Counterforce Revisited

Assessing the Nuclear Posture Review's New Missions

Charles L. Glaser and Steve Fetter

The spread of nuclear weapons to potential U.S. adversaries raises important questions for U.S. nuclear strategy and foreign policy. During the Cold War, U.S. nuclear strategy was designed to meet the challenges posed by the Soviet Union, a superpower adversary that deployed an enormous nuclear arsenal and was viewed as a threat to vital U.S. interests. Today the United States faces a strikingly different security environment. A few regional adversaries have acquired or are attempting to acquire small numbers of nuclear weapons, as well as the ability to deliver these weapons at long and even intercontinental range. Many more countries have the capacity to produce chemical and biological weapons (CBW), and a number of potential U.S. adversaries may already have done so.[1]

This article focuses on a controversial dimension of U.S. nuclear strategy: the use of nuclear weapons to destroy or threaten to destroy a regional adversary's capacity to use weapons of mass destruction (WMD).[2] There is little disagreement that the United States should deter nuclear attacks by threatening to inflict unacceptably high costs with nuclear retaliation.[3] But should it also plan to destroy with nuclear weapons an adversary's nuclear and other weapons of mass destruction and related facilities, either preemptively or in a retaliatory strike? The George W. Bush administration's 2002 Nuclear Posture

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1. See, for example, Joseph Cirincione, Jon Wolfsthal, and Miriam Rajkumar, *Deadly Arsenals: Tracking Weapons of Mass Destruction* (Washington, D.C.: Carnegie Endowment for International Peace, 2002).
2. By this we mean U.S. nuclear strikes against enemy targets that would be involved in carrying out attacks using nuclear, biological, or chemical weapons, including weapon storage facilities; deployment areas (e.g., missile launch sites or airfields); command, control, and communications facilities; and relevant civilian and military leadership. We do not include preventive attacks on nuclear facilities in countries that do not yet possess nuclear weapons.
3. Agreement is lacking, however, on whether the United States should rely on nuclear weapons to deter the use of chemical and biological weapons; see note 44.

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Review (NPR),[4] which provides the official guidance for U.S. nuclear strategy, answers in the affirmative, envisioning nuclear missions against an adversary's WMD.[5]

The NPR identifies a variety of ways in which nuclear weapons could help the United States achieve its broad goals of assuring allies, dissuading adversaries from acquiring capabilities that would threaten the United States, deterring attacks against the United States and its allies, and defeating adversaries. It also addresses the size and composition of U.S. offensive nuclear forces, the relationship between U.S. conventional and nuclear forces, and requirements for national missile defense.[6] The NPR calls for the United States to be prepared to use nuclear weapons in a wide spectrum of scenarios, ranging from a conflict with China (possibly over Taiwan) to a conflict with an "emerging threat" such as Iran, North Korea, or Syria.[7] And it calls for developing a more

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4. *Nuclear Posture Review* [excerpts], January 8, 2002, http://www.globalsecurity.org/wmd/library/policy/dod/npr.htm. This document was leaked to the press; references in this article to the NPR refer to this text, which we assume to be authentic. Our references to page numbers in the NPR refer to the page numbers included in the leaked portions of the document. Neither author has had access to the NPR, beyond these leaked excerpts. For an official unclassified description, see J.D. Crouch, *Special Briefing on the Nuclear Posture Review,* January 9, 2002, http://www.defenselink.mil/transcripts/2002/t01092002_t0109npr.html. See also Richard Sokolsky, "Demystifying the U.S. Nuclear Posture Review," *Survival,* Vol. 44, No. 3 (Autumn 2002), pp. 133–148. A recently available draft document, "Joint Publication 3-12, Doctrine for Joint Nuclear Operations, Final Coordination (2), 15 March 2005," http://www.globalsecurity.org/wmd/library/policy/dod/jp3_12fc2_mar2005htm, builds on the NPR to revise the official U.S. guidance for the employment of nuclear forces. This document is assessed in Hans M. Kristensen, "The Role of Nuclear Weapons: New Doctrine Falls Short of Bush Pledge," *Arms Control Today,* Vol. 35, No. 7 (September 2005), pp. 13–19.

5. The NPR also identifies a role for nuclear weapons in deterring large-scale conventional attacks. For analysis of counterconventional attacks, see Glenn C. Buchan, David Matonick, Calvin Shipbaugh, and Richard Mesic, *Future Roles of the U.S. Nuclear Forces: Implications for U.S. Strategy* (Santa Monica, Calif.: RAND, 2003), pp. 47–59.

6. All of these issues are controversial and have been debated over the past few years. On force size, for example, see John Deutch, "A Nuclear Posture for Today," *Foreign Affairs,* Vol. 48, No. 1 (January/February 2005), pp. 49–60; on missile defense, see Charles L. Glaser and Steve Fetter, "National Missile Defense and the Future of U.S. Nuclear Weapons Policy," *International Security,* Vol. 26, No. 1 (Summer 2001), pp. 40–92; and James M. Lindsay and Michael E. O'Hanlon, *Defending America: The Case for Limited National Missile Defense* (Washington, D.C.: Brookings, 2001).

7. These countries are listed in the NPR as "countries that could be involved in immediate, potential, or unexpected contingencies." Iraq and Libya are also mentioned, but are now of less concern since the United States' invasion and occupation of Iraq and Libya's decision to verifiably eliminate its nuclear and chemical weapons and long-range missile programs. The *Nuclear Posture Review,* p. 17, states that Russia plays a smaller role in U.S. force planning: "Adjusting immediate nuclear force requirements, in recognition of the changed relationship with Russia, is a critical step away from the Cold War policy of mutual vulnerability." But it warns that the United States needs to be prepared to revise its nuclear forces if relations worsen.

flexible targeting system that would enable the United States to quickly prepare nuclear attack options for unforeseen contingencies.

Although a key element of the strategy, the available portions of the NPR do not clearly describe scenarios in which the United States might use nuclear weapons. It does, however, identify three types of targets that the United States should improve its ability to destroy: hardened or deeply buried facilities; chemical and biological agents; and mobile and relocatable targets. Although the United States long prepared to destroy such targets in the Soviet Union (and now, presumably, in Russia), the NPR states that "new capabilities must be developed to defeat emerging threats." It calls for studying improvements in the United States' nuclear weapons arsenal—including enhanced earth-penetrating weapons (EPWs) and warheads with smaller yields—that might be required to support these missions. The question of building new nuclear weapons has received the most public attention and has generated congressional debate over funding.[8] The underlying strategic question—whether the security benefits of pursuing these new capabilities outweigh the costs—has received less attention.

To analyze these possible new counterforce roles and missions, we begin by examining the capability of nuclear weapons to destroy the targets identified above, beyond that provided by conventional weapons. For a variety of ethical, political, and military reasons, the United States would prefer to use conventional rather than nuclear weapons if at all possible. We find that conventional weapons can destroy or disable many of the types of targets that the NPR identifies for nuclear missions and that nuclear weapons would not be highly effective against some of the targets that conventional weapons cannot defeat. There is, however, one class of targets—moderately deep and precisely located underground facilities—that could be destroyed only with nuclear weapons. Most of these facilities could be destroyed using existing ground-burst nuclear weapons, but EPWs could collapse deeper facilities, as well as permit the use of lower yields against shallower facilities, resulting in less collateral damage. A decision to field an EPW would not require the design or testing of a new type of weapon; it is likely that an EPW could be built by repackaging an existing nuclear device so that it could penetrate a few me-

8. Congress approved funding for research on new weapons for fiscal years 2003 and 2004, but then denied funding for 2005. Wade Boese, "Congress Axes Funding for New Nukes," *Arms Control Today*, Vol. 34, No. 10 (December 2004), p. 34.

ters into hard rock before detonating. Whether EPWs would have military value depends on information that is not publicly available—in particular, whether destroying facilities too deep for current weapons would be necessary to protect truly vital U.S. interests. But even if the answer is yes today, adversaries could respond by digging deeper, beyond the range even of a high-yield EPW, or by adopting other strategies to protect key assets, such as dispersion and mobility, that would render EPWs useless.

Although our assessment casts serious doubt on the military value of nuclear weapons relative to conventional weapons, we next discuss the benefits of using or threatening to use U.S. nuclear weapons if they could perform unique and vital counternuclear missions. We adopt this approach because there is likely to be continuing uncertainty and disagreement over the military utility of nuclear weapons, which means that the debate will not be determined entirely by military-technical considerations; assessments of the potential benefits will also influence the policy debate.

Here and in subsequent discussion we refer narrowly to "nuclear weapons," rather than "WMD," because nuclear weapons are far more destructive than chemical and radiological weapons, which are also included under the WMD label. Some biological agents, such as anthrax, could be as deadly as nuclear weapons if delivered efficiently over populated areas and might confer to their possessor about the same level of strategic significance. For simplicity, in subsequent discussion we usually refer only to nuclear weapons and omit the reference to biological weapons. We believe, however, that the same arguments would often apply to deliverable biological weapons that were able to inflict tens or hundreds of thousands of casualties.

Focusing on nuclear weapons has significant implications for our analysis. Of the emerging threats the United States has identified, only North Korea is believed to have nuclear weapons, and it does not yet have the ability to attack the United States with intercontinental ballistic missiles. Our analysis is cast in general terms to make possible a full exploration of the logic of dealing with emerging nuclear threats. It is important to keep in mind, however, the limited scope of the current threat.

We examine three types of potential benefits that counternuclear missions might provide: (1) improvements in the ability of the United States to deter conventional and nuclear attacks; (2) increases in its ability to reduce the damage from nuclear attacks; and (3) restoration of its ability to pursue its foreign policy objectives. In performing our analysis, we employ the logic that under-

pinned Cold War analyses of U.S. nuclear strategy: counternuclear attacks lack military and political utility if they cannot limit societal damage. However, applying this logic to the security situation the United States currently faces, we reach different conclusions. Because emerging nuclear powers would have relatively small forces, the possibility that targeting these forces could enhance deterrence and limit damage must be revisited. This strikes many as counterintuitive: although the United States now faces smaller threats and is giving greater priority to preventing nuclear proliferation, the case for countermilitary uses of nuclear weapons is more powerful. The ability to destroy some or all of a small nuclear force might enable the United States to more effectively deter nuclear attacks, limit damage, and pursue its foreign policy goals. These benefits would be relatively small, however, because the United States already has a highly effective deterrent apart from any new nuclear roles or missions—or, indeed, apart from its nuclear forces altogether. In addition, these benefits are unavoidably accompanied by risks: a preemptive attack on opposing nuclear forces might be unnecessary and, unless perfectly effective, might provoke retaliation; moreover, capabilities that embolden the United States to pursue its foreign policy goals more assertively could lead to devastating attacks against the United States or its allies.

Finally, we explore three types of costs that might accompany the adoption of counternuclear missions: (1) an increased probability that states will acquire nuclear weapons; (2) an increased probability that, having acquired nuclear weapons, adversaries will choose to use them; and (3) an increased danger that the pressures of a crisis will lead to unauthorized or inadvertent use of nuclear weapons by an adversary and unnecessary use by the United States. U.S. policies that emphasize the military value of nuclear weapons, especially the need for new nuclear weapons, run against specific U.S. nonproliferation commitments and are inconsistent with the spirit of the nonproliferation regime. Consequently, the NPR is a barrier to strengthening the regime and risks weakening it. These effects are likely to be small, however, because the NPR's counternuclear missions do not influence states' basic incentives for acquiring nuclear weapons: states that suffer conventional inferiority or lack nuclear weapons to deter U.S. attacks may have persuasive security rationales for acquiring nuclear weapons, and these will not be significantly increased by U.S. counternuclear capabilities. Instead, the NPR's clearest negative effect on acquisition may be to strain the extensive cooperation required to prevent states from acquiring nuclear weapons. U.S. plans for using nuclear weapons appear

to run counter to the taboo against using such weapons, but experience has not shown that the taboo is sensitive to U.S. nuclear doctrine. The probability of nuclear escalation during a crisis is likely to increase, however, because enhanced U.S. counternuclear capabilities could fuel both accidental nuclear attacks by an adversary and unnecessary preemption by the United States.

