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Keir A. Lieber and Daryl G. Press

THE SUCCESS of nuclear deterrence may turn out to be its own undoing. Nuclear weapons helped keep the peace in Europe throughout the Cold War, preventing the bitter dispute from engulfing the continent in another catastrophic conflict. But after nearly 65 years without a major war or a nuclear attack, many prominent statesmen, scholars, and analysts have begun to take deterrence for granted. They are now calling for a major drawdown of the U.S. nuclear arsenal and a new commitment to pursue a world without these weapons.

Unfortunately, deterrence in the twenty-first century may be far more difficult for the United States than it was in the past, and having the right mix of nuclear capabilities to deal with the new challenges will be crucial. The United States leads a global network of alliances; a position that commits Washington to protecting countries all over the world. Many of its potential adversaries have acquired, or appear to be seeking, nuclear weapons. Unless the world's major disputes are resolved—for example, on the Korean Peninsula, across the Taiwan Strait, and around the Persian Gulf—or the U.S. military pulls back from these regions, the United States will sooner or later find itself embroiled in conventional wars with nuclear-armed adversaries.

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Preventing escalation in those circumstances will be far more difficult than peacetime deterrence during the Cold War. In a conventional war, U.S. adversaries would have powerful incentives to brandish or use nuclear weapons because their lives, their families, and the survival of their regimes would be at stake. Therefore, as the United States considers the future of its nuclear arsenal, it should judge its force not against the relatively easy mission of peacetime deterrence but against the demanding mission of deterring escalation during a conventional conflict, when U.S. enemies are fighting for their lives.

Debating the future of the U.S. nuclear arsenal is critical now because the Obama administration has pledged to pursue steep cuts in the force and has launched a major review of U.S. nuclear policy. (The results will be reported to Congress in February 2010.) The administration's desire to shrink the U.S. arsenal is understandable. Although the force is only one-fourth the size it was when the Cold War ended, it still includes roughly 2,200 operational strategic warheads—more than enough to retaliate against any conceivable nuclear attack. Furthermore, as we previously argued in these pages ("The Rise of U.S. Nuclear Primacy," March/April 2006), the current U.S. arsenal is vastly more capable than its Cold War predecessor, particularly in the area of "counterforce"—the ability to destroy an adversary's nuclear weapons before they can be used.

Simply counting U.S. warheads or measuring Washington's counterforce capabilities will not, however, reveal what type of arsenal is needed for deterrence in the twenty-first century. The only way to determine that is to work through the grim logic of deterrence: to consider what actions will need to be deterred, what threats will need to be issued, and what capabilities will be needed to back up those threats.

The Obama administration is right that the United States can safely cut its nuclear arsenal, but it must pay careful attention to the capabilities it retains. During a war, if a desperate adversary were to use its nuclear force to try to coerce the United States—for example, by threatening a U.S. ally or even by launching nuclear strikes against U.S. overseas bases—an arsenal comprised solely of high-yield weapons would leave U.S. leaders with terrible retaliatory options. Destroying Pyongyang or Tehran in response to a limited strike would be vastly

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disproportionate, and doing so might trigger further nuclear attacks in return. A deterrent posture based on such a dubious threat would lack credibility.

Instead, a credible deterrent should give U.S. leaders a range of retaliatory options, including the ability to respond to nuclear attacks with either conventional or nuclear strikes, to retaliate with strikes against an enemy's nuclear forces rather than its cities, and to minimize casualties. The foundation for this flexible deterrent exists. The current U.S. arsenal includes a mix of accurate high- and low-yield warheads, offering a wide range of retaliatory options—including the ability to launch precise, very low-casualty nuclear counterforce strikes. The United States must preserve that mix of capabilities—especially the low-yield weapons—as it cuts the size of its nuclear force.

