shift its view of deterrence over the next thirty years toward a less active approach to nuclear weapons, or what we refer to above as the passive deterrent case. There are especially strong political-strategic trends that suggest this shift, most notably the evolution of the international system, pressures for change in the U.S. alliances, a qualitatively different Soviet regime, increased international interest in ensuring stability, and the limits of public support for active deterrence.

Passive deterrence would be marked by an American decision to accommodate to a changing political-strategic environment in which the perceived Soviet military threat declined markedly. In this event, the United States would have the option of deemphasizing the military-technical competition in nuclear weap-

ons, and quite possibly the military-technical competition across the board. This shift would thus lead to the accentuation of some nuclear roles and requirements primarily dealing with stability and safety, while reducing or phasing out others.

Under a passive deterrent policy, the United States would be more inclined to stress the role of nuclear weapons in deterring war between major states, and especially deterring the use or threatened use of weapons of mass destruction. The United States would be less inclined to place nuclear weapons at the center of its overall national security policy and military strategy—that is, the United States would rely less on nuclear weapons to provide the decisive increment of political-strategic and military-technical leverage over its principal global rival(s). In the passive deterrence case, the United States would either abandon or greatly qualify its policy of extended nuclear deterrence. Nuclear weapons, it should be stressed, would continue to play an important role in U.S. national security policy. One of the most important roles would be as a hedge against sudden, adverse shifts in the political or military balance.

The weakness of the passive deterrent approach is that it cedes the strategic military-technical initiative to other powers and that it potentially lessens the American ability to influence local events on the Eurasian continent. If a passive deterrence policy were adopted in the absence of a clearly reduced Soviet threat, the outcome could be disastrous—and yet, for some years, the United States is likely to be uncertain about the long-term nature of that threat. A shift to passive deterrence would therefore rest on relatively optimistic assumptions about the evolution of the international environment and on relatively pessimistic assumptions about the ability of strategic military technology to support American interests in that environment.

Third, we conclude that the trends pointing in the direction of a more passive deterrent policy cannot be considered definitive. **The United States has the option to attempt (a) to maintain its current doctrine of flexible response or (b) to exploit new weapons technologies and new operational concepts.** The former option—the business-as-usual case—would entail a steady modernization of offensive nuclear forces, with strategic defenses, if any, playing a subsidiary role. The latter option would involve the exploitation of strategic defenses and long-range conventional systems, as well as advanced nuclear technologies, in what we term the mixed deterrent case.

The business-as-usual case has the advantage of comfort—the United States, its allies, and the Soviet Union have become quite familiar with the political, military, and technological issues associated with active deterrence and flexible response over the past three decades. Any significant departure from this well-known ground is bound to cause a good deal of discomfort and clashes of national and alliance interests. However, the possible alterations in the political-strategic and military-technical environments described above suggest that, over the long term, it will be more painful to maintain the nuclear status quo than to change it.

The mixed deterrent case does represent a significant change from the nuclear status quo. The major weakness of mixed deterrence is its uncertain effect on international and strategic stability. An effort by the United States to ensure leadership in the military-technical competition cannot lead with assurance to any significant long-term advantage over the Soviet Union, and it might hamper or prevent efforts to moderate Soviet political behavior. The American political and technological dynamism associated with a mixed deterrence policy might also complicate U.S. efforts to restructure its alliance system by causing friction with the increasingly assertive allies. These drawbacks to the mixed deterrent approach suggest that it would most likely be adopted as a response to a clearly increased threat over the long term, and that it will not be applied in a near-term effort to control the evolving international environment.

Finally, despite the probability that any major shift in U.S. nuclear policy would be evolutionary rather than revolutionary in character, it is impossible to rule out the possibility that significant discontinuities

might occur over the near and intermediate terms. The case for an evolutionary development in nuclear roles and requirements rests on inertia—principally caused by the facts that the institutions and hardware that currently characterize the United States nuclear force structure will remain intact for some time and that the Soviet Union will remain a major political-military threat for the foreseeable future.

Nevertheless, there are circumstances that might cause a more rapid and radical shift in the American and allied view of nuclear weapons. Over the past few years, and especially since the accession of Gorbachev to power in the Soviet Union, we have witnessed a series of unexpected political events that portend to many the end of the U.S.-Soviet conflict and a fundamental change in the European political order. Whether or not such portents are realized, we can no longer assume that inertia will continue to dominate events over the next decade—as it has since the first decade of the Cold War. Long-range planning should therefore take into account the possibility of serious discontinuities in domestic and international politics that might be caused by events such as a serious nuclear accident or use by a third party, the collapse or dramatic resurgence of the Soviet state, or a fundamental change in the political climate of key American allies.

We conclude with a cautionary note over the possibility that, if present trends continue, nuclear weapons might become excessively discounted in the political arena over the short and intermediate terms, well in advance of any corresponding decline in their strategic or military value.

ABSTRACT

A summary is presented of the findings of a three-year study by the Center for National Security Studies of the Los Alamos National Laboratory that evaluated the long-term future of nuclear weapons. Political, military, and technical trends that will influence the future of nuclear weapons are discussed.

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