

Critiquing the NPR's New Nuclear Missions

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This chapter explores the most controversial aspect of the NPR: the identification of possible new roles and missions for U.S. nuclear weapons.¹ The NPR lists three ways in which the United States might use nuclear weapons in future conflicts: 1) to destroy underground facilities that house weapons of mass destruction, leadership, and command and control assets; 2) to defeat chemical and biological agents; and 3) to attack mobile and relocatable targets. Although the United States long considered many or all of these missions vis-à-vis the Soviet Union (and now, presumably, Russia), the NPR states that “new capabilities must be developed to defeat emerging threats,” which presumably refers to North Korea, Iran, Syria, and Libya, which are mentioned in the document. 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 of 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.”²

To analyze these possible new roles and missions, this chapter explores the following questions:

- What new capabilities might nuclear weapons provide, in addition to those provided by conventional weapons?
- What are the costs and benefits of using, threatening to use, and planning to use nuclear weapons in these ways?

Our assessment raises serious doubts about the case for these new nuclear missions. Conventional weapons can be quite effective at destroying or disabling many of the types of targets that the NPR identifies for nuclear missions, and nuclear weapons are not highly effective against some of the targets that conventional weapons cannot defeat. Adversaries are unlikely to attack the United States with weapons on mass destruction, because they will to be deterred by existing U.S. retaliatory capabilities—both conventional and nuclear. Overall, we find at most a very limited role for nuclear weapons in the damage-limitation missions identified by the NPR. Further technical and strategic analysis is required to determine whether even these quite circumscribed roles are warranted and should be included in U.S. nuclear doctrine.

Nuclear vs. Conventional Weapons

Typical strategic nuclear weapons have yield-to-weight ratios a million times larger than conventional explosives; that is, a nuclear bomb weighing one ton can have an explosive yield equivalent to about one million tons of TNT. This high energy density produces much higher temperatures and 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 ground or on the surface, intense fallout, although fallout has not been relied upon by U.S. military planners as a method to disable targets.

Nuclear weapons are uniquely capable of destroying targets that cover a large area, such as cities, industrial complexes, and large military bases. These targets can be destroyed completely 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 is far more important than explosive yield. A mobile missile launcher or a shallow-buried bunker can easily be destroyed by existing conventional weapons if they are delivered precisely on target. But because blast and shock effects decrease rapidly with distance, very large increases in yield are needed to compensate for inaccuracy in weapon delivery or uncertainty about target location. For example, compared to a conventional weapon with an explosive yield of one ton of TNT, a one-kiloton nuclear weapon would have a radius of destruction only about five times larger against below-ground targets and ten times larger against above-ground targets.³ Thus, the ability of nuclear weapons to compensate for uncertainties in target location is limited unless one is prepared to use very high-yield weapons, which already exist in large numbers and which would have large collateral effects. These general observations are relevant to each of the three new missions proposed for nuclear weapons.

Defeating Hard and Deeply Buried Targets

According to the NPR, the U.S. Department of Defense has estimated that more than 10,000 underground facilities exist world wide. Some 1,400 of these facilities are known or suspected strategic sites intended to protect weapons of mass destruction (WMD), leadership, and command and control centers. The majority of these are difficult to defeat because they are hardened and deeply buried, and 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.... [T]his 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.”⁴

The NPR, however, greatly overstates the number of deeply buried underground facilities that must be held at risk by the United States. Only a handful of these underground facilities are 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 the U.S. territory, soldiers, or allies. Any scenario for using nuclear weapons would require knowing which few of these

facilities were strategically vital. Thus, good intelligence is far more important in defeating underground facilities than are the types of weapons available to attack them. But recent performance of the intelligence community in this regard is not encouraging. The United States carried out a massive bombing campaign against suspected WMD facilities during the first Gulf War, but inspections undertaken after the war showed that the majority of actual WMD sites had not been attacked. In the opening salvo of the second Gulf War, the United States dropped four one-ton bombs on a site U.S. intelligence believed was a command bunker containing Saddam Hussein. According to news reports, later inspections by U.S. Army revealed that no underground facility existed at the site.⁵ Intelligence of the highest accuracy and reliability would be required before using a nuclear weapon against such sites.