DETERRENCE IN DARK TIMES

THE PRIMARY purpose of U.S. nuclear forces is to deter nuclear attacks on the United States and its allies. During peacetime, this is not a demanding mission. The chance that leaders in Beijing, Moscow, or even Pyongyang will launch a surprise nuclear attack tomorrow is vanishingly small. But peacetime deterrence is not the proper yardstick for measuring the adequacy of U.S. nuclear forces. Rather, the United States' arsenal should be designed to provide robust deterrence in the most difficult of plausible circumstances: during a conventional war against a nuclear-armed adversary.

In the coming decades, the United States may find itself facing nuclear-armed states on the battlefield. U.S. alliances span the globe, and the United States is frequently drawn into regional conflicts. Washington has launched six major military operations since the fall of the Berlin Wall: in Panama, Somalia, Kosovo, Afghanistan, and twice in Iraq. Furthermore, most of the United States' potential adversaries have developed—or seem to be developing—nuclear weapons. Aside from terrorism, the threats that dominate U.S. military planning come from China, North Korea, and Iran: two members of the nuclear club, and one intent on joining it.

The central problem for U.S. deterrence in the future is that even rational adversaries will have powerful incentives to introduce nuclear

weapons—that is, threaten to use them, put them on alert, test them, or even use them—during a conventional war against the United States. If U.S. military forces begin to prevail on the battlefield, U.S. adversaries may use nuclear threats to compel a cease-fire or deny the United States access to allied military bases. Such threats might succeed in pressuring the United States to settle the conflict short of a decisive victory.

Such escalatory strategies are rational. Losing a conventional war to the United States would be a disastrous outcome for any leader, and it would be worth taking great risks to force a cease-fire and avert

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total defeat. The fate of recent U.S. adversaries is revealing. The ex-dictator of Panama, Manuel Noriega, remains in a Miami prison. The former Bosnian Serb leader, Radovan Karadzic, awaits trial in The Hague, where Yugoslav President Slobodan Milosevic died in detention three years ago. Saddam Hussein's punishment for losing the 2003 war was total: his government was toppled, his sons were killed, and he was hanged on a dimly lit

gallows, surrounded by enemies. Even those leaders who have eluded the United States—such as the Somali warlord Muhammad Farah Aidid and Osama bin Laden—have done so despite intense U.S. efforts to capture or kill them. The United States' overseas conflicts are limited wars only from the U.S. perspective; to adversaries, they are existential. It should not be surprising if they use every weapon at their disposal to stave off total defeat.

Coercive nuclear escalation may sound like a far-fetched strategy, but it was NATO's policy during much of the Cold War. The Western allies felt that they were hopelessly outgunned in Europe at the conventional level by the Warsaw Pact. Even though NATO harbored little hope of prevailing in a nuclear war, it planned to initiate a series of escalating nuclear operations at the outbreak of war—alerts, tactical nuclear strikes, and wider nuclear attacks—to force the Soviets to accept a cease-fire. The United States' future adversaries face the same basic problem today: vast conventional military inferiority. They may adopt the same solution. Leaders in Beijing may choose gradual,

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coercive escalation if they face imminent military defeat in the Taiwan Strait—a loss that could weaken the Chinese Communist Party's grip on power. And if U.S. military forces were advancing toward Pyongyang, there is no reason to expect that North Korean leaders would keep their nuclear weapons on the sidelines.

Layered on top of these challenges are two additional ones. First, U.S. conventional military doctrine is inherently escalatory. The new American way of war involves launching simultaneous air and ground attacks throughout the theater to blind, confuse, and overwhelm the enemy. Even if the United States decided to leave the adversary's leaders in power (stopping short of regime change so as to prevent the confrontation from escalating), how would Washington credibly convey the assurance that it was not seeking regime change once its adversary was blinded by attacks on its radar and communication systems and command bunkers? A central strategic puzzle of modern war is that the tactics best suited to dominating the conventional battlefield are the same ones most likely to trigger nuclear escalation.