In sum, the issue of using nuclear weapons for counternuclear missions is more complex than it was during the Cold War, and a limited but relatively unappealing role for these nuclear missions may exist. Counterforce (and missile defense) may be able to reduce the costs and risks associated with an adversary's nuclear and biological weapons capabilities, but not to the extent that the United States will be able to pursue its foreign policy goals as it might have before proliferation. Even when the interests of the United States in a regional conflict are high, the possibility of devastating nuclear (or possibly biological) attacks against U.S. cities or regional allies should constrain its foreign policy and military actions. For example, the option of initiating a conventional war with a nuclear adversary for the purpose of changing its regime through invasion and occupation should be taken off the table. More generally, the United States must accept that its nuclear strategy cannot solve the problems and dangers created by the proliferation of nuclear weapons to regional adversaries.

Even if the United States adopts a more constrained foreign policy vis-à-vis emerging nuclear states, there may be cases in which truly vital interests are at stake and the United States decides that engaging in a conflict is necessary. If such a conflict escalates and the United States believes that its adversary is preparing a nuclear attack, and if there are critical targets that can be destroyed only with nuclear weapons, then using nuclear weapons to limit damage might be the United States' best option. We expect that such cases will be extremely rare. To make sound decisions, U.S. policymakers must fully appreciate the limits and uncertainties of U.S. damage-limitation capabilities, the risks of escalation and retaliation, and the extent of collateral damage that would result from attacking specific targets.

The Military Value of New Nuclear Missions

Before discussing specific missions for nuclear weapons, it is important to understand the basic differences between nuclear and conventional weapons. A typical strategic nuclear weapon has a yield-to-weight ratio a million times

larger than a conventional explosive; that is, a nuclear bomb weighing 1 ton can have an explosive yield equivalent to 1 million tons of TNT. This high energy density produces much higher temperatures and much greater thermal effects than can be achieved with conventional weapons. Nuclear weapons also produce an initial burst of radiation and, if the weapon is detonated close to the Earth's surface, intense fallout.

Because of the high yields that are possible, nuclear weapons are uniquely capable of leveling targets that cover a large area, such as cities, industrial complexes, and large military bases. These targets can be destroyed by a single nuclear warhead detonated at a relatively high altitude, without requiring high accuracy of delivery. For point or hardened targets, on the other hand, accuracy of delivery is far more important than explosive yield. A mobile missile launcher or a shallow-buried hardened bunker can be destroyed by existing conventional weapons if they are delivered precisely on target. Nuclear weapons do not require such precise delivery, but very large increases in yield are needed to compensate for inaccuracy in weapon delivery or uncertainty about target location because blast and ground-shock effects decrease rapidly with distance. For example, compared to a conventional weapon with an explosive yield of 1 ton of TNT, a 1-kiloton nuclear weapon would have a radius of destruction only five to ten times larger.[9] Thus, the ability of nuclear weapons to compensate for uncertainties in target location is limited unless one is prepared to use high-yield weapons, which the United States already deploys in large numbers and which would have correspondingly large collateral effects. These general observations are relevant to each of the three new missions proposed for nuclear weapons in the NPR.

Defeating hard and deeply buried targets

The Defense Intelligence Agency estimates that there are about 10,000 hard and deeply buried targets (HDBTs) in the combined territories of potential U.S.

9. The range for a given level of air-blast damage (peak overpressure) is proportional to the one-third power of yield; thus, a 1-ton explosion produces about the same peak overpressure (about 100 pounds per square inch) at a distance of 10 meters as a 1-kiloton explosion produces at a distance of 100 meters (for a fixed scaled height of burst). At low yields, the radius of destruction for very hard buried targets is given roughly by the apparent crater radius; for explosions at 3 meters depth in hard rock, the crater radius for a 1-kiloton explosion (26 meters) is about five times larger than that produced by a 1-ton explosion (5.5 meters). Samuel Glasstone and Phillip J. Dolan, *Effects of Nuclear Weapons,* 3d ed. (Washington, D.C.: U.S. Department of Defense and Department of Energy, 1977).

adversaries.[10] Some 1,400 of these facilities are known or suspected strategic sites intended to protect weapons of mass destruction and associated delivery systems, leadership, and command and control centers. Many of these are difficult to defeat because they are deeply buried or because their exact location is unknown. The NPR states that "current conventional weapons are not effective for the long-term physical destruction of deep, underground facilities," and that current nuclear weapons, which have limited ground-penetration capability, do not "provide a high probability of defeat of these important targets. With a more effective earth penetrator, many buried targets could be attacked using a weapon with a much lower yield. . . . This lower yield would achieve the same damage while producing less fallout (by a factor of ten to twenty) than would the much larger yield surface burst. For defeat of very deep or larger underground facilities, penetrating weapons with large yields would be needed to collapse the facility."[11]

The NPR overstates the potential utility of nuclear weapons for this mission. First, although "more than 100 HDBTs could be candidates for targeting" with nuclear weapons,[12] only a handful of these facilities are likely to be strategically vital, in the sense that they would be used to protect weapons or command and control assets necessary to carry out devastating attacks against U.S. territory, soldiers, or allies.

Second, recent U.S. experience suggests that intelligence of the quality required to confidently and reliably identify strategically vital facilities may not be available. The United States carried out a massive conventional bombing campaign against suspected Iraqi WMD facilities during the 1991 Persian Gulf War, but inspections undertaken after the war showed that the majority of actual WMD sites had not been attacked. The overall record of U.S. intelligence in the 2003 Iraq war was little better in this regard, despite a dozen years of intense scrutiny focused on Iraq. A large number of suspected WMD and command and control facilities were found during the subsequent occupation to have been misidentified or inactive. Perhaps the best-known case was the opening salvo of the war, in which the United States dropped four 1-ton

10. Submitted by the Secretary of Defense, in Conjunction with the Secretary of Energy, "Report to Congress on the Defeat of Hard and Deeply Buried Targets," July 2001, p. 8; and National Research Council, *Effects of Nuclear Earth-Penetrator and Other Weapons* (Washington, D.C.: National Academy Press, 2005), p. 3.
11. *Nuclear Posture Review,* p. 47.
12. National Research Council, *Effects of Nuclear Earth-Penetrator and Other Weapons,* p. 3.

bombs on a site that U.S. intelligence believed was a command bunker containing Saddam Hussein. According to news reports, later inspections revealed that no underground facility existed at the site.[13]

Third, if good intelligence is available, most underground facilities also can be defeated with conventional weapons.[14] Existing conventional earth-penetrating bombs can collapse facilities located under less than 10 meters of concrete or hard rock if the location of the bunker is known precisely. Deeper and harder facilities often can be defeated short of physical destruction by attacking surface features such as tunnel entrances, air shafts, power supplies, and communication lines and antennas. Subsequent surveillance by fighter aircraft or armed unmanned aerial vehicles (UAVs) could detect and prevent attempts to remove weapons or to place the facility back into operation.

Fourth, facilities that are not located precisely or are buried very deeply underground cannot be destroyed even by earth-penetrating nuclear warheads. The practical limit to warhead penetration is 10 meters in hard rock.[15] Facilities deeper than 50 or 300 meters could not be destroyed with high confidence by EPWs with yields less than 1 kiloton or 1 megaton, respectively, even if the weapon is delivered precisely on target (i.e., directly above the facility).[16] Some existing facilities are 500 to 700 meters deep, putting them beyond the destructive range of high-yield EPWs.[17] Even relatively shallow facilities could not be

13. Associated Press, "U.S. Can't Find Hussein Bunker," *Washington Post,* May 30, 2003. For insight into the current difficulties in assessing North Korea's nuclear programs, see Douglas Jehl and David E. Sanger, "North Korea Nuclear Goals: Case of Mixed Signals," *New York Times,* July 25, 2005.

14. For a more detailed analysis, see Michael A. Levi, "Fire in the Hole: Nuclear and Non-nuclear Options for Counterproliferation," Global Policy Program, Working Paper No. 31 (Washington, D.C.: Carnegie Endowment for International Peace, November 2002), http://www.ceip.org/files/pdf/wp31.pdf.

15. Robert W. Nelson, "Low-Yield Earth-Penetrating Nuclear Weapons," *Science & Global Security,* Vol. 10, No. 1 (January 2002), pp. 5–10; Michael May and Zachary Haldeman, "Effectiveness of Nuclear Weapons against Buried Biological Agents," *Science & Global Security,* Vol. 12, Nos. 1–2 (January–August 2004), pp. 91–114; Christopher E. Paine, principal author with Thomas B. Cochran, Matthew G. McKinzie, and Robert S. Norris, "Countering Proliferation, or Compounding It? The Bush Administration's Quest for Earth-Penetrating and Low-Yield Nuclear Weapons" (Washington, D.C.: Natural Resources Defense Council, May 2003), http://www.nrdc.org/nuclear/bush/abb.pdf, pp. 9–11.

16. National Research Council, *Effects of Nuclear Earth-Penetrator and Other Weapons;* figure 4.13 gives maximum target depths of 88 and 235 meters for 10- and 300-kiloton weapons delivered with perfect accuracy and detonated at a depth of 3 meters, for 95 percent probability of severe damage of a tunnel-type target with hardness of 1 kilobar in granite. Extrapolating to 1 kiloton and 1 megaton gives maximum target depths of about 50 and 300 meters, respectively.

17. National Research Council, *Effects of Nuclear Earth-Penetrator and Other Weapons,* p. 14.

reliability destroyed with nuclear EPWs if their underground location, which could be many hundreds of meters from tunnel entrances and other surface features, could not be determined—and the weapon delivered—within 50 to 300 meters.

Fifth, even if today there are strategically vital facilities that are at shallow enough depths and have been located by U.S. intelligence with sufficient precision to permit effective EPW attacks, determined adversaries could respond to the deployment of EPW by building deeper facilities, beyond the destructive range of even high-yield EPWs. Tunneling into the side of a mountain is a straightforward procedure; any country that can build a tunnel 300 meters long can build one 1,000 meters long, and thereby triple the depth of the facility at the end of the tunnel at a cost that is roughly proportional to the length of the tunnel.[18] Adversaries might also respond by abandoning hard and deeply buried bunkers altogether, relying instead on mobile facilities or on moving key functions between a large number of inexpensive surface facilities. For example, an adversary's WMD might be hidden in plain view, stored in an otherwise inconspicuous building in an industrial park on the outskirts of a city.

Finally, the utility of nuclear EPWs is further diminished by the substantial collateral damage they would produce. More than half of the suspected hard and deeply buried targets that the United States considers strategically important are located in or near urban areas.[19] Because EPWs cannot penetrate more than several meters in hard rock, the effects are about the same as a surface burst of the same yield. The blast, thermal, and radiation effects of an EPW detonated in or near a major city would kill tens to hundreds of thousands of people.[20] EPWs would permit the use of lower-yield weapons against shallower facilities, however, with a corresponding reduction in fatalities. For example, a 10-kiloton weapon detonated at a depth of a few meters would

18. Ivan Oelrich, Blake Purnell, and Scott Drewes, "Earth Penetrating Nuclear Warheads against Deep Targets: Concepts, Countermeasures, and Consequences" (Washington, D.C.: Federation of American Scientists, April 2005), http://www.fas.org/resource/04192005105503.pdf.
19. National Research Council, *Effects of Nuclear Earth-Penetrator and Other Weapons,* p. 14.
20. National Research Council, *Effects of Nuclear Earth-Penetrator and Other Weapons,* estimated the following number of casualties for a 10-kiloton EPW used in or near an urban area: 100,000 casualties (of which about half would be deaths) for a weapon detonated about 7 kilometers north of the White House in Washington, D.C.; about 700,000 casualties for a weapon detonated 3 kilometers from the center of a city with a population of 3 million; and 4,000 to 40,000 deaths for a weapon detonated 30 kilometers from the center of the same city, depending on wind direction.

produce about the same ground shock and could destroy underground facilities to about the same depth (80 meters in hard rock) as a 250-kiloton detonated on the surface. For targets in cities, the reduction in yield might reduce casualties by a factor of two to ten.

In addition, EPWs would produce fallout that could cause serious collateral damage far from the target, which in turn could complicate other U.S. military operations. For example, fallout from a 10-kiloton EPW would deliver a lethal dose of radiation over an area of about 30 square kilometers.[21] The high-yield EPWs that would be needed to destroy deeply buried facilities would contaminate vast areas. A 1-megaton EPW, which could destroy facilities down to 300 meters in hard rock, would produce a lethal area of more than 1,000 square kilometers and extending more than 100 kilometers downwind, and would likely cause tens of thousands of civilian casualties even if used on targets far from cities.[22] Radiation doses in excess of international standards for civilians would extend over areas hundreds of times larger than the lethal areas produced by an EPW.

