



Threat Convergence: New Pathways to Proliferation? Expert Series

The One Hundred Percent Solution to Preventing Catastrophic Nuclear Terrorism

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The Mantra is the Message

During the 2004 U.S. presidential campaign, President George W. Bush and Democratic contender Senator John F. Kerry remarkably agreed that their highest security priority was to deter terrorist use of nuclear weapons. Kerry's mantra—no material, no bomb, no nuclear terrorism—captures the essence of the supply-side solution. Backing up the mantra, Kerry's campaign published a four-point plan for nuclear terrorism prevention: (1) ensure high security for all nuclear weapons and weapons-usable nuclear materials; (2) ban the production of new weapons-usable materials including plutonium and highly enriched uranium; (3) reduce excess stockpiles of nuclear weapons and weapons-usable materials; and (4) redouble efforts to stop additional countries from acquiring nuclear weapons or the capabilities to make those weapons.

The first three points focus on the supply side of the problem. Only the fourth point addresses how the demand among nation-states can increase the peril of nuclear terror. But Kerry's plan did not go far enough to counter the demand for nuclear weapons, especially among the existing nuclear-armed countries. The Bush administration's efforts have also fallen short in halting the demand. Witness North Korea's October 2006 nuclear test and growing nuclear arsenal and Iran's increasing nuclear capability.

A one hundred percent solution to preventing nuclear terrorism would eliminate the supply of nuclear weapons and weapons-usable materials and counter the nation-state demand for these weapons and materials. Interest notwithstanding, non-state actors cannot unleash nuclear terror without first accessing weapons or weapons-usable materials. And these weapons and materials will continue to exist as long as some countries continue to covet them. Therefore, the ultimate solution to nuclear terrorism prevention is to achieve verifiable nuclear disarmament and to phase out demand for non-weapons use of weapons-usable nuclear material. A complementary mantra to Kerry's is: "Remember no nation-state demand, no bombs, no nuclear terrorism."

Calls for nuclear disarmament counter perceived security benefits that certain countries derive from possessing nuclear weapons. Leaders of these countries need to decide whether the purported benefits outweigh the security risks of increased threats of proliferation and nuclear terrorism. Although political leaders may think they are willing and prepared to live with and manage these risks, the longer the world is divided into nuclear haves and have-nots, the greater is the likelihood that these dangers will mushroom. Before examining possible ways to counteract nation-state demand, it is necessary to dispel the notion that terrorists could make a nuclear explosive without access to nation-state stockpiles of weapons and weapons-usable materials.

Pathways to the Bomb: Uncovering the Common Denominator

To become nuclear terrorists, a terrorist group would need to buy, steal, or be given nuclear weapons or the materials to make those weapons. A nuclear bomb, no matter how simple or advanced in its design, requires fissile material. Fissile material consists of substances that can easily fission, or split apart, and release energy. Those fissile substances include plutonium, highly enriched uranium, another form (or isotope) of uranium called uranium-233, as well as isotopes of americium and neptunium. While all of these substances are capable of easily undergoing fission, only the first two have fueled nuclear weapons produced by countries.

In addition, stockpiles of americium, uranium-233, and neptunium are relatively small although India has plans to make and use large quantities of uranium-233 in the coming decades. In contrast, the world is awash in relatively huge amounts of plutonium and highly enriched uranium with enough of these materials available to make tens of thousands of crude, but devastating, nuclear explosives.

Expensive and technically challenging processes are required to make plutonium or highly enriched uranium. While plutonium exists in trace amounts in nature, all isotopes of plutonium have relatively short half-lives and have decayed away quickly on the timescale of the earth's four billion year history. A nuclear reactor is required to produce the several kilograms necessary to make one plutonium bomb. A research reactor with a 25 to 40 Megawatt thermal power rating would provide adequate power to make at least one bomb's worth of plutonium in a year. Typically, such a reactor would cost at least tens of millions or upwards of a few hundred million dollars.