Furthermore, managing complex military operations to prevent escalation is always difficult. In 1991, in the lead-up to the Persian Gulf War, U.S. Secretary of State James Baker assured Iraq's foreign minister, Tariq Aziz, that the United States would leave Saddam's regime in power as long as Iraq did not use its chemical or biological weapons. But despite Baker's assurance, the U.S. military unleashed a major bombing campaign targeting Iraq's leaders, which on at least one occasion nearly killed Saddam. The political intent to control escalation was not reflected in the military operations, which nearly achieved a regime change.

In future confrontations with nuclear-armed adversaries, the United States will undoubtedly want to prevent nuclear escalation. But the leaders of U.S. adversaries will face life-and-death incentives to use their nuclear arsenals to force a cease-fire and remain in power.

THE CASE FOR COUNTERFORCE

IF THE United States hopes to deter nuclear attacks during conventional wars, it must figure out how it might respond to such attacks, and it must retain the nuclear forces to do so. The most horrific

retaliatory threat that the United States might issue—to destroy cities if enemy leaders brandish or use nuclear weapons—is a poor foundation for deterrence. First, this threat lacks credibility. Destroying cities would be a vastly disproportionate response if an enemy used nuclear weapons against a purely military target, such as a U.S. carrier group at sea or even a U.S. base located away from a major city (such as the U.S. airfields on Guam or Okinawa). During recent wars, the United States has labored to minimize enemy civilian casualties. It is hard to believe that Washington would reverse course and intentionally slaughter hundreds of thousands of civilians, especially if no U.S. or allied city has been destroyed.

Moreover, a retaliatory strike on an enemy city would not even achieve critical military objectives, so the horrendous consequences

would be inflicted for little purpose. If an enemy used nuclear weapons, the most pressing U.S. objective would be to prevent further nuclear attacks. Destroying one of the enemy's cities—even its capital—would neither eliminate its nuclear forces nor even necessarily kill its leaders. Nor could the United States respond to an enemy's limited nuclear strike simply by marching to its capital city to capture and hang its leaders;

If not backed by the capability and the credibility to execute threats, deterrence is a dangerous bluff.

that would leave time for more strikes on allies' cities. In such a crisis, the United States would need to stop the enemy's nuclear attacks immediately.

Of course, no one knows how a U.S. president would respond in such dark circumstances. It is possible that the United States would retaliate by attacking enemy cities—fear or anger might prevail over reason. But that mere possibility is a perilous foundation for deterrence. A credible deterrent must give U.S. leaders acceptable options in the event an enemy were to use nuclear weapons. An arsenal that can only destroy cities fails that test.

The least bad option in the face of explicit nuclear threats or after a limited nuclear strike may be a counterforce attack to prevent further nuclear use. A counterforce strike could be conducted with either conventional or nuclear weapons, or a mix of the two. The

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Attack could be limited to the enemy's nuclear delivery systems—for example, its bombers and missile silos—or a wider range of sites related to its nuclear program. Ideally, a U.S. counterforce strike would completely destroy the enemy's nuclear forces. But if an adversary had already launched a nuclear attack against the United States or its allies, a response that greatly reduced the adversary's nuclear force could save countless lives, and it could open the door to decisive military actions (such as conquest and regime change) to punish the enemy's leadership for using nuclear weapons.

During the last decades of the Cold War, the nuclear arsenals of the United States and the Soviet Union were too big to be completely destroyed in a disarming strike, and, in any case, their nuclear delivery systems were not accurate enough to destroy large numbers of hardened targets. But the world has changed. Washington's potential adversaries field much smaller arsenals. Meanwhile, U.S. delivery systems have grown vastly more accurate.