Thus, nuclear weapons are potentially useful for defeating hard or deeply buried targets only under a narrow range of circumstances. The target would have to be strategically vital, in the sense that defeating the facility would significantly reduce the probability of enemy nuclear attacks against the United States and its allies or their troops. U.S. intelligence would have to be sufficiently confident about the nature of the facility and its location and depth to justify a nuclear attack. The facility would have to be too deep to be vulnerable to conventional attack, but not too deep to be vulnerable to nuclear attack, and a conventional attack on tunnel entrances and other surface features would for some reason have to be judged inadequate. Finally, the collateral damage that would result from a nuclear attack, which could be very great for high-yield weapons or for even low-yield weapons used against targets in or near cities, would have to be deemed acceptable and not disproportionate to the military objective. We expect that few targets meet all of these criteria, but without access to detailed intelligence information, it is difficult to judge

21. Frank Serduke, "Standard KDFOC4 Fallout Calculations for Buried Nuclear Detonations," UCRL-ID-146937 (Livermore, Calif.: Lawrence Livermore National Laboratory, September 2001).
22. Ibid. National Research Council, *Effects of Nuclear Earth-Penetrator and Other Weapons*, estimates the average number of casualties for attacks using a 1-megaton EPW of 20,000 for a target "20 kilometers from a small town," and 80,000 for a target "60 kilometers from the nearest city and 13 kilometers from a small town."

whether an important role for earth-penetrating nuclear weapons may remain. But even if such targets exist, a determined adversary would likely respond to the deployment of a U.S. nuclear EPW in ways that would render it largely, if not entirely, useless.

Defeating Chemical and Biological Agents

The NPR mentions the possibility that nuclear weapons might be used to neutralize stocks of chemical and biological weapons. This arises from a concern that conventional weapons may not be able to destroy these agents and prevent their use, and that conventional attacks might disperse the agents and expose nearby civilians and U.S. soldiers. The effectiveness of nuclear weapons for this mission would depend, however, on details of facility design and conditions of agent storage that very likely would not be known to an attacker.[23] To neutralize chemical or biological agents, the fireball produced by the nuclear explosion must enter the underground bunker and engulf the agents, heating them to high temperatures. For an EPW with a yield of 1 to 10 kilotons, this would be possible only if the detonation occurred within the bunker or 5 to 10 meters from the bunker wall, and if the CBW stocks were not shielded from the fireball (e.g., stored in tunnels leading from the main bunker). Thus, nuclear weapons could be effective in neutralizing CBW only if stocks are in surface or shallow-buried facilities, and if the facilities—and the CBW stocks within those facilities—can be located precisely. If the nuclear explosion occurs close enough to rupture but not completely neutralize CBW stockpiles, active agent will be dispersed by the explosion, posing a hazard to surrounding civilians and U.S. soldiers. The lethal area from BW agents dispersed by a nuclear EPW could exceed the lethal area from radioactive fallout.[24]

An alternative approach would be to attack shallow-buried facilities with conventional weapons. Although this also would risk releasing active agents into the environment, the overall risks to nearby civilians and U.S. soldiers are likely in most cases to be smaller than with nuclear attacks, including the risks

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23. May and Haldeman, "Effectiveness of Nuclear Weapons against Buried Biological Agents"; Robert W. Nelson, "Nuclear 'Bunker Busters' Would More Likely Disperse Than Destroy Buried Stockpiles of Biological and Chemical Agents," *Science & Global Security,* Vol. 12, Nos. 1–2 (January–August 2004), pp. 69–90; and National Research Council, *Effects of Nuclear Earth-Penetrator and Other Weapons.*

24. May and Haldeman, "Effectiveness of Nuclear Weapons against Buried Biological Agents," p. 21; and National Research Council, *Effects of Nuclear Earth-Penetrator and Other Weapons.*

of radioactive fallout. For example, even a worst-case release of nerve agent from a conventional attack on a storage facility would kill far fewer civilians than would a 3-kiloton nuclear EPW.[25] The use of nuclear weapons might reduce total casualties only if conventional attacks released kilogram quantities of an extremely deadly agent, such as anthrax, in respirable form, while a nuclear attack dispersed ten or a hundred times less. New nonnuclear weapons are being developed that could disable or destroy CBW storage and production facilities with a much lower risk of dispersal. If occupation by U.S. forces is the military objective, the best strategy may be to prevent access to CBW facilities by destroying roads and entrances and to monitor the facilities using armed aircraft or UAVs to prevent access to the CBW. The agents could then be neutralized with far greater safety after U.S. troops arrive and secure the site.

Attacking mobile and relocatable targets

The NPR also mentions that "one of the greatest challenges today is accounting for the location uncertainty of mobile and relocatable targets."[26] These targets might include road-, rail-, or ship-mobile missile launchers, command posts, and CBW production facilities. If such targets can be pinpointed, they can be destroyed easily with existing conventional weapon systems, such as fighter aircraft or armed UAVs. If the target location is not known precisely, the use of nuclear weapons, which have a much larger radius of destruction, might be considered. Target location uncertainty might result from the time interval between spotting the target (e.g., with photoreconnaissance satellites) and delivering a weapon on the target (e.g., with a ballistic missile).

As noted above, however, large increases in explosive yield are required to compensate for relatively small increases in distance due to either inaccuracies in target location or weapon delivery. A 1-kiloton nuclear weapon can severely damage vehicles, rail cars, or ships at distances of up to about 200 meters; a 1-megaton weapon can do so at distances up to about 2 kilometers.[27] These ranges are small compared to potential location uncertainties. Consider, for example, a target moving in one direction along a straight road or rail line at an average speed that is uncertain by plus or minus 10 kilometers per hour. Thirty minutes after locating the target (the flight time of an intercontinental

25. National Research Council, *Effects of Nuclear Earth-Penetrator and Other Weapons,* figure 6.12.
26. *Nuclear Posture Review,* p. 47.
27. Glasstone and Dolan, *Effects of Nuclear Weapons,* pp. 221–224.

ballistic missile), the target could be anywhere along a line 10 kilometers in length, requiring twenty-five 1-kiloton or three 1-megaton bombs to destroy it. If the target (e.g., a ship or mobile missile launcher) could travel in any direction at speeds up to 25 kilometers per hour, it could be anywhere within an area of 500 square kilometers after thirty minutes; a single 1-megaton bomb would have less than a 3 percent chance of destroying it. Thus, unless the United States is willing to use large numbers of nuclear weapons to destroy a single target, such weapons would be useful only when target location uncertainties are less than a few hundred meters, but greater than a few tens of meters. Because in this case the lethal range would be maximized by detonating the warheads well above ground, there would be no local fallout, and few civilian casualties would result from the use of kiloton-yield warheads in remote areas (e.g., more than 10 kilometers from the nearest town).

The effectiveness of nuclear weapons for destroying mobile and relocatable targets could be improved substantially through the development of advanced surveillance, tracking, and guidance systems and maneuvering reentry vehicles that would allow ballistic missile warheads to home on their targets. Of course, further improvement in such systems would allow the use of conventional warheads for the same purpose.

developing new warheads for new missions?

As a result of the NPR, an "advanced concepts initiative" was established to explore "possible modifications to existing weapons to provide additional yield flexibility in the stockpile; improved earth penetrating weapons (EPWs) to counter the increased use by potential adversaries of hardened and deeply buried facilities; and warheads that reduce collateral damage." According to the NPR, the Department of Defense and the National Nuclear Security Agency will "jointly review potential programs to provide nuclear capabilities, and identify opportunities for further study, including assessments of whether nuclear testing would be required to field such warheads."[28]

Contrary to the inference in the above statement, no new warhead designs are needed to pursue the missions outlined in the NPR. New earth-penetrating weapons can use existing designs, such as the B61 and B83 bombs, repackaged in cases designed to protect the nuclear device as it penetrates the Earth's sur-

28. *Nuclear Posture Review,* pp. 34–35.

face. This, in fact, is the stated goal of the Bush administration's proposed program to field a "robust nuclear earth penetrator": to develop an EPW using the B61 or B83 that could be certified without nuclear testing.[29] Similarly, the other missions discussed above—destroying CB agents and mobile targets—would not benefit significantly from new weapon designs. In both cases, the principal problem is delivering the weapon on target; if that can be achieved, any nuclear warhead with the required yield should be able to do the job almost as well as a new design optimized for this purpose.

The NPR cites the need for "additional yield flexibility," but existing nuclear bombs already have a wide range of yields. The B61 bomb, for example, is reported to have four selectable yields ranging from 0.3 to 350 kilotons, and the B83 bomb is said to have a similar range of yields, up to 1,200 kilotons.[30] Although it is sometimes argued that lower-yield weapons are needed to deal with emerging threats,[31] the yields of all other existing warheads could be reduced substantially with relatively simple and straightforward modifications, such as removing the boost gas from the weapon or otherwise disabling the secondary.[32] Some of these modifications would not require nuclear testing to have high confidence in the reduced yield.

Finally, the NPR mentions "warheads that reduce collateral damage," which presumably refers to something more than using the lowest yield necessary to achieve the specified military objective. It is sometimes claimed that new

29. Jonathan Medalia, "Robust Nuclear Earth Penetrator Budget Request and Plan, FY2005–FY2009," report RL32347 (Washington, D.C.: Congressional Research Service, April 9, 2004).
30. Robert S. Norris, Hans M. Kristensen, and Joshua Handler, "The B61 Family of Bombs," *Bulletin of the Atomic Scientists,* Vol. 59, No. 1 (January/February 2003), p. 74; and Robert S. Norris and William M. Arkin, "U.S. Nuclear Stockpile," *Bulletin of the Atomic Scientists,* Vol. 54, No. 4 (July/August 1998), p. 69.
31. Stephen Younger, "Nuclear Weapons in the Twenty-first Century," LAUR-00-2850 (Los Alamos, N.M.: Los Alamos National Laboratory, June 27, 2000).
32. In thermonuclear weapons, thermal radiation from the detonation of the "primary" is used to compress a physically separate "secondary." The primary is an implosion-type fission device with a relatively low yield; the secondary is responsible for most of the energy released by a typical weapon. The yield of the primary is "boosted" by introducing a mixture of tritium and deuterium gas into the hollow "pit" or shell of plutonium; the tritium and deuterium undergo fusion at the high densities and temperatures created by the implosion and the resulting fission reactions, producing high-energy neutrons that significantly enhance the fission chain reaction. The "boost gas" typically is stored in an external reservoir and transferred through a tube into the pit just before the weapon is detonated. If the boost gas is removed, the yield of the primary will be insufficient to compress the secondary, greatly reducing the total yield of the weapon. See Richard L. Garwin and Georges Charpak, *Megawatts and Megatons: A Turning Point in the Nuclear Age?* (New York: Alfred A. Knopf, 2001), pp. 62–65.

designs—so-called clean weapons that derive most of their explosive yield from fusion rather than fission reactions—might reduce the fallout produced when weapons are detonated near the surface. Substantial collateral damage, however, is unavoidable for several reasons. First, the fission yield cannot be reduced below a minimum value (on the order of 1 kiloton), which alone would create considerable local contamination. Second, neutrons produced by fusion reactions induce substantial radioactivity in the surrounding soil, much of which is ejected into the air and deposited as fallout. Third, much of the collateral damage resulting from the use of nuclear weapons in or near cities—where reducing damage matters most—is due to blast and thermal effects, which depend primarily on the total warhead yield. The use of a "clean" EPW in a city would reduce total casualties by less than a factor of two relative to an existing weapon design of the same yield; even against targets well outside of cities, the reduction in casualties would be less than a factor of four.[33]

Benefits of New Nuclear Missions

The United States should have a strong preference for being able to perform counternuclear missions with conventional weapons. It has a variety of reasons for not using nuclear weapons, including not wanting to inflict disproportionate damage and not wanting to violate the norm against the use of nuclear weapons. Moreover, an adversary that recognizes these barriers to U.S. nuclear use might question the credibility of U.S. nuclear threats, which would reduce their deterrent value.[34] If, however, conventional weapons are incapable of destroying the adversary's ability to attack with nuclear weapons—which, as discussed above, would be the case only under a limited set of conditions—then there may be valuable roles for U.S. nuclear weapons.

We divide the benefits that might be provided by nuclear weapons that are

33. Steve Fetter's calculations using estimates of prompt and fallout casualties resulting from attacks on various target types using EPWs with yields ranging from 1 to 1,000 kilotons (70 percent fission yield) that are given in National Research Council, *Effects of Nuclear Earth-Penetrator and Other Weapons,* with the following assumptions: prompt casualties are independent of fission yield; fallout casualties are proportional to fission yield; minimum fission yield of 1 kiloton; and neutron-induced activity equivalent to 0.2 kilotons of fission yield per kiloton of fusion yield. In general, the reduction factor is less than two for attacks in cities, for attacks with low-yield weapons, or for attacks during weather conditions that minimize fallout casualties.