Moreover, building the reactor would require dozens or up to hundreds of technically trained workers. Furthermore, hiding the construction would be extraordinarily difficult. Finally, operating the reactor would require a relatively large team of qualified engineers and technicians. Although a well-financed terrorist group could conceivably have enough money to hire the requisite technically trained people and to buy the parts for the reactor, it is extremely unlikely that the group could do this activity undetected. If the group had state sponsorship, the reactor construction could fit inside the purported plans of a state to build a reactor for the purposes of research or medical isotope production, for instance. But that scenario falls under the category of nation-state demand.

Highly enriched uranium does not exist in nature. Natural uranium contains 99.2745 percent of uranium-238, a non-fissile isotope, 0.72 percent of uranium-235, a fissile isotope, and 0.0055 percent of uranium-234, a non-fissile isotope. The concentration of the bomb-usable uranium-235 in natural uranium is too low to produce an explosive chain reaction. Increasing the concentration requires enrichment. Enrichment of natural uranium can produce low-enriched uranium (LEU) suitable for fueling many commercial reactors, or highly enriched uranium (HEU) for powering nuclear bombs. HEU is defined as a mixture of uranium containing uranium-235 of 20 percent or greater concentration.

Whereas HEU of any concentration can, in principle, power a nuclear explosive, HEU with concentrations that are 80 percent or greater are more practical for use in weapons. The greater the concentration, the less HEU is needed for the explosive. For example, about 25 kilograms of weapons-grade uranium (90 percent or greater in concentration) are needed to make a bomb. In comparison, several hundred kilograms of 20 percent HEU would be required to build a bomb.

A number of enrichment techniques are available, but all of them are expensive and usually require hundreds, if not thousands, of technically trained people to build and operate an enrichment facility that could make a bomb's worth of HEU in a year. Although Aum Shinrikyo took steps toward uranium enrichment, including the purchase of land in Australia with natural uranium deposits and recruitment of scientists, the group failed to acquire the nuclear weapons it deemed necessary to bring forth an Armageddon.

Even nation-states have struggled with obtaining the capability to enrich uranium. Enrichment programs can take years to develop. Pakistan devoted significant national resources to its enrichment program from the mid-1970s to the early 1980s before its program could deliver sufficient fissile material. Pakistan's achievement rested on the efforts of Dr. Abdul Qadeer Khan.

In contrast, Saddam Hussein's scientists spent many years and tried many enrichment techniques, but Iraq did not cross the threshold to producing sufficient enriched uranium prior to the 1991 Gulf War. Perhaps because Iraq apparently lacked someone with the skills of A. Q. Khan, the Iraqi enrichment program never fulfilled Saddam's vision. Also, Iran has had a uranium enrichment program since the late 1980s but only this year has it made even small quantities of low enriched uranium, according to reports by the International Atomic Energy Agency.

Understanding Nation-State Demand for Nuclear Weapons

Stemming nuclear arms races in the Middle East and East Asia and preventing terrorists from having greater opportunities to seize caches of nuclear weapons and weapons-usable nuclear materials will require greater understanding of why certain nations have pursued and are pursuing nuclear weapons capability. This understanding then should translate into better tools for curbing nation-state demand for these weapons.

A nation might seek nuclear arms to deter external attack, prevent nuclear blackmail, retaliate against chemical or biological attack, compensate for conventional military inferiority, exert regional or global influence, or enhance domestic and international prestige. Typically, more than one factor has influenced a nation's decision to acquire nuclear weapons or at least the latent capability to make these weapons.

Deterring External Attack

Nuclear weapons are mostly tools for deterring, not waging, war. The essence of nuclear deterrence is to frighten an enemy with devastating force. Deterrence means instilling terror; thus, security analysts often talk about a balance of terror between two nuclear-armed adversaries. A nation possessing nuclear arms could, in principle, protect itself from an attack and might never have to actually use these weapons in war. The words "in principle" are vitally important because mere ownership of such weapons is not sufficient to ensure national survival against external attack. A nuclear-armed nation would have to devote sufficient resources to make sure enough nuclear weapons survive an adversary's military strike.