Most underground facilities also can be defeated with conventional weapons if good intelligence is available.⁶ Existing conventional earth penetrating bombs can collapse facilities located under less than ten meters of concrete or hard rock if the location of the bunker is known precisely. Moreover, underground facilities 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.

Most importantly, facilities that are not located precisely or are buried very deeply underground cannot be destroyed even by new, deep-penetrating nuclear warheads. The practical limit to warhead penetration is ten meters in hard rock,⁷ and facilities located in hard rock can be confidently destroyed only if they are within the zone of fractured rock formed by the explosion.⁸ Thus, facilities deeper than 50 or 250 meters could not be destroyed with high confidence by EPWs with yield less than one kiloton or one megaton, respectively. Even shallow facilities in hard rock could not be reliably destroyed if their location, which could be many hundreds of meters from tunnel entrances and other surface features, could not be determined (and the weapon delivered) with similar accuracy (i.e., within 50 to 250 meters).

Thus, nuclear weapons would be useful for defeating hard and deeply buried targets only under a fairly narrow range of circumstances. The facility would have to be strategically vital, in the sense that defeating the facility would significantly reduce the probability of enemy WMD attacks against the United States, its allies, or allied troops. U.S. intelligence would have to be confident about the nature of the facility and its location and depth. And the facility would have to be too deep to be vulnerable to conventional attack, but not too deep to be vulnerable to nuclear attack. Such facilities likely exist, but developing new nuclear weapons to destroy them probably would lead determined adversaries to simply dig deeper.

The utility of nuclear EPWs is further diminished by that fact that they would produce substantial fallout, which in most cases would cause serious collateral damage and significantly complicate other U.S. military operations in the area. Because EPWs cannot penetrate more than ten meters in hard rock, most of the radioactivity produced by the explosion would be released into the atmosphere. As noted by the NPR, the area receiving high radiation doses from fallout would be ten to twenty times smaller than would be produced by a surface burst with equal radius of destruction against underground targets. Nevertheless, the area contaminated by even low-yield EPWs would be substantial. Fallout from a one-kiloton EPW would deliver a lethal

dose over an area of five to ten square kilometers, which would kill thousands of civilians if used in or near a city.⁹ The high-yield EPWs that would be needed to destroy very deeply buried facilities would contaminate vast areas. One group estimated that a 300-kiloton EPW detonated near Pyongyang, North Korea, would cause 500,000 casualties—with the wind blowing *away* from the city.¹⁰ A 1-megaton EPW would produce a lethal area of more than 1000 square miles and would likely cause thousands of civilian deaths even if used in remote areas. Doses in excess of international standards would extend over areas hundreds of times larger than the lethal areas produced by an EPW.

Defeating Chemical and Biological Agents

The NPR mentions the possibility that nuclear weapons might be used to neutralize stocks of chemical and biological weapons (CBW). This point arises from a concern that conventional weapons may not be able to destroy these facilities and prevent the use of these agents, and that conventional attacks might expose civilians and U.S. soldiers in the area to these agents. Extensive analysis, however, has shown that the effectiveness of nuclear weapons for this mission also is limited.¹¹ To neutralize chemical or biological agents, the nuclear explosion must occur at very close range and within the bunker in which the agents are stored. For example, an EPW with a yield of one to ten kilotons could sterilize all or nearly all biological agents stored within a radius of only five to ten meters of the detonation. Thus, nuclear weapons could only be effective in neutralizing CBW if stocks are in surface or shallow-buried facilities, and if the facilities—and the CBW stocks within the facility—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.¹²

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, including the risks of fallout, are likely to be smaller than with nuclear attacks. Even a worst-case release of CW from a conventional attack on a storage facility would kill fewer civilians than would a low-yield nuclear EPW.¹³ Moreover, new non-nuclear weapons are being developed which could disable or destroy CBW storage and production facilities with much lower risk of dispersal. If occupation 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 can 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.” These targets might include road-, rail-, or ship-mobile missile launchers, command posts, and mobile CBW production facilities. If such targets can be located precisely, they easily can be destroyed 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).

Large increases in explosive yield, however, would be required to compensate for relatively small increases in distance due either to inaccuracies in target location or weapon delivery. A one-kiloton weapon can severely damage vehicles, rail cars, or ships at distances of up to about two hundred meters; a one-megaton weapon can do so at distances up to about two kilometers.¹⁴ These ranges are small compared with 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 ten kilometers per hour. Thirty minutes after locating the target (the flight time of an ICBM), the target could be anywhere along a line ten kilometers in length, requiring 25 one-kiloton or 3 one-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 twenty-five kilometers per hour, it could be anywhere within an area of 500 square kilometers after thirty minutes; a single one-megaton bomb would have less than a three percent chance of destroying it.

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 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. Thus, nuclear weapons might be useful 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 the 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 ten kilometers from the nearest village).

Benefits of New Nuclear Roles

The benefits of being able to destroy an adversary's ability to attack with weapons of mass destruction are potentially very large. In the worst scenario, the United States might prevent an adversary from attacking American cities with nuclear or biological weapons. Other horrible outcomes that might be prevented include nuclear or biological attacks against allies or against American troops. It is the possibility of truly catastrophic damage that most clearly motivates interest in using nuclear weapons for damage limitation and requires a judicious evaluation of the option. In addition, the ability to destroy an adversary's WMD could enhance the U.S. ability to deter aggression and to terminate a war on favorable terms. A country that has a survivable WMD capability might be able to deter the United States from intervening in a regional conflict by threatening to escalate to WMD attacks against U.S. interests. The ability to destroy the adversary's WMD would undermine this threat and thereby help deter an aggressor from initiating or escalating the conflict.

The United States should have a strong preference for being able to perform these missions with conventional weapons—because it has a variety of reasons for not using nuclear weapons and because an adversary might therefore question the credibility of nuclear threats, which would reduce their counter-deterrent value. If, however, conventional weapons are incapable of destroying the adversary's ability to attack with WMD, then there may be valuable roles for nuclear weapons. Of course, this will only be the case if there are scenarios in which using

nuclear weapons would significantly increase U.S. prospects for destroying an adversary's capability, which might be true only under a very limited set of conditions. Still, assuming that such cases exist, we need to explore more thoroughly the benefits of using and threatening to use nuclear weapons.

First, the benefits of developing new nuclear capabilities to enhance deterrent threats are limited because the United States can probably deter the adversary's use of WMD. We greatly exaggerate the value of new U.S. nuclear forces, doctrine, or use if we assume that the adversary actually would use WMD against U.S. interests. The U.S. ability to inflict massive nuclear retaliatory damage is likely to deter all states under all but the most extreme conditions.¹⁵ Moreover, the U.S. deterrent is not limited to nuclear threats. The United States also could rely on its conventional superiority to threaten to retaliate against states or overthrow regimes that use WMD. Intimidating conventional threats would enable the United States to avoid relying on threats of first use of nuclear weapons, while adding to U.S. credibility. Furthermore, the one scenario in which an adversary might be likely to use WMD against the United States is largely under U.S. control. If the United States makes clear that it intends to conquer a state, then the leader of that state may decide he has little to lose by using WMD, either in a last-ditch effort to deter the United States or simply to exact revenge. Fortunately, the United States can essentially eliminate this rationale for enemy attacks with WMD by choosing not to invade and overthrow the regime.¹⁶ The possibility that a U.S. invasion would lead an adversary to escalate to nuclear attacks, together with the military, political and humanitarian costs to the United States of using nuclear weapons to preemptively destroy the adversary's WMD, would likely be critical considerations in deciding against invasion.

The U.S. ability to deter WMD attacks is less clear-cut if the adversary has a survivable WMD capability, especially a nuclear capability, which it could use to deter U.S. retaliation.¹⁷ In this case, the adversary would be more willing to attack, believing that U.S. retaliation might be deterred by the prospect of additional attacks. Therefore, if nuclear weapons are required to make the adversary's WMD capability vulnerable, then they would increase the U.S. ability to deter WMD attacks, as well as enabling it to reduce the damage if escalation to WMD becomes likely.

Second, the benefits of using nuclear weapons to destroy WMD depend on the type of WMD involved. Although frequently lumped together within this category, nuclear, chemical, and biological weapons inflict drastically different types and degrees of damage.¹⁸ 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. Passive defenses would be largely ineffective short of complete evacuation. By contrast, the potentially lethal area created by even a large-scale attack with chemical weapons 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 (e.g., shelters, masks, atropine injections, evacuation of contaminated areas, etc.). 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 like anthrax could kill as many people as a primitive nuclear weapon; attacks with contagious agents like 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 weapons.

Costs of new nuclear roles

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;¹⁹ and it makes adversaries more willing to use nuclear weapons.²⁰ These ideas are more fully examined in Chapter 12 of this book. To explore these criticisms here, we must flesh out the arguments and scrutinize the logic that underpins them.

Acquisition of Nuclear Weapons

How might U.S. adoption of new nuclear missions influence decisions by other countries to acquire nuclear weapons?²¹ One line of argument focuses on an adversary's security requirements: The shift in U.S. nuclear policy leads the adversary to believe that nuclear weapons are now necessary to protect its security. A state that has chemical or biological weapons might conclude that it now needs nuclear weapons to deter American attacks against its WMD; a state that already has nuclear weapons might conclude that it needs more weapons—and more survivable weapons—to deter American nuclear attacks.

While the logic of these arguments is sound, the magnitude of the effect is unlikely to be very large. 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.

There also are considerations that cut in the opposite direction. U.S. threats to use nuclear weapons against nuclear targets could decrease incentives to acquire nuclear weapons by making explicit that possessing nuclear weapons puts states 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 the adversary's nuclear capability, then these threats could reduce the value of acquiring nuclear weapons in the first place, by reducing the expectation that they would be available for deterrence.²² These considerations by themselves are unlikely to convince a state to forego nuclear weapons, but they push in that direction.

Another line of argument suggests that states will become more likely to acquire nuclear weapons if the U.S. advertises the military utility of nuclear weapons against certain new types of targets. But the key reason for acquiring nuclear weapons, especially for a state that suffers conventional inferiority, is for deterrence, which depends primarily on their countervalue potential, not their utility against these sorts of targets. Moreover, a conventionally inferior adversary might want nuclear weapons because they could be effective against concentrations of conventional military capabilities, including ports and airbases, and could therefore help to undermine American conventional superiority. 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 WMD capabilities.

There is, however, a second layer of argument that deserves consideration. By emphasizing the possible uses of nuclear weapons, the NPR weakens the taboo against using nuclear weapons. 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 non-proliferation regime are all linked, and to achieve its non-proliferation goals, the United States should downplay all uses of nuclear weapons instead of highlighting new missions.

Evaluating this argument requires understanding the sources of the nuclear taboo.²³ 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. It is hard to see how the relationship could be a strong one. The nuclear 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 conventional attack and to bring about the termination of a conventional war 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 America's 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 the majority of U.S. force modernization during the 1970s and 1980s.²⁴

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 policy of no-first-use have identified strengthening the norm against using nuclear weapons as a key rationale for changing U.S. nuclear doctrine.²⁵ 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, the difficulty of establishing hard lines between different types of nuclear use, and the weight of decades of non-use. These factors are so powerful that doctrinal shifts alone are unlikely to strengthen or weaken the taboo significantly.²⁶

Instead, the NPR is more likely to have a negative effect on nonproliferation by increasing the probability of nuclear use by the United States, which could in turn encourage other states to acquire nuclear weapons. As discussed below, new roles and missions (and corresponding new weapons and targeting plans) increase the likelihood of nuclear use by the United States, which could shatter the nuclear taboo. With this barrier to U.S. nuclear use reduced, other states would be more likely to acquire nuclear weapons for deterring American nuclear attacks. In addition, states that were restrained by the nuclear taboo might then see nuclear weapons as more usable and, therefore, more valuable for coercion.

In addition, the NPR and related weapons development—particularly weapon testing—could hurt U.S. multilateral nonproliferation efforts. By continuing to emphasize the military value of nuclear weapons, the United States may inadvertently strengthen the hand of pro-nuclear elites in

debates within non-nuclear states, while undermining those opposed to acquiring nuclear weapons.²⁷ It could also undermine the ability of the United States to form and maintain strong international coalitions opposing proliferation (e.g., vis-à-vis North Korea and Iran), or to get broad international agreement to strengthen barriers to proliferation (e.g., export controls and enhanced safeguards and physical protection measures). Although these effects are undoubtedly negative, their magnitude is hard to judge.

Use of Nuclear Weapons by Adversaries

Another concern is that adopting new roles and missions for U.S. nuclear forces might make adversaries more willing to use nuclear weapons. The basic argument is as follows: the NPR increases the probability that the United States will use nuclear weapons by promoting new roles and missions for them; if the United States uses nuclear weapons the taboo would be shattered,²⁸ and as a result other states would become more willing to use nuclear weapons, either against 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 would be more likely to use nuclear weapons against the United States, U.S. military forces, or America's allies in the region, or India might be more willing to use nuclear weapons preemptively to destroy Pakistani nuclear weapons.

The first step in this argument is correct: The NPR increases the probability that the United States would use nuclear weapons—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 Bush administration believes this is warranted in light of the dangers the United States faces. Moreover, the NPR argues that this change in nuclear doctrine will discourage proliferation and will therefore ultimately decrease the number of situations in which nuclear weapons might be used 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 as a result of policies promulgated by the NPR.

The second step—American nuclear use would shatter the nuclear taboo—is also basically correct, although the long-term effects are less clear. Nuclear use would end a very long period of non-use, which is now approaching sixty years. Analyses of the nuclear taboo emphasize that its strength increases as the period of non-use increases; use of nuclear weapons would weaken this dimension of the taboo. In addition, if American 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 nuclear weapons.

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 the United States, the rationale for American 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 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.²⁹

On the other hand, if American use of nuclear weapons resulted in tremendous destruction, or if it resulted in catastrophic retaliation, governments and publics might come to better appreciate the danger posed by nuclear weapons, with their destructive potential made more vivid and horrifying, which in turn might strengthen the taboo against using nuclear weapons. It is not unimaginable that this would lead to serious efforts to prohibit nuclear weapons, just as the use of chemical weapons ultimately led to prohibitions on their use and, ultimately, their possession.

The third step in the argument—that other states will become more willing 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 nuclear 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 American 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 nuclear weapons in an earlier conflict. On the other hand, an adversary that the United States cannot deter is not likely to be influenced very much 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 quite small, but possibly non-zero, set of adversaries and scenarios.

Conclusions and Recommendations

Overall, we find at most a very limited role for nuclear weapons in the damage-limitation missions identified by the NPR. Adversaries are unlikely to attack the United States or its vital interests with WMD, because the United States possesses highly capable deterrent forces and the will to use them if attacked with WMD. Moreover, if deterrence fails, U.S. conventional forces can be quite effective at destroying or disabling the new types of targets the NPR identifies for nuclear weapons, with much smaller collateral effects. Consequently, there is at best a very limited role for nuclear weapons in these missions.

Nevertheless, no matter how well the United States designs its deterrent policy, there remains some possibility that deterrence could fail and conventional weapons would be ineffective against strategically critical targets. Given the enormous destruction that an adversary could inflict with nuclear and certain types of biological weapons, we can imagine scenarios in which the United States would benefit from using nuclear weapons in a damage-limitation attack. Using nuclear weapons would generate a variety of costs—including possibly increasing the probability that other states would use nuclear weapons, hurting U.S. nonproliferation policy, and damaging the United States international reputation (as well as its self-image). But we cannot 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 poorer prospects of defeating targets essential to these enemy attacks.