34. On this impact of the nuclear taboo, see T.V. Paul, "Nuclear Taboo and War Initiation in Regional Conflicts," *Journal of Conflict Resolution,* Vol. 39, No. 4 (December 1995), pp. 696–717.

uniquely capable of destroying the adversary's nuclear attack capability into three types: deterrence, damage limitation, and protection of U.S. foreign policy.[35] These issues were studied extensively during the Cold War when the United States confronted a large, sophisticated, and diverse Soviet nuclear arsenal. In contrast, the United States now faces new potential adversaries that either have a small nuclear force or that may acquire such a force over the next decade or two. The new counternuclear missions identified by the NPR focus on these emerging threats. Consequently, conclusions about U.S. nuclear strategy that held during the Cold War may not hold today.

Analyses of U.S. requirements for dealing with the Soviet nuclear threat produced no consensus, but instead a deeply divided debate over U.S. nuclear strategy and force requirements.[36] Official U.S. nuclear doctrine identified an important role for targeting Soviet nuclear forces, and U.S. forces were dedicated to this mission.[37] A variety of influential arguments in the open literature supported this counterforce strategy; some of these reasons were similar to those articulated by U.S. doctrine, whereas others offered alternative rationales.[38]

In contrast, a prominent family of arguments emphasized that the U.S.-Soviet nuclear relationship was defined by mutual and extremely high societal vulnerability, in which neither the United States nor the Soviet Union could significantly reduce the other's ability to inflict virtually unlimited damage.[39]

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35. The NPR uses somewhat different categories: defeat instead of damage limitation—some conceptions of defeat could include damage limitation as a component; and dissuasion, which we comment on briefly but do not address fully.

36. Analyses of this debate include Charles L. Glaser, "Why Do Strategists Disagree about the Requirements of Strategic Nuclear Deterrence?" in Lynn Eden and Steven E. Miller, *Nuclear Arguments: Understanding the Strategic Nuclear Arms and Arms Control Debates* (Ithaca, N.Y.: Cornell University Press, 1989); and Michael Krepon, *Strategic Stalemate: Nuclear Weapons and Arms Control in American Politics* (New York: St. Martin's, 1984).

37. On the history of U.S. doctrine, see Lawrence Freedman, *The Evolution of Nuclear Strategy,* 3d ed. (New York: Palgrave Macmillan, 2003). For an official statement of U.S. doctrine in the early 1980s, see Secretary of Defense Harold Brown, *Annual Report, FY 1982* (Washington, D.C.: U.S. Government Printing Office, 1981), pp. 37–61. On U.S. nuclear war plans, see Desmond Ball and Robert C. Toth, "Revising the SIOP: Taking War-Fighting to Dangerous Extremes, *International Security,* Vol. 14, No. 4 (Spring 1990), pp. 65–92.

38. Prominent examples include Paul H. Nitze, "Deterring Our Deterrent," *Foreign Policy,* No. 25 (Winter 1976–77), pp. 195–210; and Colin S. Gray and Keith Payne, "Victory Is Policy," *Foreign Policy,* No. 39 (Summer 1980), pp. 14–27.

39. See, for example, Thomas C. Schelling, *Arms and Influence* (New Haven, Conn.: Yale University Press, 1966); Robert Jervis, *The Meaning of the Nuclear Revolution: Statecraft and the Prospect of Armageddon* (Ithaca, N.Y.: Cornell University Press, 1989); Robert Powell, *Nuclear Deterrence Theory: The Search for Credibility* (Cambridge: Cambridge University Press, 1990); and Charles L. Glaser, *Analyzing Strategic Nuclear Policy* (Princeton, N.J.: Princeton University Press, 1990).

This perspective provides an important point of comparison because it was built on powerful logical arguments, produced clear guidance on a number of key strategy questions, and found virtually no role for counternuclear missions. According to these arguments, the superpowers lived in a world of mutual assured destruction capabilities in which deterrence depended on the ability to attack what the adversary valued, not on the ability to attack the adversary's nuclear forces. Damage limitation (i.e., reducing the damage that the adversary could inflict) was impossible because the forces that would survive a counterforce attack could still inflict the level of damage required for assured destruction; from this perspective, the forces that could be destroyed were redundant. The ability of the United States to achieve its foreign policy objectives did not depend on the relative size of U.S. and Soviet forces, but instead on the balance of resolve on the contested issue. These conclusions about deterrence, damage limitation, and foreign policy objectives were closely intertwined: counterforce attacks could not contribute to deterrence or advance U.S. foreign policy because they could not limit damage and, therefore, could not provide a bargaining advantage. Nuclear weapons thus lacked military utility; they were useful only for coercion via countervalue attacks. Another broad conclusion was that force size mattered little, if at all, because differences in force size did not translate into meaningful differences in the ability to inflict retaliatory damage.

The analysis that follows shows that applying the same logic to the emerging threats the United States currently faces produces different answers to the deterrence, damage limitation and foreign policy questions.[40] The hard part of the analysis lies in evaluating the size of this divergence.

DETERRENCE OF NUCLEAR ATTACKS

Counternuclear capabilities could enhance the U.S. ability to deter nuclear attacks by denying an adversary a survivable nuclear capability. The deterrent value of counternuclear capabilities is limited, however, because the United States already possesses a range of potent deterrent capabilities, including the countervalue threats posed by existing nuclear forces.

We expect that the U.S. ability to inflict massive nuclear retaliatory damage

40. Contrary to some recent analyses—for example, Keith B. Payne, *The Fallacies of Cold War Deterrence and a New Direction* (Lexington: University of Kentucky Press, 2001)—our argument is not based on criticism of these Cold War nuclear deterrence arguments; instead, we accept the basic framework and obtain different results because the United States faces a radically different nuclear situation.

would deter nuclear attacks by all states under all but the most extreme conditions.[41] U.S. threats are likely to be most credible for nuclear attacks against the U.S. homeland, but threats to retaliate for nuclear attacks against U.S. allies and troops are also likely to enjoy substantial credibility. Deterrence is likely to be effective because, as was argued extensively during the Cold War, even relatively little credibility is sufficient when the costs of retaliation are so large.[42]

Moreover, the U.S. deterrent is not limited to nuclear threats. The United States could also rely on its conventional superiority to threaten to impose high costs on states that use nuclear weapons, including attacking and conquering states and overthrowing their regimes. Potent conventional threats would enable the United States to avoid relying exclusively on threats of first use of nuclear weapons to deter chemical and biological attacks. This is important because U.S. threats to retaliate with nuclear weapons may be less credible when the damage inflicted by the adversary is relatively small. For example, attacks with chemical weapons would be much less damaging than with nuclear weapons. As a result, the United States would likely find nuclear retaliation to be less appropriate,[43] and an adversary that recognizes this might therefore doubt the credibility of U.S. nuclear threats and therefore be less likely to be deterred.[44] U.S. conventional capabilities help to solve this credibility problem.

Although the possibility of U.S. nuclear retaliation seems likely to deter nuclear attacks under most conditions, there are scenarios in which the U.S.

41. On uncertainty about the effects of nuclear threats in the 1991 Persian Gulf War, see Scott D. Sagan, "The Commitment Trap: Why the United States Should Not Use Nuclear Threats to Deter Biological and Chemical Weapons Attacks," *International Security,* Vol. 24, No. 4 (Spring 2000), pp. 91–96.
42. Reviewing these arguments is Glaser, *Analyzing Strategic Nuclear Policy,* chap. 2.
43. This could reflect a U.S. belief that responses should be proportional, but also U.S. recognition of a norm or taboo against using nuclear weapons, which we address below.
44. Whether the United States should rely on nuclear threats to deter chemical and biological attacks has been the subject of extensive debate. For a range of arguments, see David Gompert, Kenneth Watman, and Dean Wilkening, "Nuclear First Use Revisited," *Survival,* Vol. 37, No. 3 (Autumn 1995), pp. 27–44; Victor A. Utgoff, "Nuclear Weapons and the Deterrence of Biological and Chemical Warfare," Occasional Paper No. 36 (Washington, D.C.: Henry L. Stimson Center, October 1997); and Sagan, "The Commitment Trap." Proponents of relying on nuclear threats emphasize the lack of a symmetric response and the deterrent value of threats to inflict extremely high costs, even if these threats are not highly credible. Opponents underscore the potential of conventional threats to deter, the reputational pressures that doctrine can create for the actual use of nuclear weapons, and the damage to U.S. nonproliferation policy that is caused by a first-use doctrine. We do not focus on this debate here because this case for nuclear threats does not rely primarily on their counter-CBW capability, but instead on their countervalue capability.

deterrent might be inadequate, or at least in which the United States might not be confident that it would be adequate. Probably the clearest example is a scenario in which the United States makes clear that it intends to conquer a state; the state's leader might then decide he has little to lose by using nuclear weapons, either in a last-ditch effort to deter the United States or simply to exact revenge.[45] Fortunately, this type of scenario is largely under U.S. control—the United States can essentially eliminate this rationale for enemy escalation to nuclear attacks by choosing not to invade and overthrow the regime, and by making this clear to the adversary.[46] Of course, this is not entirely good news. If there are cases in which U.S. goals require conquest and regime change, the adversary's nuclear weapons will damage U.S. foreign policy. (We address this problem more broadly in a following section.)

There could also be doubts about the effectiveness of the U.S. deterrent in scenarios in which the adversary has a survivable nuclear capability. An adversary might be able to use (or at least believe that it could use) a survivable nuclear or biological weapons capability to deter U.S. nuclear retaliation. In this case, the adversary might be more willing to launch a limited nuclear attack because it believed that U.S. retaliation might be deterred by the prospect of additional attacks by the adversary. For example, doubting the credibility of U.S. retaliation, an adversary might be more willing to launch a small nuclear attack against the United States or its allies in the hope of compelling the United States to withdraw from a conventional regional war. The United States could retaliate massively, but its desire to avoid further nuclear damage might prevent it from doing so. In this bargaining situation, the United States would have an advantage in the ability to inflict damage, but its adversary might have a countervailing advantage in resolve.[47] This frequently could be the case because a regional power is likely to care more about most regional issues than the United States does. As a result, the United States might not prevail, but in-

45. This was essentially the CIA's assessment before the Iraq war of whether Saddam would use chemical or biological weapons. See "CIA Letter to Senate on Baghdad's Intentions," *New York Times,* October 9, 2002.

46. An important qualification is that U.S. military operations required to retake territory could be confused with the operations required to conquer a country. On this danger and approaches for reducing it, see Barry R. Posen, "U.S. Security Policy in a Nuclear-Armed World (Or: What If Iraq Had Had Nuclear Weapons?)," *Security Studies,* Vol. 6, No. 3 (Spring 1997), pp. 1–31.

47. On limited nuclear war and bargaining in the Cold War context, see Freedman, *The Evolution of Nuclear Strategy;* Morton H. Halperin, *Limited War in the Nuclear Age* (New York: Wiley, 1963); and Robert Powell, "The Theoretical Foundations of Strategic Nuclear Deterrence," *Political Science Quarterly,* Vol. 100, No. 1 (Spring 1985), pp. 75–96.

stead be willing to meet the adversary's demands. Recognizing this possibility, the adversary might not be deterred from launching its initial limited nuclear attack.

Consequently, nuclear counterforce capabilities, if required to make the adversary's nuclear capability vulnerable, could increase the ability of the United States to deter nuclear attacks. In this type of scenario, the United States would use nuclear weapons second against the adversary's forces; the adversary's recognition of this possibility would contribute to deterrence of its initial limited nuclear attack. The deterrent value of nuclear counterforce would depend on how much of the adversary's retaliatory force the United States could destroy. The ability to completely destroy the adversary's nuclear attack capability is likely to have a much larger effect, because otherwise the United States would remain vulnerable to additional nuclear attacks. Thus, although our earlier analysis focused on the potential of nuclear weapons to destroy individual targets, analysis of the value of the counternuclear forces must consider the size and diversity of the adversary's force. Knowing how many deliverable nuclear weapons the United States could not destroy could be more important than knowing how many it could destroy. If militarily effective, U.S. threats to retaliate should be much more credible than threats to strike first, because the United States, its allies, or its troops abroad would have already been attacked.