Preventing Nuclear Extortion

Nations can also wield nuclear weapons as tools of political coercion, at times with unpredictable and counter-productive effect. The acrimonious relationship between the People's Republic of China and the United States during the 1950s illustrates a classic example. Communist Chairman Mao Zedong, intimidated by the American nuclear arsenal during the 1950-1953 Korean War and the 1954-1955 Taiwan Strait Crisis and General MacArthur's consideration of nuclear weapons' deployment, ordered in early 1955 the development of Chinese nuclear weapons.¹ Charges and counter-charges of nuclear blackmail have punctuated the six party talks to try to end North Korea's nuclear weapons programs. Accession to North Korea's demands in exchange for its commitment to halt its reactor program illustrates how nuclear capabilities can greatly enhance the power of a weak state over a strong state or states.

Retaliating Against Chemical and Biological Attacks

The nuclear option can serve as a means of last resort to retaliate against use of chemical or biological weapons in a military conflict. If a nuclear-armed nation can credibly threaten such a response, it might deter use of these weapons. Limited use of chemical or biological arms could limit casualties to non-combatants, so long as contaminants are not dispersed from a battlefield remote from civilian populations, and contagion is contained. Nuclear weapons used in retaliation to such attacks could also strictly strike military targets, but radioactive fallout could spread far from the battlefield, resulting in substantial harm to many civilians.

¹ John Wilson Lewis and Xue Litai, *China Builds the Bomb* (Stanford University Press, 1991).

The United States has not ruled out use of nuclear arms in retaliation for chemical or biological attack. During the 1991 Gulf War, the U.S. government warned Iraq that any use of chemical or biological weapons could lead to a devastating response from the United States. Although Washington did not explicitly refer to a nuclear response, the pronouncement tacitly implied that as an option. More recently, the 2002 U.S. National Strategy to Combat Weapons of Mass Destruction stated, “The United States will continue to make clear that it reserves the right to respond with overwhelming force – including through resort to all of our options – to the use of WMD against the United States, our forces abroad, and friends and allies.” While not explicitly mentioned, it is widely believed that such a response includes nuclear attack, an overwhelming force.

Compensating for Conventional Military Inferiority

Some nations have employed the threat of nuclear use to fill in conventional force gaps. In the 1950s, for example, the United States under the Eisenhower administration believed that nuclear arms offered “more bang for the buck” compared to conventional military expenditures. During this time period, the United States and NATO felt overwhelmed by the conventional arms superiority of the Soviet Union and the Warsaw Pact. Certainly in sheer numbers, the Soviet and Warsaw Pact militaries outmanned and outgunned NATO.

The qualitative advantage, however, in conventional weapons’ accuracy and maneuverability probably belonged to NATO during most, if not all, of the Cold War period. Nevertheless, many Western leaders, especially during the 1950s, perceived that battlefield nuclear arms could dissuade the Soviet Union from attacking Western Europe. The U.S. military in Europe carried out numerous exercises to simulate actual use of nuclear weapons. Establishing a credible threat of nuclear use was considered necessary to demonstrate U.S. and NATO resolve.

In contemporary times, other nations are learning lessons from this historical period. For instance, Russia has renounced its Cold War no-first-use nuclear weapons policy, and has reportedly drawn up battle plans that rely on the use of nuclear weapons to combat conventional attacks that threaten the existence of the Russian state.² Similarly, Pakistan has sought to make up for shortfalls in its conventional military vis-à-vis India by planning for possible battlefield nuclear strikes.

Enhancing Regional and Geopolitical Power

A yearning for regional or geopolitical power can motivate a nation to acquire nuclear weapons. By obtaining nuclear arms, a weak nation might enhance its power relative to a stronger nation. Thus, nuclear weapons can act as great equalizers. This dynamic can play out between regional or geopolitical adversaries. The nuclear face-off between India and Pakistan illustrates the former relationship.

² For an in-depth analysis, see Nikolai Sokov, “Russia’s Nuclear Doctrine,” Nuclear Threat Initiative Issue Brief, August 2004, available at: http://www.nti.org/e_research/e3_55a.html.