MODELING THE UNTHINKABLE

TO ILLUSTRATE the growth in U.S. counterforce capabilities, we applied a set of simple formulas that analysts have used for decades to estimate the effectiveness of counterforce attacks. We modeled a U.S. strike on a small target set: 20 intercontinental ballistic missiles (ICBMs) in hardened silos, the approximate size of China's current long-range, silo-based missile force. The analysis compared the capabilities of a 1985 Minuteman ICBM to those of a modern Trident II submarine-launched ballistic missile.¹

In 1985, a single U.S. ICBM warhead had less than a 60 percent chance of destroying a typical silo. Even if four or five additional warheads were used, the cumulative odds of destroying the silo would never exceed 90 percent because of the problem of "fratricide," whereby incoming warheads destroy each other. Beyond five warheads, adding more does no good. A probability of 90 percent might sound high, but it falls far short if the goal is to completely disarm an enemy: with

¹The technical details of the analysis presented in this essay are available online at www.dartmouth.edu/~dpress.

a 90 percent chance of destroying each target, the odds of destroying all 20 are roughly 12 percent. In 1985, then, a U.S. ICBM attack had little chance of destroying even a small enemy nuclear arsenal.

Today, a multiple-warhead attack on a single silo using a Trident II missile would have a roughly 99 percent chance of destroying it, and the probability that a barrage would destroy all 20 targets is well above 95 percent. Given the accuracy of the U.S. military's current delivery systems, the only question is target identification: silos that can be found can be destroyed. During the Cold War, the United States worked hard to pinpoint Soviet nuclear forces, with great success. Locating potential adversaries' small nuclear arsenals is undoubtedly a top priority for U.S. intelligence today.

The revolution in accuracy is producing an even more momentous change: it is becoming possible for the United States to conduct low-

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yield nuclear counterforce strikes that inflict relatively few casualties. A U.S. Department of Defense computer model, called the Hazard Prediction and Assessment Capability (HPAC), estimates the dispersion of deadly radioactive fallout in a given region after a nuclear detonation. The software uses the warhead's explosive power, the height of the burst, and data about local weather

and demographics to estimate how much fallout would be generated, where it would blow, and how many people it would injure or kill.

HPAC results can be chilling. In 2006, a team of nuclear weapons analysts from the Federation of American Scientists (FAS) and the Natural Resources Defense Council (NRDC) used HPAC to estimate the consequences of a U.S. nuclear attack using high-yield warheads against China's ICBM field. Even though China's silos are located in the countryside, the model predicted that the fallout would blow over a large area, killing 3-4 million people. U.S. counterforce capabilities were useless, the study implied, because even a limited strike would kill an unconscionable number of civilians.

But the United States can already conduct nuclear counterforce strikes at a tiny fraction of the human devastation that the FAS/NRDC study predicted, and small additional improvements to the U.S. force

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could dramatically reduce the potential collateral damage even further. The United States' nuclear weapons are now so accurate that it can conduct successful counterforce attacks using the smallest-yield warheads in the arsenal, rather than the huge warheads that the FAS/NRDC simulation modeled. And to further reduce the fallout, the weapons can be set to detonate as airbursts, which would allow most of the radiation to dissipate in the upper atmosphere. We ran multiple HPAC scenarios against the identical target set used in the FAS/NRDC study but modeled low-yield airbursts rather than high-yield groundbursts. The fatality estimates plunged from 3-4 million to less than 700—a figure comparable to the number of civilians reportedly killed since 2006 in Pakistan by U.S. drone strikes.

One should be skeptical about the results of any model that depends on unpredictable factors, such as wind speed and direction. But in the scenarios we modeled, the area of lethal fallout was so small that very few civilians would have become ill or died, regardless of which way the wind blew.

Critics may cringe at this analysis. Many of them, understandably, say that nuclear weapons are—and should remain—unusable. But if the United States is to retain these weapons for the purpose of deterring nuclear attacks, it needs a force that gives U.S. leaders retaliatory options they might actually employ. If the only retaliatory option entails killing millions of civilians, then the U.S. deterrent will lack credibility. Giving U.S. leaders alternatives that do not target civilians is both wise and just.

A counterforce attack—whether using conventional munitions or low- or high-yield nuclear weapons—would be fraught with peril. Even a small possibility of a single enemy warhead's surviving such a strike would undoubtedly give any U.S. leader great pause. But in the midst of a conventional war, if an enemy were using nuclear threats or limited nuclear attacks to try to coerce the United States or its allies, these would be the capabilities that would give a U.S. president real options.