While the credibility of U.S. threats is likely to be determined largely by the United States' interests and capabilities, official doctrine could influence the adversary's assessment because doctrine guides U.S. planning and operations, and also influences which uses of force are considered legitimate. Therefore, making this mission explicit in publicly available statements of U.S. doctrine might enhance the U.S. ability to deter limited nuclear attacks.

Damage limitation

A second way in which counternuclear capabilities could increase U.S. security is by enabling the United States to reduce the amount of damage an adversary can inflict with its nuclear weapons. The benefits of being able to destroy an adversary's ability to attack with weapons of mass destruction are potentially huge: the United States might prevent an adversary from attacking U.S. or allied cities with nuclear or biological weapons.

The argument for damage limitation is more straightforward and potentially more compelling than is the argument for deterrence. The United States can try to anticipate the ways in which it could become involved in future conflicts and to understand what might deter an adversary from attacking with nuclear

weapons, but it cannot guarantee that deterrence will succeed.[48] Therefore, if the United States becomes involved in a conflict with an adversary that might escalate to nuclear use, the ability to destroy the adversary's capacity to use nuclear weapons could be valuable.

The United States could use nuclear weapons for damage limitation in two broadly different ways—counterforce first strikes and counterforce second strikes. The category of first strikes includes a spectrum of possibilities. One possibility would be to attack early in a conflict, in anticipation of possible escalation but before the United States has clear evidence that the adversary is preparing to launch a nuclear attack;[49] another possibility is a truly preemptive attack in which the United States engages in an intense crisis or fights a conventional war but does not escalate until it has clear intelligence indicating the adversary is preparing a nuclear attack. The former risks using nuclear weapons unnecessarily; the latter risks allowing a nuclear attack by failing to act early enough. Both risk provoking nuclear retaliation if U.S. first use is not perfectly effective in destroying the adversary's force.

In contrast, counterforce second strikes could be valuable for damage limitation if the adversary holds some nuclear weapons in reserve following its initial nuclear attack. As discussed in the preceding section, the adversary has an incentive to hold survivable weapons in reserve to deter U.S. retaliation. Damage limitation and deterrence are intimately intertwined in these arguments. In evaluating benefits, however, it is useful to distinguish between reducing the probability of war via deterrence and reducing the costs of war via damage limitation.

There are a number of factors we need to consider to avoid exaggerating the value of a damage-limitation capability. First, as discussed above, U.S. prospects for deterring the adversary's use of nuclear weapons are good, even without improving the U.S. nuclear counternuclear capability. If deterrence is successful, then damage limitation is unnecessary.

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48. In addition to deterrence failures resulting from rational bargaining in the face of a variety of uncertainties, extensive research suggests that deterrence failures could also result from flawed decisionmaking. See, for example, Robert Jervis, Richard Ned Lebow, and Janice Gross Stein, *Psychology and Deterrence* (Baltimore, Md.: Johns Hopkins University Press, 1985).

49. Still further out on this side of the spectrum would be a fully preventive attack in which the United States launches a nuclear strike before a crisis begins. Roger Speed and Michael May, "Dangerous Doctrine," *Bulletin of the Atomic Scientists*, Vol. 61, No. 2 (March/April 2005), pp. 38–49, consider the NPR in the context of the Bush Doctrine's emphasis on preventive war. We believe that the case for preventive nuclear attacks is especially weak, among other reasons because the prospects for deterrence are likely to be very good (albeit not perfect).

Second, although obvious, we need to emphasize that the overall effectiveness of the U.S. damage-limitation capability matters. If the adversary was actually going to attack, a preemptive U.S. attack that destroys some but not all of its weapons would likely reduce the damage the United States would suffer. Even in this case, however, preemption could be self-defeating. An adversary that was planning a limited strike might launch a larger retaliatory attack with its degraded but surviving force. In contrast, if the United States is uncertain about whether its adversary is going to attack, or if its intelligence that the adversary is going to attack is flawed, then a damage-limitation strike that is not perfect could provoke the adversary to attack, resulting in a nuclear attack that might have otherwise been avoided.

Third, if a U.S. damage-limitation attack destroys the adversary's delivery systems or command and control (or perhaps both), but not its nuclear weapons, then effective damage limitation may depend on gaining control of the surviving nuclear weapons. If the United States does not gain control of these weapons, the adversary might be able to deliver them via unconventional means, or the government might lose control of them, creating the possibility that the weapons will fall into the hands of terrorists. Consequently, a comprehensive damage-limitation campaign probably requires invading and occupying the adversary's country following the counternuclear attack—even if the United States was otherwise uninterested in regime change.

Fourth, when U.S. damage-limitation capabilities are imperfect or uncertain (which we expect will usually be the case), the United States' best option will often be to adapt its foreign policy to avoid these conflicts, instead of turning to its damage-limitation capabilities for protection. For all of these reasons, we greatly exaggerate the value of enhanced damage-limitation capabilities and of a doctrine that requires them if we simply assume scenarios in which an adversary plans to use nuclear weapons against U.S. interests.

Finally, as noted at the outset, the benefits of using nuclear weapons to destroy an adversary's WMD depend on the type of WMD involved. Although frequently lumped together within this category, nuclear, chemical, biological, and radiological weapons inflict drastically different types and degrees of damage.[50] An attack on a large U.S. city with even the most primitive nuclear weapon is certain to be a true catastrophe, with the dead numbering in the tens of thousands, possibly much higher. Passive defenses would be largely in-

50. Steve Fetter, "Ballistic Missiles and Weapons of Mass Destruction: What Is the Threat? What Should Be Done?" *International Security,* Vol. 16, No. 1 (Summer 1991), pp. 5–42.

effective short of complete evacuation. By contrast, the lethal area created by even a large-scale attack with chemical agents would likely be a hundred times smaller, and it could be much less if the agent was distributed inefficiently or under unfavorable weather conditions. Moreover, casualties could be greatly and reliably reduced by passive defenses (including shelters, masks, atropine injections, and evacuation of contaminated areas). Radiological weapons would most likely be less deadly than chemical weapons. Biological weapons are more difficult to characterize. Inefficient or small-scale attacks or attacks with less deadly agents might kill no one; efficient, large-scale attacks with deadly agents such as anthrax could kill as many people as a primitive nuclear weapon; attacks with contagious agents such as smallpox could trigger an epidemic and kill millions. Thus, the case for using nuclear weapons to destroy nuclear and certain types of biological weapons is much stronger than for chemical or radiological weapons.

PROTECTION OF U.S. FOREIGN POLICY

A theme that runs through the preceding discussion is that acquisition of nuclear weapons by a potentially hostile state could reduce the ability of the United States to pursue its foreign policy and regional goals. The adversary's ability to escalate to nuclear attacks might deter the United States both from intervening in a regional conflict and from initiating a conventional war.[51] For example, many commentators have argued that a key reason that the United States invaded Iraq but not North Korea, which posed a much larger nuclear danger, was that the latter had already acquired a small number of nuclear weapons.[52] If Iraq had acquired nuclear weapons before the 1991 Gulf War, the U.S. decision to expel Iraq from Kuwait would have been much more difficult.

Underlying these constraints on U.S. foreign policy is the recognition that the United States may be unable to deter nuclear escalation with high confidence when the adversary cares a great deal about the outcome of a conflict.

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51. In line with this concern, Joseph S. Bermudez Jr., "The Democratic People's Republic of Korea and Unconventional Weapons," in Peter R. Lavoy, Scott D. Sagan, and James J. Wirtz, eds., *Planning the Unthinkable: How New Powers Will Use Nuclear, Biological, and Chemical Weapons* (Ithaca, N.Y.: Cornell University Press, 2000), pp. 193–194, argues that North Korea envisions nuclear weapons supporting a North Korean military offensive against South Korea by deterring U.S. nuclear escalation in response to chemical attacks designed to enhance its offensive capabilities.

52. This demonstration of the deterrent value of nuclear weapons may have increased Iran's determination to acquire them. See Kenneth Pollack and Ray Takeyh, "Taking on Tehran," *Foreign Affairs,* Vol. 84, No. 2 (March/April 2005), p. 24.

Even if U.S. prospects for deterring escalation are good, unless U.S. interests are very large, the United States will have compelling reasons for staying out of conflicts that have even a small probability of escalating to nuclear attacks. The NPR recognizes this problem and emphasizes that national missile defense could serve as a partial solution: "[Missile] defense of U.S. territory and power projection forces, including U.S. forces abroad, combined with the certainty of U.S. ability to strike in response, can bring into better balance U.S. stakes and risks in a regional confrontation and thus reinforce the credibility of U.S. guarantees designed to deter attacks on allies and friends."[53]

Although not addressed in the available portions of the NPR, the ability of the United States to destroy the adversary's nuclear weapons before they are launched would have essentially the same effect. Reducing U.S. vulnerability would limit the effectiveness of the adversary's deterrent, thereby increasing U.S. willingness to intervene in pursuit of its foreign policy interests. Both preemptive and retaliatory attacks could provide this benefit, but in somewhat different ways. U.S. preemption, if perfectly effective, would deny the adversary the option of escalating, thereby enabling the United States to act in the region without fear of nuclear attack; even a partially effective attack would reduce U.S. vulnerability to a small nuclear force. In contrast, U.S. threats of second use of nuclear weapons, intended to destroy any nuclear forces that an adversary holds in reserve following its initial use of nuclear weapons, would enhance the ability of the United States to deter the adversary's escalation to nuclear use, which would in turn reduce the risks of U.S. intervention in the region.

Although U.S. damage-limitation capabilities would provide these foreign policy benefits, they would also bring significant risks. Most basic, the ability of the United States to pursue its foreign policy interests more assertively could increase the probability that an adversary will use nuclear weapons against it. By promising to reduce U.S. vulnerability, counternuclear threats could make the United States willing to engage in certain conflicts that it would otherwise avoid and to bargain harder in others. Although the balance of resolve would shift toward the United States, there could be cases in which the probability that an adversary will escalate to nuclear attack also increases. This can occur when the shift in the balance of resolve increases uncertainty

53. *Nuclear Posture Review,* p. 14.

about which state's resolve is greater.[54] The somewhat counterintuitive result is that while enhanced counternuclear capabilities strengthen the willingness of the United States to pursue its interests, they can also increase the probability that the United States or its allies will suffer a nuclear attack. In cases in which this is not true, U.S. counternuclear capabilities either are insufficient to restore leeway to the United States' foreign policy or unnecessary because it already enjoys a large advantage in resolve.

In addition, there is some danger that the United States will exaggerate the effectiveness of its counternuclear capabilities and, as a result, run an unjustifiably high risk of suffering a nuclear attack. As stressed earlier, for counternuclear attacks to be effective, the United States would require excellent intelligence on the location and operation of the adversary's nuclear force. U.S. leaders who fail to appreciate uncertainties in U.S. intelligence might launch a nuclear attack that was much less likely to be effective than they believed. It is essential that U.S. leaders be fully informed about the likely effectiveness of U.S. counternuclear capabilities, including not only uncertainty about U.S. weapons systems, but also uncertainty about U.S. intelligence concerning the adversary's force deployments and operations. Any biases in the U.S. system that exaggerate the overall effectiveness of U.S. damage-limitation capabilities could lead to unwarranted assertiveness and the accompanying risks of nuclear attack.[55]

SUMMARY OF BENEFITS

To summarize, we find at most a very limited role for nuclear weapons in the counterproliferation missions identified by the NPR. Adversaries are highly unlikely to attack the United States or its vital interests with nuclear weapons because the United States possesses highly capable military forces and the will to use them if attacked with nuclear weapons. The high probability of effective deterrence reduces the value of damage-limitation capabilities and the need to restore leeway to U.S. foreign policy.

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54. For an insightful analysis that focuses on the impact of U.S. missile defenses, see Robert Powell, "Nuclear Deterrence Theory, Nuclear Proliferation, and National Missile Defense," *International Security,* Vol. 27, No. 4 (Spring 2003), pp. 86–118.

55. On the possibility of military bias toward offensive effectiveness, see Jack Snyder, *The Ideology of the Offensive: Military Decision Making and Disasters of 1914* (Ithaca, N.Y.: Cornell University Press, 1984); and Barry R. Posen, *The Sources of Military Doctrine: France, Britain, and Germany between the World Wars* (Ithaca, N.Y.: Cornell University Press, 1984).