As an exemplar of the latter situation, the Cold War pitted the Soviet Union, which had been traditionally an Eastern Hemisphere power, versus the United States, which had been historically dominant in the Western Hemisphere. During the Cold War, both nations sought to expand their political influence around the globe. The ultimate military power inherent in nuclear weapons helped these nations exert control over other nations. Such power also allowed development of the concept of extended deterrence, providing security assurances to allies to convince them not to obtain nuclear arms of their own. These assurances are often called nuclear umbrellas.

Despite its weak economy and small size, North Korea's nuclear weapons capability permits it to punch above its weight class. North Korea has affected the security of at least five other nations: China, Japan, Russia, South Korea, and the United States. Kim Jong Il sees nuclear weapons as a means to ensure regime survival and to manipulate Northeast Asian security. North Korea could have far reaching implications beyond Northeast Asia by demonstrating that a weak state can fend off perceived or real security threats through use of nuclear capabilities.

Strengthening Domestic and International Prestige

Some nations derive domestic and international political stature from having nuclear arms or the capability to make such arms. Because all five of the *de jure* (as legally recognized under the Non-Proliferation Treaty) are permanent members of the UN Security Council, leaders of certain nations believe that in order to climb to the top of the world's stage, they must acquire nuclear capabilities. After enduring a few years of censure, these new nuclear-armed nations might don the cloak of great power respectability. For example, many Indian leaders have long expressed strong interest in achieving a permanent seat on the Security Council for India.

Whereas this accomplishment does not appear ready to take place soon, many in India believe that it is only a matter of time, especially if proposals to reform the Security Council are implemented. Although Iranian leaders have been careful to couch their nuclear program as purely for peaceful purposes, they have transformed this program into a nationalistic issue and have tapped into the strong feelings of Persian pride extending over many centuries of past scientific and intellectual accomplishments.

Other Nuclear Weapons-Usable Assets

Even if countries can be convinced to say farewell to nuclear arms, plenty of weapons-usable nuclear material would still exist, providing enough material to power thousands of nuclear bombs. More than forty countries with civilian nuclear programs contain relatively small amounts of highly enriched uranium. Still, many of the more than 120 research reactors and related facilities within these countries have enough HEU to build a nuclear bomb.³ Some of these reactors also produce radioisotopes for medical and other commercial uses in radioactive sources. Although it is possible to make these radioisotopes in reactors using non-bomb-usable uranium, major isotope-producing companies have resisted paying the costs to convert their HEU-fueled reactors to low enriched uranium.

³ U.S. General Accounting Office, *DOE Needs to Take Action to Further Reduce the Use of Weapons-Usable Uranium in Civilian Research Reactors*, GAO-04-807, July 2004, p. 28.

Other uses of HEU outside of weapons include fueling certain types of submarines and ice breakers as well as providing power for proposed reactors in outer space. The United States, for example, remains committed to using weapons-grade uranium to fuel dozens of submarines, and Russia powers several ice breakers with weapons-usable uranium. Last year, U.S. Secretary of Energy Samuel Bodman further solidified American plans to hold onto a huge stockpile of HEU by declaring that the United States will set aside 160 metric tons of weapons-grade HEU for use in submarines and 20 tons of HEU for space missions and for research reactors that are waiting conversion to low enriched uranium.⁴ While the third use helps bridge the gap during the time required for conversion, the other two uses perpetuate dependency and thus demand for HEU in the United States. This message sends a double standard to other countries contemplating whether they should use HEU to power their ships and possible future space reactors.

The world is awash in plutonium contained in several civilian nuclear programs. More than a dozen countries possess more than 230 metric tons of plutonium separated from spent reactor fuel, and the rate of separating or reprocessing exceeds the rate of consumption as reactor fuel. France, Russia, and Great Britain have reprocessed much of this plutonium. Japan is on the verge of launching a major commercial-scale reprocessing plant at Rokkasho-mura, and India has also invested significant resources in reprocessing. According to the best unofficial estimate, the global stockpile of plutonium in separated form is increasing at the rate of about ten metric tons per year.⁵ This amount is enough for hundreds of terrorist- or state-made nuclear bombs annually.