Although such scenarios are not impossible to imagine, it may be that there are no realistic scenarios in which employing nuclear weapons would be the United States' best option. The NPR does not provide an assessment of whether the types of targets with which it is concerned can be destroyed or disabled with conventional weapons. The first step in assessing the value of nuclear options is to determine whether there exist targets that cannot be destroyed with conventional weapons, but that could be destroyed with nuclear weapons. If such targets exist, the next step is to determine whether any of these targets are in countries that possess nuclear or sophisticated biological weapons and whether the targets would play an essential role in an adversary's ability to launch a devastating attack. Thorough analysis of these questions is required for understanding the implications of the NPR. Because answers to these questions are critically important, we believe technical experts from outside the government, such as the Jason scientists—a group of elite academic scientists who have advised the U.S. government on national security for decades—or a committee of the National Academy of Sciences, should be consulted to offer critiques and alternatives to classified Department of Defense studies.

Once this assessment of targets is complete, and assuming that there exist high-value targets that can be defeated with nuclear but not with conventional weapons, 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. U.S. confidence in its characterization of each target should be evaluated, because U.S. decision-makers must consider the true urgency of launching a nuclear attack. The scenario in which a target might need to be attacked should be analyzed to provide guidance on when in a crisis the United States would need to launch a nuclear attack. All of this information would be essential to U.S. leaders faced with the momentous decision about whether and when to order a nuclear attack. U.S. leaders, including the president, should be briefed fully about the effects to ensure that they appreciate the urgency, risks, and complexities before involved in a crisis or war.

In sum, the NPR raises more questions than it answers, and it overstates the extent of new roles for U.S. nuclear weapons. We anticipate that more thorough study of possible targets—and the risks and costs of nuclear attacks on these targets—will lead to a more measured nuclear doctrine in which there are, at most, a few scenarios in which the United States might use nuclear weapons preemptively. There may not be any.

¹ *Nuclear Posture Review* [excerpts], 8 January 2002, <http://www.globalsecurity.org/wmd/library/policy/dod/npr.htm>. References in this chapter to the NPR refer to this text, which we assume to be authentic.

² *Nuclear Posture Review*, p. 34-35.

³ The range for a given level of air-blast damage (peak overpressure) is proportional to the one-third power of yield; thus, a one-ton explosion produces about the same peak overpressure (about 100 psi) at a distance of ten meters as a one-kiloton explosion produces at a distance of one hundred meters (for a fixed scaled height of burst). The radius of destruction for very hard buried targets is given roughly by the apparent crater radius, which roughly proportional to the 0.22 power of yield for explosions in hard rock at constant depth of burial; the crater radius for a one-kiloton explosion is 4.6 times larger than that produced by a one-ton explosion at the same depth. See Samuel Glasstone and Phillip J. Dolan, *Effects of Nuclear Weapons*, 3rd ed. (Washington, DC: U.S. Department of Defense and Department of Energy, 1977).

⁴ *Nuclear Posture Review*, p. 47.

⁵ "U.S. Can't Find Hussein Bunker," *Washington Post*, 30 May 2003 A19.

⁶ For a more detailed analysis, see Michael A. Levi, "Fire in the Hole: Nuclear and Non-Nuclear Options for Counterproliferation," working paper, (Washington, DC: Carnegie Endowment for International Peace, November 2002), <http://www.ceip.org/files/pdf/wp31.pdf>.

⁷ Robert W. Nelson, "Low-Yield Earth-Penetrating Nuclear Weapons," *Science and Global Security* 10, No. 1 (2002): 5-10; Michael May and Zachary Haldeman, "Effectiveness of Nuclear Weapons against Buried Biological Agents," report, (Stanford, CA: Center for International Security and Cooperation, Stanford University, June 2003), 5-6, 25-26 (an updated version is available at <http://iis-db.stanford.edu/pubs/20216/MayHaldeman0104.pdf>); 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, DC: Natural Resources Defense Council, May 2003), 9-11, <http://iis-db.stanford.edu/pubs/20216/MayHaldeman0104.pdf>.