Nevertheless, we can imagine scenarios in which nuclear counterforce would bring benefits, with damage limitation being the most clear cut.[56] No matter how well the United States designs its deterrent policy, there will remain some possibility that it would engage a nuclear adversary in a conventional conflict that neither state initially believed would escalate to nuclear war, but that then became unexpectedly intense or difficult to control. Given the enormous destruction that an adversary could inflict with nuclear (and certain types of biological) weapons, if the United States believed the adversary was very likely to escalate to nuclear war, and if U.S. conventional weapons were incapable of destroying its nuclear weapons, then a preemptive attack designed to limit damage might be the best option.

Other roles for nuclear counterforce are less likely to increase U.S. security and could decrease it. Relying on nuclear counterforce capabilities to restore leeway to U.S. foreign policy will rarely, if ever, be in the United States' interest. If the probability of nuclear war is sufficiently high that the United States must contemplate a preemptive attack to make the risks of intervention acceptable, then it should almost always choose not to start, enter, or escalate the conflict, because the risks of war would not be warranted. In addition, although a damage-limitation capability could improve the U.S. bargaining position, the probability of nuclear war could also increase if the United States adopts a more assertive foreign policy. Relying on U.S. nuclear counterforce to enhance deterrence by threatening the adversary's reserve forces may be sounder, although it seems unlikely that adversaries will base their strategies on the complex logic of limited nuclear attacks backed up by survivable forces. Moreover, if the United States is focusing on deterrence but not preemption, then these must be scenarios in which the probability of avoiding nuclear war

56. Although we find that nuclear counterforce might contribute to deterrence and damage limitation against an emerging nuclear power, our arguments are consistent with the now standard proposition that nuclear weapons favor the defense. First, the offense-defense balance can depend on the size of forces. If a country deploys a small force (either because it cannot afford a larger arsenal or because it faces specific resource constraints), the extent of defense advantage will be smaller. See Charles L. Glaser and Chaim Kaufmann, "What Is the Offense-Defense Balance and Can We Measure It?" *International Security,* Vol. 22, No. 4 (Spring 1998), p. 66. Second, although the United States might have some damage-limitation capability, depending on the opposing state's basing and delivery capabilities, the offense-defense balance would continue to favor defense—the forces required to eliminate the deterrent value of the adversary's nuclear force would be substantial. Third, advantages in power, which can be translated into advantages in the quality and quantity of forces, can enable a state to acquire an offensive capability even when defense has the advantage.

is judged to be sufficiently good that it can forgo the option of attacking first. In short, among the potential new missions for nuclear weapons, the strongest case envisions damage-limitation capabilities as a type of insurance policy that would be designed to have little impact on the breadth or assertiveness of U.S. foreign policy and therefore would not increase the probability of nuclear war.

Costs of New Nuclear Missions

An assessment of the overall case for nuclear counterforce missions requires consideration of their costs, as well as the benefits evaluated above. Critics of the NPR have argued that establishing new missions for nuclear weapons is a bad idea for several reasons: it encourages states to acquire nuclear weapons or improve their nuclear forces, while undermining the U.S. ability to slow proliferation;[57] and it makes adversaries more willing to use nuclear weapons.[58] To explore these criticisms, we flesh out the arguments and scrutinize the logic that underpins them. In addition, we consider the possibility that vulnerability of the adversary's nuclear forces could, during a severe crisis, create incentives for both the United States and the adversary to use nuclear weapons early, thereby adding to the variety of ways in which nuclear weapons might be used.

acquisition of nuclear weapons by adversaries

Whether a state acquires nuclear weapons depends on both how valuable the state believes nuclear weapons would be for achieving its goals and how difficult these weapons are to acquire. The following subsections address states' incentives for acquiring nuclear weapons and the barriers to their acquisition.

incentives for acquisition. How might U.S. adoption of new nuclear missions influence decisions by other states to acquire nuclear weapons?[59] One line of argument focuses on an adversary's security requirements: the shift in

57. Michael May, "An Alternative Nuclear Posture," *Physics & Society*, October 1, 2003, http://cisac.Stanford.edu/news/380; and Henry Kelly and Ivan Oelrich, "Will New Nuclear Weapons Make Us More Secure?" http://www.fas.org/ssp/docs/030916-newnukes.
58. May, "An Alternative Nuclear Posture."
59. For analyses of states' nuclear acquisition decisions, see Scott D. Sagan, "Why Do States Build Nuclear Weapons? Three Models in Search of a Bomb," *International Security*, Vol. 21, No. 3 (Winter 1996/97), pp. 54–86; and T.V. Paul, *Power versus Prudence: Why Nations Forgo Nuclear Weapons* (Montreal: McGill-Queen's University Press, 2000).

U.S. nuclear policy leads the adversary to believe that nuclear weapons have become necessary to protect its security. A state that has chemical or biological weapons might conclude that it needs nuclear weapons to deter U.S. attacks against its WMD; a state that already has nuclear weapons might conclude that it needs more weapons—and more survivable weapons—to deter U.S. nuclear attacks.

Although the logic of these arguments is sound, the magnitude of the effect is likely to be small. First, a country that sees the United States as a potential threat to its security or regional goals would likely already place substantial value on nuclear weapons, because they are the only means of offsetting U.S. conventional superiority. Second, because U.S. conventional capabilities already pose a serious threat to any target that the United States can find, emerging nuclear states already have an incentive to build more survivable and larger nuclear forces. This incentive is further increased by the potential inherent in existing U.S. nuclear forces. Therefore, although explicit nuclear threats may push states further in this direction, the effect should be small because these threats do not significantly increase states' incentives to acquire nuclear weapons or improve existing nuclear capabilities. The most significant effect of U.S. doctrine on a state's decision to acquire nuclear weapons is probably how it affects the state's internal domestic debate. By continuing to emphasize their military value, the United States may inadvertently strengthen the hand of pronuclear elites, while undermining those opposed to acquiring nuclear weapons.[60]

There are also considerations that cut in the opposite direction. U.S. threats to use nuclear weapons against nuclear targets could decrease a state's incentives to acquire nuclear weapons by making explicit that possessing them puts it on the U.S. nuclear target list. Moreover, if nuclear threats increase the adversary's assessment that the United States would use nuclear weapons to destroy its nuclear capability, then these threats could reduce the value of acquiring nuclear weapons in the first place, by lowering the expectation that they would be available for deterrence.[61] These considerations by themselves are unlikely to convince a state to forgo nuclear weapons, but they push in that direction.

60. Sagan, "Why Do States Build Nuclear Weapons?" pp. 72–73, makes this point in a related context.

61. The NPR argues more generally that "systems capable of striking a wide range of targets throughout an adversary's territory may dissuade a potential adversary from pursuing threatening capabilities." *Nuclear Posture Review,* p. 12.

Another line of argument suggests that states will become more likely to acquire nuclear weapons if the United States advertises the military utility of nuclear weapons against certain new types of targets. But the key reason for a state to acquire nuclear weapons, especially one that suffers from conventional inferiority, is deterrence, which depends primarily on their countervalue potential, not their utility against these sorts of targets. In addition, a conventionally inferior adversary might find nuclear weapons valuable for undermining U.S. conventional superiority because they could be effective against concentrations of conventional military capabilities, including ports and air bases. In contrast, the missions that the NPR does highlight are likely to be of at most secondary interest to potential and emerging nuclear states: they will be unable to acquire a damage-limitation capability against U.S. nuclear forces and may not face regional powers that possess potent nuclear capabilities.

There is, however, a second layer of this argument that deserves consideration. Critics worry that by emphasizing the possible uses of nuclear weapons, the NPR weakens the taboo against their use.[62] If the taboo is weakened, potential proliferators may find nuclear weapons more attractive because they can be used more easily for coercion and for deterrence of conventional attacks. By this logic, U.S. nuclear doctrine, the nuclear taboo, and the nonproliferation regime are tightly intertwined; to achieve its nonproliferation goals, the United States should downplay all uses of nuclear weapons instead of highlighting new missions.

Evaluating this argument requires an understanding of the sources of the nuclear taboo.[63] Specifically, we need to consider the link between nuclear doctrine and capabilities, on the one hand, and beliefs about the appropriateness of nuclear use, on the other. We have little reason to believe that the nuclear taboo depends strongly on U.S. nuclear doctrine. The taboo developed during decades in which the United States planned for the use of nuclear weapons in increasingly varied ways, including the first use of nuclear weapons to deter a conventional attack and to bring about the termination of a conventional war

62. On the nuclear taboo, see Nina Tannenwald, "The Nuclear Taboo: The United States and the Normative Basis for Nuclear Non-use," *International Organization,* Vol. 53, No. 3 (Summer 1999), pp. 433–468; Elizabeth Kier and Jonathan Mercer, "Setting Precedents in Anarchy: Military Intervention and Weapons of Mass Destruction," *International Security,* Vol. 20, No. 4 (Spring 1996), pp. 77–106; and Paul, "Nuclear Taboo and War Initiation in Regional Conflicts."

63. On the development of the nuclear taboo, see Nina Tannenwald, "Stigmatizing the Bomb: Origins of the Nuclear Taboo," *International Security,* Vol. 29, No. 4 (Spring 2005), pp. 5–49.

that the United States and its allies were losing, and acquired increasingly advanced nuclear forces to perform these missions. The threat of first use to protect the United States' NATO allies played a central role in driving U.S. nuclear force requirements; in addition to guiding U.S.-European force requirements and command and control, extending nuclear deterrence was the most prominent rationale for the extensive strategic counterforce capabilities that accounted for most U.S. force modernization during the 1970s and 1980s.[64] Thus, we do not anticipate that adding new nuclear counterforce missions will hurt U.S. nonproliferation policy via this taboo-weakening mechanism.

This leaves open the possibility that the nuclear taboo would be strengthened by doctrinal changes that reject the use of nuclear weapons. Some proponents of a no-first-use policy have identified strengthening the norm against using nuclear weapons as a key rationale for changing U.S. nuclear doctrine.[65] Again, however, the strength of this potential effect must be analyzed relative to the sources of the nuclear taboo. The nuclear taboo reflects the widespread recognition of the destructive potential of nuclear weapons, which has contributed to their being categorized as different from other weapons; the difficulty of establishing sharp lines between the use of nuclear weapons of different sizes, as well as between different types of nuclear use; and the weight of decades of nonuse. These factors may be so powerful that doctrinal shifts alone are unlikely to strengthen or weaken the taboo significantly.[66]

Part of the challenge in analyzing the impact of doctrine on the nuclear taboo is the paucity of cases in which the central features of U.S. nuclear doctrine have been relevant to U.S. decisions about whether to use nuclear weapons. During the Cold War, U.S. nuclear doctrine was designed to deter a very large conventional war that threatened truly vital U.S. interests (e.g., a large Warsaw

64. On U.S. nuclear doctrine, see Freedman, *The Evolution of Nuclear Strategy;* on the relationship between extended deterrence and U.S. counterforce requirements, see Glaser, *Analyzing Strategic Nuclear Policy*, chap. 7. See, however, Tannenwald, "Stigmatizing the Bomb," pp. 27–33, who posits a much closer relationship between U.S. nuclear policy and the taboo.

65. See, for example, Committee on International Security and Arms Control, National Academy of Sciences, *The Future of U.S. Nuclear Weapons Policy* (Washington, D.C.: National Academy Press, 1997), which calls for shifting to a no-first-use policy to support U.S. nonproliferation goals and argues that the practice of nuclear deterrence can fuel proliferation by, among other reasons, "lending respectability to reliance on nuclear deterrence." Ibid., p. 18.

66. For example, Thomas C. Schelling, "The Role of Nuclear Weapons," in L. Benjamin Ederington and Michael J. Mazarr, *Turning Point: The Gulf War and U.S. Military Strategy* (Boulder, Colo.: Westview, 1994), p. 113, argues that "the inhibition on any president's authorizing the use of nuclear weapons was already far stronger than any no-first-use declaration [or even treaty] could make it; an official announcement of a no-first-use policy would have the same effect as adding a hemp rope to an anchor chain."

Pact invasion of Western Europe) and nuclear attacks against the United States and its allies. Fortunately, since the early 1960s, crises and wars on this scale have not occurred. Consequently, although there is now clear evidence of a nuclear taboo, we have little information both about the extent of this taboo—the range of scenarios in which nuclear use is considered inappropriate—and the impact of U.S. doctrine on the depth and breadth of the taboo. This leaves open the possibility that excluding the new counterforce missions from U.S. doctrine would strengthen the taboo. Removing first use from U.S. nuclear doctrine (and the associated war plans) would likely change the ways in which U.S. political and military leaders envisioned the purposes of nuclear weapons under the most severe conflict conditions. Even removing a subset of first use—for example, eliminating nuclear use in response to a conventional attack while maintaining the option of nuclear preemption—could have this effect. If changes in doctrine reflected an assessment of the risks of nuclear use, and not the appropriateness of use, then the shift would not initially reflect a change in the taboo. Over time, however, the revised doctrine might alter the options that U.S. leaders even considered, leading to a further narrowing of what was viewed as the appropriate use of nuclear weapons.

The possibility of this interaction between U.S. nuclear doctrine and the nuclear taboo raises two further issues. First, the positive impact on proliferation would occur only if potential proliferators both accept the taboo and revise their understanding of it in response to changes in U.S. nuclear doctrine. Given the weak link between U.S. doctrine and the development of the nuclear taboo in the United States, we expect this interaction to be even weaker. Second, we need to question the desirability of strengthening the nuclear taboo to cover all types of U.S. first use of nuclear weapons. If, as we conclude, there is the possibility under a very restrictive set of circumstance that the benefits of damage-limitation attack could exceed the costs, then an absolute taboo (unless also recognized by all potential adversaries) could reduce U.S. security.

BARRIERS TO ACQUISITION. So far, this section has considered the effect of the NPR on states' incentives to obtain nuclear weapons. Whether a state acquires nuclear weapons, however, also depends on the barriers it faces. Many of the countries that the United States has been most concerned about, including Iraq, North Korea, and possibly Iran, decided they wanted nuclear weapons; the question was whether they could acquire them. Consequently, if adopting new nuclear missions (and especially testing new nuclear weapons) would hurt U.S. multilateral nonproliferation efforts, thereby lowering the barriers to acquisition, the result could be increased proliferation. More spe-

cifically, the NPR could undermine the U.S. ability both to form and maintain strong international coalitions against identified potential proliferators (e.g., North Korea and Iran) and to achieve broad international support for strengthening barriers to proliferation, including tightening the requirements of the Nonproliferation Treaty (NPT), enhancing export controls, and improving physical protection measures. Critics argue that maintaining and improving the nonproliferation regime requires strong U.S. leadership, but that many aspects of U.S. strategic nuclear policy—including its nuclear doctrine—are undermining the U.S. ability to play this essential role.[67]

According to these arguments, the NPT regime is a complex, multidimensional deal between states that are attempting to prevent proliferation. If the United States wants other states to devote themselves to preventing proliferation, then it must hold up its side of the nonproliferation bargain. Otherwise, it loses the legitimacy that is required to lead effectively, and other states will conclude that the nonproliferation policies that it advocates are inequitable and therefore refuse to adopt them. Consequently, this argument holds that to advance its nonproliferation goals, the United States should adopt an array of changes required to bring U.S. nuclear policy in line with its NPT regime obligations, including: further reduction of the size of its nuclear forces to a level well below that agreed to in the 2002 Treaty of Moscow; negotiation of verifiable and irreversible limits on the total number of nuclear warheads; a recommitment to pursuing nuclear disarmament; the restoration of confidence in negative security guarantees that commit the United States not to use nuclear weapons against nonnuclear powers; ratification of the Comprehensive Test Ban Treaty (CTBT); and the revision of U.S. doctrine to restrict the planned uses of nuclear weapons.[68] Adopting these changes is all the more important because the United States committed itself to many of these policies at the 2000 NPT renewal conference; as a result, these policies are no longer simply part of a broad but flexible interpretation of the NPT regime, but rather explicit criteria by which states can and do judge U.S. nonproliferation policy.

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67. George Perkovich, Jessica Tuchman Matthews, Joseph Cirincione, Rose Gottemoeller, and Jon Wolfsthal, *Universal Compliance: A Strategy for Nuclear Security* (Washington, D.C.: Carnegie Endowment for International Peace, 2005), pp. 24–26, 30, 133–157. See also Kurt M. Campbell, "Reconsidering a Nuclear Future: Why Countries Might Cross Over to the Other Side," in Campbell, Robert J. Einhorn, and Mitchell B. Reiss, eds., *The Nuclear Tipping Point: Why States Reconsider Their Nuclear Choices* (Washington, D.C.: Brookings, 2004), pp. 22–23.

68. U.S. negative security assurances have been limited to cases in which the nonnuclear state is not allied with a nuclear power that is attacking the United States. Perkovich et al., *Universal Compliance,* pp. 138–139, also includes changing the operational status of U.S. nuclear forces. Although we believe the United States should implement these changes, we think the potential link to U.S. proliferation goals is weaker than their other proposed changes.

Although the effect on proliferation of U.S. nuclear policy that fails to make these changes is undoubtedly negative, the magnitude is hard to judge. Nonproliferation links to U.S. nuclear policy are frequently stated by elites and reported by critics, yet the underlying logic is not obvious. U.S. nuclear policy does not directly influence the security interests of states that support the nonproliferation regime to prevent other states from acquiring nuclear weapons. For example, why would Germany, Russia, or China's interest in stopping Iran from acquiring nuclear weapons depend on whether the United States has 2,000 nuclear weapons or 500, or on whether the United States has signed the CTBT? If these basic interests are not influenced, then why should a state be less determined to prevent proliferation simply because U.S. nuclear policy is not fully in line with its NPT regime obligations? If other supporters of the nonproliferation regime recognize that the United States is not meeting its potential leadership role, should they not redouble their efforts to improve the regime?

The argument therefore must not hinge primarily on a clear link to security interests, but instead to a combination of states' sense of a fair bargain and of respect for their own international standing. Other countries may simply resent the United States' unwillingness to constrain its own policies in ways that conform to emerging international norms. As a result, they might even be willing to pursue policies that reduce their security rather than accept a strikingly unbalanced bargain with the United States. So, for example, a state might be less willing to insist on revising the NPT to require nonnuclear states to forgo the acquisition of a complete nuclear fuel cycle if the United States is unwilling to constrain its nuclear policies, whether the question is the size of its nuclear force, nuclear testing, or new nuclear missions. Although these issues are not directly linked in security terms, they are potentially linked by some broader understanding of the obligation that all states have to constrain their behavior for the larger international good. The inherently discriminatory nature of the NPT regime may make this sense of equity especially important.

The strength of these nonsecurity linkages is difficult to evaluate because it depends on the relative weight that states place on security and nonsecurity values.[69] Given the frequency with which the equity and legitimacy concerns are raised, we believe they should be factored into U.S. nuclear policy. We are inclined, however, to believe the effects are small because states will give

69. It could also depend on a state's domestic politics, in which opposition to falling in line with the United States could outweigh a leader's preference to focus more narrowly on the state's security interests.

weight to pursuing their security interests. Given both the uncertainties and our sense of the magnitude of these linkages, we recommend that the United States pursue nuclear policies that support the NPT regime when the narrow security case for adopting them is already solid; nonproliferation considerations then make the overall argument still more compelling. As we discuss in the concluding section, following this approach, the United States should adopt many of the nuclear policies noted above, thereby significantly improving its reputation for complying with the NPT regime. The case for nuclear counterforce missions, however, is not overwhelmed by these nonproliferation regime considerations.

Intentional use of nuclear weapons by adversaries

Another concern is that adopting new missions for U.S. nuclear forces might make adversaries more willing to use nuclear weapons. The basic argument is as follows: first, the NPR increases the probability that the United States will use nuclear weapons by promoting new roles and missions for them; second, if the United States uses nuclear weapons, the taboo would be shattered;[70] and, third, other states would therefore become more inclined to use nuclear weapons against either the United States or regional adversaries. According to this line of argument, if in the recent war against Iraq the United States had used nuclear weapons to destroy Iraqi WMD or deeply buried command bunkers (assuming they existed), in a future conflict North Korea might be more likely to use nuclear weapons against the United States, U.S. military forces, or U.S. regional allies. Likewise, India might be more willing to use nuclear weapons preemptively to destroy Pakistani nuclear weapons.

The first step in this argument is correct: in a variety of ways, the NPR's new nuclear missions increase the probability that the United States would use nuclear weapons. We have already discussed the possibility that damage-limitation capabilities could lead the United States to pursue a more assertive foreign policy that increases the probability of nuclear war. In addition, both by identifying and legitimizing new roles and by calling for improvements in the U.S. arsenal that would increase the effectiveness and reduce the collateral damage of nuclear use, the NPR lowers the nuclear threshold, thereby increas-

70. Another possibility is that the NPR weakens the nuclear taboo simply by making clear the U.S. willingness to use nuclear weapons and does not depend on the United States actually using them. This argument, already discussed above, does not appear to be very strong, although there is the possibility of missing the opportunity to further strengthening the taboo.

ing the probability that for a given level of conflict the United States will use nuclear weapons. The NPR argues that this change in nuclear doctrine will discourage proliferation and will therefore ultimately decrease the number of situations in which the United States might use nuclear weapons to counter proliferation. We doubt that this will be a dominant effect and judge that, on balance, the probability of U.S. nuclear use will increase. In addition, as we discuss below, the new missions could create pressures for the United States to use nuclear weapons early during a severe crisis.

The second step—U.S. nuclear use would shatter the nuclear taboo—is also correct, although the long-term effects are less clear. Nuclear use would end a very long period of nonuse, which now exceeds sixty years. Analyses of the nuclear taboo emphasize that its strength increases as the period of nonuse increases; use of nuclear weapons would weaken this dimension of the taboo. In addition, if U.S. first use against military targets is effective and results in limited collateral damage, the sharp distinction between nuclear and conventional weapons might be reduced, and the nuclear taboo would be eroded severely. Nuclear use also would weaken the identity-based prohibition on the use of nuclear weapons because the leader of the Western world and the world's most powerful country would have once again used nuclear weapons. As a result, other states would not be as severely stigmatized or ostracized if they used nuclear weapons, and it would be more difficult to marshal coordinated international action against countries that use them.

At the same time, other factors do not work so sharply against the taboo and might even reinforce it over the longer term. As explained above, the impact of using nuclear weapons could depend on the scenario and purpose for which they are used. If the United States used nuclear weapons preemptively when its adversary was certainly preparing to launch a nuclear attack against it, the rationale for U.S. nuclear use might be sufficiently compelling that most observers and nations would accept its legitimacy, particularly if the collateral effects of the attacks were modest. The result could be a further articulation, but not necessarily a dramatic weakening, of the nuclear taboo. The aversion to using nuclear weapons would largely stand; but under very narrow conditions, nuclear use would be recognized as acceptable and perhaps even necessary, although undesirable.[71]

On the other hand, if U.S. use of nuclear weapons resulted in tremendous

71. Schelling, "The Role of Nuclear Weapons," comments on many of these considerations.

destruction, or if it resulted in catastrophic retaliation, governments and publics might come to better appreciate the danger they pose, with their destructive potential made more vivid and horrifying, which in turn might strengthen the nuclear taboo. It is not unimaginable that this would lead to serious efforts to prohibit nuclear weapons, just as the use of chemical weapons led to prohibitions on their use and, ultimately, their possession.[72]

The third step in the argument—that other states will become more inclined to use nuclear weapons—is more complicated and less clearly correct. We do not know much about whether the adversaries in question embrace the nuclear taboo. The most extensive work on the taboo focuses on the United States; for states that do not yet have nuclear weapons, there can be no direct evidence of their attitudes toward use. Iraq repeatedly violated the taboo on the use of chemical weapons, which at least raises doubts about whether it would be constrained by a nuclear taboo. If the United States is facing an adversary that does not accept the nuclear taboo, there is little, if any, cost in weakening the convention against use, except for the possibility that the adversary would have embraced the taboo eventually but for the U.S. nuclear attack. Moreover, the effect of the nuclear taboo is likely to be less important than other considerations. An opponent that otherwise can be deterred will not be significantly more likely to use nuclear weapons simply because the United States weakened the nuclear taboo by using them in an earlier conflict. On the other hand, an adversary that the United States cannot deter is unlikely to be strongly influenced by the nuclear taboo—either because the state perceives itself to be in a desperate situation or because a state that is willing to risk high levels of damage to its own people is less likely to be repulsed by inflicting massive damage on others. A weakening of the nuclear taboo would thus appear to have its greatest effect on the remaining cases: states that are difficult but not impossible to deter, and that recognize and are influenced by the nuclear taboo. This seems likely to be a small, but possibly nonzero, set of adversaries and scenarios.

Crisis pressures for the use of nuclear weapons

Enhancing the U.S. nuclear capability to destroy an adversary's nuclear force could create dangers in a severe crisis or once a conventional war had begun.