The economic costs of plutonium reprocessing greatly exceed the costs of fresh uranium fuel. Still, a few countries have made the decision to bear these added costs because they believe that eventually a plutonium economy would help provide for greater energy security. Faced with this continuing demand for civilian plutonium for the foreseeable future, a compromise policy would encourage the plutonium-producing and consuming countries to minimize the stockpile of separated plutonium by making sure that the rate of production matches the rate of consumption.

In early 2006, the Bush administration proposed the Global Nuclear Energy Partnership (GNEP), which, in part, intends to reprocess plutonium but would not completely separate out the plutonium from all of the spent fuel. While the administration claims that this procedure would be proliferation-resistant, the unintended consequence could be to encourage countries to continue with current proliferation-prone reprocessing methods. An encouraging aspect of GNEP is a proposal to offer fuel supply services to countries that decide not to pursue uranium enrichment and plutonium reprocessing.

⁴ U.S. Secretary of Energy Samuel Bodman, Remarks to the Carnegie International Nonproliferation Conference, Washington, DC, November 7, 2005.

⁵ Institute for Science and International Security, Global Stockpiles of Nuclear Explosive Materials, End 2003, September 2005, available at http://www.isis-online.org/global_stocks/end2003/tableofcontents.html

If successfully developed by GNEP fuel suppliers and adopted by countries that need reactor fuel, this proposal could curb the spread of bomb-usable technologies. But countries such as Argentina, Australia, Brazil, and South Africa have recently indicated that they want to become fuel supplier states. Thus, unintentionally, the GNEP proposal appears to have created an incentive for more states to pursue these technologies. GNEP has apparently fallen into the politically fatal trap of a double standard.

Searching for Common Ground and Providing for Greater Security for All

Can America and the rest of the world commit to preventing nuclear terrorism and nuclear war by pursuing and eventually achieving disarmament? First, people need to find common ground to discuss these issues. This task is daunting given global and national political rifts. In the United States, for instance, during the 1990s and into the twenty-first century, citizens have become increasingly polarized into liberal and conservative enclaves. The *National Journal* summed up the split in its July 12, 2003, issue: “The Left tends to blame Bush and the nuclear-armed nations for falling short of [Non-Proliferation] treaty obligations. The Right, on the other hand, tends to blame what it sees as inherent weaknesses in the treaty, and the way that rogue states have manipulated it.” A nonpartisan framework to go beyond this divide is urgently needed.

The NPT is not just about stopping the spread of nuclear weapons but is fundamentally, as stated in the preamble of the treaty, about preventing nuclear war. The NPT requires both nuclear-armed and non-nuclear armed nations to live up to shared responsibilities. The NPT obligates the nuclear weapon states to pursue disarmament but does not specify when that should occur. The treaty also provides non-nuclear weapon states with “the inalienable right” to peaceful nuclear technologies but that right is contingent on those countries not acquiring nuclear explosives and maintaining safeguards on their nuclear programs.

The impasse at the 2005 NPT Review Conference underscored the difficulty in dealing with these two obligations. The United States largely dodged the issue of its commitment to nuclear disarmament while it wanted to shine a spotlight on Iran’s “crisis of compliance” with safeguards commitments. Iran continued to highlight its “right” to peaceful nuclear technologies. This situation resulted in a stalemate that blocked progress at the major five-year conference to stem the spread of nuclear weapons.

Regardless of whether someone believes in nuclear abolition or indefinite nuclear possession, most adherents of these two camps can find points of agreement to form an effective strategy to reduce the risks of nuclear war and nuclear terrorism. All people would agree that they would want fewer nuclear weapons pointed at them. Moreover, they would concur that the existing nuclear arms should be embedded in secure command and control systems. Such systems would reduce, but not eliminate, the likelihood of inadvertent use, i.e. accidental nuclear war, or loss of control, i.e. loose nukes that could fall into the hands of terrorists.