⁸ May and Haldeman, "Effectiveness of Nuclear Weapons," 17-18; Glasstone and Dolan, *Effects of Nuclear Weapons*, 265.

⁹ Nelson, "Low-Yield EPWs"; Paine, et al., "Countering Proliferation"; and Frank Serduke, "Standard KDFOC4 Fallout Calculations for Buried Nuclear Detonations," UCRL-ID-146937 (Livermore, CA: Lawrence Livermore National Laboratory, September 2001).

¹⁰ Paine, et al., "Countering Proliferation," 7.

¹¹ 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 and Global Security* (forthcoming).

¹² May and Haldeman, "Effectiveness of Nuclear Weapons," 21.

¹³ Author's calculations, comparing a 10-ton release of sarin (5% of a 200-ton inventory) with the effects of a 1-kiloton nuclear explosion at a depth of 10 meters.

¹⁴ Glasstone and Dolan, *Effects of Nuclear Weapons*, 221-224.

¹⁵ On uncertainty about the effects of nuclear threats in the 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*, 24, No. 4 (Spring 2000): 91-96.

¹⁶ 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* 6, No. 3 (Spring 1997): 1-31.

¹⁷ For a more detailed analysis of this issue see Charles L. Glaser and Steve Fetter, "National Missile Defense and the Future of U.S. Nuclear Weapons Policy," *International Security* 26, no. 1 (Summer 2001): 66-68.

¹⁸ Steve Fetter, "Ballistic Missiles and Weapons of Mass Destruction: What Is the Threat? What Should Be Done?" *International Security* 16, no. 1 (1991): 5-42.

¹⁹ Michael May, "An Alternative Nuclear Posture," *Physics and Society* (October 2003), <http://epswww.epfl.ch/aps/units/fps/newsletters/2003/oct/oct03.pdf>; available alternately at <http://www.aps.org/units/fps/newsletters/2003/october/articles.cfm#2>;

Henry Kelly and Ivan Oelrich, "Will New Nuclear Weapons Make Us More Secure?," www.fas.org/ssp/docs/030916-newnukes.

²⁰ May, "An Alternative Nuclear Posture." [FOR THIS NOTE AND N. 23, WE CAN ALSO CITE TO THE KNOP CHAPTER WITHIN THIS VOLUME.]

²¹ 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* 21, No. 3 (Winter 1996/97): 54-86; T.V. Paul, *Power Versus Prudence: Why Nations Forgo Nuclear Weapons* (Montreal: McGill-Queen's University Press, 2000).

²² The NPR argues more generally: "Systems capable of striking a wide range of targets throughout an adversary's territory may dissuade a potential adversary from pursuing threatening capabilities."

²³ see Nina Tannenwald, "The Nuclear Taboo: The United States and the Normative Basis for Nuclear Non-Use," *International Organization* 53, No. 3 (Summer 1999): 433-468; Elizabeth Kier and Jonathan Mercer, "Setting Precedents in Anarchy: Military Intervention and Weapons of Mass Destruction," *International Security* 20, No. 4 (Spring 1996): 77-106.

²⁴ On U.S. nuclear doctrine see Lawrence Freedman, *The Evolution of Nuclear Strategy* (New York: St. Martin's Press, 1983); on the relationship between extended deterrence and U.S. counterforce requirements see Charles L. Glaser, *Analyzing Strategic Nuclear Policy* (Princeton: Princeton University Press, 1990), chap. 7.

²⁵ 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 no-first-use to support U.S. non-proliferation goals (p. 71), and argues that the practice of nuclear deterrence can fuel proliferation by, among other reasons, "lending respectability to reliance on nuclear deterrence."

²⁶ 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: Westview Press, 1994), 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."

²⁷ Sagan, "Why Do States Build Nuclear Weapons," 72-73, makes this point in a related context.

²⁸ 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 has already been discussed above and does not appear very strong, although there is the possibility of missing the opportunity to further strengthening the taboo.

²⁹ Schelling, "The Role of Nuclear Weapons," comments on many of these considerations.