72. On chemical weapons, see Richard M. Price, *The Chemical Weapons Taboo* (Ithaca, N.Y.: Cornell University Press, 1997); and John Ellis van Courtland Moon, "Chemical Weapons and Deterrence: The World War II Experience," *International Security,* Vol. 8, No. 6 (Spring 1984), pp. 3–35.

An adversary whose command and control capabilities are highly vulnerable could have incentives to operate its forces in ways that increase the probability of accidental and unauthorized attacks; an adversary whose nuclear forces are highly vulnerable would have incentives to raise their operational alert level and possibly to use its weapons before the United States attacks. In addition, the United States could face pressures to attack early in a crisis, while the adversary's nuclear forces and command and control were still vulnerable.

Enhancing U.S. counternuclear capabilities would have these effects only if the adversary's capabilities were not already highly vulnerable prior to the enhancements, and if the adversary is confident of this. Specifically, if U.S. conventional and nuclear forces already render the adversary's forces and command and control highly vulnerable, these dangers would already exist and not be increased significantly.

An adversary that believes the United States can knock out its command and control facilities would fear that the United States could destroy its ability to launch its nuclear forces, even if the United States was unable to destroy all of them. To solve this problem, the adversary's leadership could delegate launch authority and capability to the military officers who operate the weapons, thereby protecting the state's ability to attack even if its command authority has been destroyed. The danger is that field commanders might then launch an attack that the national leadership would not have authorized, possibly because they believe their weapons are going to be destroyed or because they misunderstood an order from the leadership.[73] In addition, the danger of an accidental attack might increase simply because, under tense and demanding conditions, there would be more individuals who were capable of launching a nuclear attack.

A state with vulnerable nuclear weapons might also have some incentive to use them early in a crisis or conventional war. An adversary that plans to rely on limited nuclear attacks to coerce the United States to back down in a regional conflict or to deter invasion of its homeland could feel pressure to escalate early if it believed the United States might launch a damage-limitation or

73. There is a sophisticated debate over whether command and control vulnerability of states with small nuclear arsenals would have these negative effects. For the case that it would not, see Jordan Seng, "Command and Control Advantages of Minor Nuclear States," *Security Studies,* Vol. 6, No. 4 (Summer 1997), pp. 50–92; and David J. Karl, "Proliferation Pessimism and Emerging Nuclear Powers," *International Security,* Vol. 21, No. 3 (Winter 1996/97), pp. 87–119. For the more traditional case that it would, see Peter D. Feaver, "Neooptimists and Proliferation's Enduring Problems," *Security Studies,* Vol. 6, No. 4 (Summer 1997), pp. 93–125.

disarming attack early in the conflict. The prospects for avoiding this nuclear escalation would be better if the adversary's forces were more survivable. For example, the vulnerability of the adversary's forces could result in a nuclear attack if it believes incorrectly that the United States is fighting a conventional war with the goal of conquering the state and overthrowing its regime. If the adversary's nuclear force were survivable, it could wait and would learn that U.S. goals were limited. In contrast, with vulnerable nuclear forces, the adversary could feel pressure to launch its forces early, before the United States launched a disarming attack. In addition, an adversary that valued inflicting damage on the United States and believed its weapons were going to be destroyed would have incentives to use them before the United States attacked. Fortunately, states that place great value on inflicting damage for its own sake (including revenge) are likely to be extremely rare; even the "rogue" states that have been the focus of so much attention by the Bush administration would likely be deterred by the costs of U.S. retaliation. Again, however, if such a state believes that the United States is planning to conquer it and therefore has little to lose, the vulnerability of its nuclear forces could create time pressures that deny the opportunity to learn otherwise.

This brief discussion suggests that the combination of an assertive U.S. foreign policy with a nuclear strategy that emphasizes counternuclear capabilities has the potential to be doubly dangerous. Such a foreign policy could lead potential adversaries to believe that the United States is interested in overthrowing their regime or conquering their country. The U.S. invasion of Iraq and the Bush administration's emphasis on regime change have had this effect on North Korea and Iran. Given this belief about U.S. goals, an adversary would be more likely to believe that U.S. aims in a regional conflict are unlimited, which would increase its incentives to rush to alert its nuclear forces and to employ limited nuclear attacks early in a conflict to deter the United States. These incentives could reinforce the pressures created by vulnerable nuclear forces for the adversary to escalate to nuclear use. The danger posed by combining these incentives suggests another reason that nuclear proliferation should lead the United States to adopt a more restrained foreign policy.

The ability to destroy the adversary's forces could also create incentives for the United States to attack early in a conflict. If the adversary has the ability to make its capabilities more survivable—for example, by dispersing forces or delegating launch authority—the United States would face pressure to launch counternuclear attacks before the adversary institutes these survivability

measures.[74] We can foresee a spiral of crisis interactions that increase the probability of a U.S. attack: improvements in U.S. nuclear forces magnify the adversary's incentives in a crisis to raise the alert status of its forces; this increase in alert status creates pressure for the United States to attack while its forces are still effective; in addition, the United States might interpret the adversary's move as indicating that it plans to attack, further increasing the pressure on the United States to attack quickly. Consequently, the counternuclear forces that enhance deterrence and limit damage are also likely to create time pressures that increase the probability that a crisis would escalate to nuclear war. A variety of costs could result. Although preemption to limit damage might be the best option, pressures to attack early increase the probability of unnecessary attacks—that is, mistaken preemption in cases in which the adversary was not going to escalate to nuclear attacks. If some of the adversary's force then survives, it might launch a retaliatory nuclear attack against U.S. interests. In addition, the U.S. attack could result in extensive collateral damage with large humanitarian costs. And as noted above, this otherwise avoidable use of nuclear weapons would likely weaken the nuclear taboo and damage the United States' international reputation.

Conclusions and Recommendations

We have found at most a very limited set of scenarios in which nuclear counterforce missions might increase U.S. security. Nuclear counterforce would provide the promised benefits—for deterrence, damage limitation, and U.S. foreign policy—in only a tiny fraction of potential conflict scenarios because the United States has a highly effective deterrent without these missions; because most types of counterforce targets can be destroyed by U.S. conventional weapons; and because nuclear weapons cannot destroy some critical targets. In addition, these missions could bring a variety of costs. Relying on nuclear counterforce capabilities to restore leeway to U.S. foreign policy is risky because a United States that bargains harder because it has a damage-limitation capability could also be more likely to be attacked with nuclear weapons by a determined adversary. In addition, a doctrine that emphasizes

74. On the dangers created by windows, including this type of tactical window, see Stephen Van Evera, *Causes of War: Power and the Roots of Conflict* (Ithaca, N.Y.: Cornell University Press, 1990), chap. 4.

nuclear counterforce options could increase the probability that the United States would unnecessarily escalate a conventional conflict—preempting when in fact the adversary was not going to attack—and heighten the probability that an adversary would accidentally use nuclear weapons during a crisis. Moreover, pursuing additional nuclear counterforce capabilities would hurt the U.S. ability to maintain and strengthen the nonproliferation regime. Actually using nuclear weapons would bring additional costs, shattering the nuclear taboo and damaging the United States' international reputation. These costs lead us to conclude that the United States should not rely on nuclear counterforce to reduce the constraining effects of nuclear proliferation on its foreign policy.

We cannot, however, rule out the possibility that the benefits of damage limitation could exceed these costs if the adversary was armed with nuclear or sophisticated biological weapons; if the probability that the United States was going to be attacked with these weapons was high; and if conventional weapons had significantly worse prospects of defeating targets essential to these enemy attacks. Consequently, U.S. decisionmakers need to learn still more about the potential benefits of damage-limitation attacks and consider ways to minimize the potential costs of preserving this role for nuclear weapons.

Although we can imagine situations in which nuclear counterforce provides benefits, it may be that there are no realistic scenarios in which employing nuclear weapons would be the best option. The NPR does not provide an assessment of how much nuclear attacks on a particular set of targets would degrade a potential adversary's capacity to use nuclear weapons. Such an assessment would identify the targets that would play an essential role in launching devastating nuclear or biological attacks against the United States or its allies; determine which of these targets could not be defeated with conventional weapons but could be defeated with nuclear weapons; examine the quality of U.S. intelligence about the nature and vulnerability of these targets; and evaluate how large an adversary's surviving deliverable nuclear and biological capability would be following a U.S. counterforce attack. A thorough analysis of these questions is required for understanding the implications of the NPR. Because answers to these questions are critically important, technical experts from outside the government, such as the JASONS (a group of elite academic scientists who have advised the U.S. government on national security for decades) or a panel convened by the National Research Council, should be involved in offering critiques and alternatives to classified U.S. Department of Defense studies.

Assuming that nuclear counterforce would make an important contribution to U.S. damage-limitation capabilities, further analysis is required to assess the costs and risks of a nuclear attack. The collateral damage from a nuclear attack should be estimated for each target, including blast and thermal effects, fallout, and the possible dispersal of chemical and biological agents. The scenarios in which a target might need to be attacked should be analyzed to provide guidance on when in a crisis the United States might consider launching a preemptive nuclear attack. All of this information would be essential to U.S. leaders faced with the momentous decision of whether and when to order a nuclear attack. U.S. leaders, including the president, should be briefed fully about this analysis to ensure that they appreciate the urgency, risks, and complexities before becoming involved in a crisis or war.[75]

To moderate the potentially negative proliferation impacts of including nuclear counterforce missions in its doctrine, the United States should bring other components of its nuclear policy into line with its nonproliferation regime obligations. Meeting these obligations should improve the United States' international reputation for holding up its side of the nonproliferation bargain and thereby enhance its ability to play a leadership role in sustaining the regime. The actual impact on other states' nonproliferation policies is uncertain, so these policy changes should be largely consistent with narrowly defined U.S. security interests. Fortunately, a number of key policies meet this requirement. The United States should significantly cut the size of its nuclear arsenal, moving well below the 2,200 deployed strategic warheads allowed by the Treaty of Moscow. The NPR states that Russia is no longer the focus of U.S. force planning, but gives no reason for keeping U.S. forces at such high levels. In fact, a force this size can be justified only with reference to Russia. It is hard to see how more than a few dozen U.S. strategic nuclear weapons would be needed to deter, respond to, or defeat the emerging threats identified by the NPR, which now include North Korea, Iran, and Syria. China also is identified as a country "that could be involved in an immediate or potential contingency," but it currently has only 20 warheads that can reach the United States, and the intelligence community believes that this will grow to no more than 100 warheads by 2015.[76] The number of operationally deployed warheads nec-

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75. On the difficulty of attracting high-level attention to U.S. war plans, see Janne Nolan, *Guardians of the Arsenal: The Politics of Nuclear Strategy* (New York: Basic Books, 1989).

76. National Intelligence Council, "Foreign Missile Developments and the Ballistic Missile Threat through 2015," unclassified summary of a National Intelligence Estimate, December 2001, http://www.cia.gov/nic/PDF_GIF_otherprod/missilethreat2001.pdf. The total size of China's nuclear

essary for contingencies that do not involve Russia therefore seems unlikely to total more than a few hundred. In addition, unlike the Treaty of Moscow, future agreements with Russia should include adequate verification measures and should extend well into the future. The United States should also make clear that it will not test new nuclear weapons and provide confidence in that commitment by ratifying the Comprehensive Test Ban Treaty. This restraint is not costly because even if the United States requires low-yield or earth-penetrating nuclear weapons for counterforce missions, these weapons can be adapted from the existing stockpile.

In short, the proliferation of nuclear weapons and certain types of biological weapons creates significant challenges for U.S. military and foreign policy for which there are no easy answers. Our analysis leaves open the possibility that nuclear counterforce might have a role to play. Further analysis of possible targets may show that nuclear options are unnecessary or would be ineffective. If this is not the case, the United States should include counterforce options in its nuclear doctrine, while giving priority to understanding the risks generated by nuclear threats and use. If the United States goes down this path, then its foreign policy must be tailored to reduce the probability of getting into conflicts that could escalate to nuclear attacks. An assertive foreign policy combined with a national security strategy that generates doubts about the extent of the United States' ambition fails to strike the delicate balance demanded by nuclear proliferation.

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force—nonstrategic as well as strategic weapons—is much larger and could therefore lead to requirements for a larger U.S. force. The Chinese force, however, may not be as large as is commonly believed. See Jeffrey Lewis, "The Ambiguous Arsenal," *Bulletin of the Atomic Scientists,* Vol. 61, No. 3 (May/June 2005), pp. 52–59.