Citizens would agree that they want their country to avoid war especially a nuclear war. The world has not experienced a world war since 1945. Many believe that nuclear weapons helped to prevent the United States and the Soviet Union from directly fighting each other during the Cold War. As U.S. President John F. Kennedy warned in 1963, "Total war makes no sense in an age when great powers can maintain large and relatively invulnerable nuclear forces and refuse to surrender without resort to those forces."⁶ But possession of nuclear weapons did not prevent the United States and the Soviet Union from fighting less than total war and suffering defeat in Vietnam and Afghanistan.

Historians and international security analyst may never resolve whether the two Cold War superpowers would have fought a war or wars against each other if they did not have nuclear arms. The question remains whether these weapons are essential to prevent war between great powers. If nuclear abolition demonstrably raises the risk of such wars, a case could be made to keep at least small nuclear arsenals to provide a minimum deterrent and insurance against world war.

But even minimal deterrent postures are not sustainable over the long term. Continued possession of nuclear arsenals, albeit small stockpiles, would perpetuate the current double standard. The ultimate end point is either all or none. If the existing nuclear-armed nations cannot achieve disarmament, more and more nations will feel threatened and compelled to develop nuclear capabilities. But nuclear weapons are really a symptom of underlying security problems. Progress on disarmament will not gain traction until the major powers, especially the United States, work to improve the security of all countries. This is a complex endeavor. Each security challenge poses different problems.

Whereas no definite recipe exists to solve all security problems that could lead to development of nuclear capabilities, certain ingredients are apparent from history. One lesson is that real or perceived threats to the survival of a country can spur the threatened country to develop nuclear weapons. A corollary is that nuclear threats can have the same effect. Another lesson is that culture and pride matter. Wounded nationalistic feelings can result in a rally around the flag as well as a nuclear program.

Addressing related regional security concerns can help lessen the demand for nuclear capabilities. For example, a resolution of or at least a serious attempt to resolve the Arab-Israeli conflict would reduce much of the rhetorical, if not actual, demand for nuclear capabilities in Iran and the greater Middle East. In early November 2006, six Arab countries, including Algeria, Egypt, Morocco, Saudi Arabia, Tunisia, and the U.A.E. expressed interest in starting nuclear power programs. The Arab-Israeli conflict has served as a unifying issue for the Arab and larger Islamic world. Solving this problem could open the door to bringing Israel into the nonproliferation regime and to establishing a nuclear weapon free zone in the Middle East. As the current situation stands, many people in the Arab world tend to favor an Iranian nuclear capability as a counterbalance to Israel's nuclear arsenal.

⁶ President John F. Kennedy speech to American University, 1963.

Military preemptive attacks have not stopped nuclear programs but can actually stimulate greater desire for nuclear capabilities. For instance, the Israeli preemptive attack against the Osirak reactor in Iraq in 1981 destroyed that reactor but drove Saddam's nuclear bomb program underground and largely out of sight on inspections. On the other hand, resolving security concerns and achieving a positive change from the inside in a country's governance offer effective methods for quenching appetite for nuclear weapons.

Nuclear weapons program renunciation could occur even as a regime is experiencing internal transformation, and multilateral sanctions can help prompt this change. For example, anti-apartheid sanctions and the resulting prospect of internal political change convinced then-South African President F. W. de Klerk to order the dismantling of his country's nuclear weapons program. Argentina and Brazil also renounced nuclear programs that could have become weapons programs when they were undergoing change from military to civilian rule. With its December 2003 renunciation of WMD programs, Libya appears to also represent a recent subtle impending change in governance as power is gradually being handed over from Colonel Muammar Gaddafi to his son Saif. Also in the case of Libya, multilateral sanctions helped convince Gaddafi to end his WMD programs.

According to Ron Suskind in his book *The One Percent Doctrine*, Vice President Dick Cheney believes that if there is even a one percent chance of an attack on the United States, we must act as if it is a certainty and must do what we can to prevent it from happening.⁷ While the actual chance of a nuclear terror attack is debatable, it is not zero. The United States and the international community should seize the opportunity now to apply the one hundred percent solution, including securing and then eliminating all weapons-usable nuclear materials as well as renouncing nuclear arms, to prevent nuclear terrorism.

⁷ Ron Suskind, *The One Percent Doctrine* (New York: Simon & Schuster, 2006).

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