GOOD THINGS IN SMALL PACKAGES

As the United States restructures its nuclear arsenal and overall strategic posture, it should ensure that it has three distinct capabilities. First, it still needs some high-yield nuclear weapons (such as those

deployed on land-based missiles and in submarines), although fewer than it currently possesses. If the U.S. military had to destroy an enemy's nuclear force in circumstances so dire that collateral damage was not a major concern, these weapons would provide the best odds of success. They maximize the odds of getting the target, albeit at the cost of enormous collateral damage.

The United States also needs conventional counterforce weapons. The U.S. military already fields precision nonnuclear weapons that can destroy nuclear targets, and the Pentagon has wisely made conventional capabilities a key element of its "global strike" mission, which seeks

Without working through the macabre realities of deterrence, the United States risks creating a nuclear force that gives a president acceptable choices.

the capacity to hit any target anywhere in the world in less than an hour. Conventional weapons permit the United States to conduct a counterforce strike without crossing the nuclear threshold, and without killing millions.

To illustrate the promise of conventional counterforce, we modeled an attack on 20 land-based silos using B-2 bombers and bombs guided by GPS. If GPS signals were not jammed, an attack would destroy most of the silos and have about a 50-50 chance of destroying them all. The problem with con-

ventional counterforce weapons is that, lacking the destructive power of nuclear weapons, they depend on pinpoint accuracy. If an enemy can jam GPS signals near the target, the odds of destroying all 20 silos with current bombs are essentially nil. In short, conventional weapons offer the ability to destroy an enemy's nuclear forces with minimal collateral damage, although with only a fair chance of success.

For the third leg of the U.S. strategic force, the United States should retain the lowest-yield warheads in its nuclear arsenal and (if it has not already done so) enhance their accuracy. If the low-yield nuclear bombs and cruise missiles, which reportedly use inertial guidance systems, were even half as accurate as their conventional, GPS-guided cousins, they could match the effectiveness of high-yield nuclear weapons while inflicting casualties more akin to those caused by conventional bombs.

Improving the accuracy of the United States' low-yield nuclear bombs and cruise missiles may not be as simple as attaching GPS

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guidance systems. The Pentagon has been reluctant to use GPS on nuclear weapons because adversaries might conduct intense GPS jamming near their high-value targets or disrupt GPS transmissions with high-altitude nuclear detonations. But GPS may still have a role. The United States has overcome local GPS jamming in the past. More important, the enhanced accuracy gained by having GPS guidance during even half of a weapon's flight time—before the signal is lost—would be enough in many circumstances to permit a highly effective, low-casualty counterforce strike. Whether the slight accuracy improvements come from GPS, next-generation inertial guidance, or other technologies, high-accuracy delivery systems with low-yield weapons should form the backbone of the U.S. nuclear deterrent.

CONFRONTING NUCLEAR REALITIES

CRITICS MAY object to such calculations on the grounds that this approach evaluates the U.S. nuclear arsenal by measuring its capability to carry out nuclear strikes when the real purpose of the arsenal should be to deter wars, not fight them. According to this criticism, whether U.S. nuclear forces can destroy Chinese, North Korean, or (in the future) Iranian nuclear targets during a war is irrelevant, and planning for such contingencies is macabre.

But this criticism is incoherent. Deterrence depends on the capacity to carry out threats. Retaining that capacity is not a sign that the United States has moved beyond deterrence to a war-fighting posture for its nuclear arsenal; rather, the capacity to execute threats is the very foundation of deterrence.

Of course, a deterrent threat also needs to be credible—that is, an adversary needs to be convinced that a retaliatory threat will actually be executed. If not backed by the capability and the credibility to execute threats, deterrence is merely a dangerous bluff. A deterrent force should therefore provide decision-makers with options they would conceivably execute if their redlines were crossed. Otherwise, allies will question U.S. assurances, adversaries will doubt U.S. threats, and a U.S. president may confront an escalating crisis without any acceptable options.

More broadly, any analyst or policymaker who proposes a nuclear posture for the United States must answer four fundamental questions:

