Deterring Nuclear Terrorism

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Jane Harman, *Director, President, and CEO*

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Preface and Acknowledgments

A nuclear weapon in the hands of terrorists—a "game changer," in President Obama's words—poses a catastrophic threat to the United States and the world. The terrorist attacks on September 11, 2001 by Al Qaeda accentuated the threatening nexus of nuclear proliferation and terrorism.

But if a *non-state* terrorist group were to buy, steal, or build a bomb, a *state* would be involved—either as the source of the weapon or the weapons-usable fissile material. The countries of primary concern with respect to the transfer or theft of nuclear weapons are all at inflection points.

Russia has discontinued the 20-year "cooperative threat reduction" program with the United States.

Pakistan has the world's fastest growing nuclear arsenal even as this fragile state confronts the threat of homegrown jihadists.

North Korea, an impoverished state whose ruling regime has a history of engaging in illicit activities, is poised to significantly expand its nuclear arsenal and could sell a weapon or technology to a terrorist group.

And Iran, which remains on the U.S. State Department's state sponsors of terrorism list, negotiated a nuclear deal with the world's major powers that, if successfully implemented, will hinder the Tehran regime's ability to acquire a bomb or weapons-grade fissile material for 15 years.

These major shifts, which will affect the risks of nuclear terrorism, are the occasion for this study's reassessment 15 years after 9/11.

Building on my previous work on "rogue" and "outlier" states, this monograph's core argument is that effective strategies on the *state* level are the prerequisite for addressing threats of nuclear terrorism posed by *non-state* entities, such as Al Qaeda. Such strategies of deterrence will not eliminate the non-state threat but will go far in achieving that objective.

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The views expressed here are my own.

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Regime Change: U.S. Strategy through the Prism of 9/11

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Nuclear Proliferation after the Cold War (edited with Mitchell Reiss)

Détente and the Nixon Doctrine: American Foreign Policy and the Pursuit of Stability, 1969-1976

Security in the Persian Gulf: Sources of Inter-State Conflict

Executive Summary

Al Qaeda and other terrorist groups are determined, as President Obama stated, "to buy, build or steal" a nuclear weapon and "would have no problem with using it." Preventing a nuclear 9/11 hinges on foiling terrorist efforts to acquire the capability that would allow them to act on their intention.

That entails blocking the pathways to terrorist acquisition of a nuclear weapon: transfer—the sale or handoff of a weapon from a nuclear-weapon state; leakage—the theft of a nuclear weapon or weapons-grade fissile material; and indigenous production—the construction of a nuclear device from illicitly obtained weapons-grade fissile material.

Each pathway to nuclear acquisition by a non-state terrorist group is contingent on an act of commission or negligence by a state. The "leakage" of a weapon to a terrorist group would originate from one of the nine nuclear-weapon states, or the 26 states (at current count) with weapons-grade fissile material in their civilian stocks. Effective strategies on the state level to prevent nuclear terrorism will not eliminate non-state threats, but will go far in achieving that objective.

The countries of primary concern with respect to the nexus of proliferation and terrorism—Pakistan, North Korea, Iran, and Russia—are each at an inflection point.

Pakistan continues to build up its nuclear arsenal (including the development of battlefield tactical nuclear weapons), employs terrorism as an instrument of state policy, and faces the internal

Left: President Obama at the The 2016 Nuclear Security Summit, held in Washington, D.C., on March 31 and April 1, 2016.

security threat of radical Islamists attempting to infiltrate its nuclear establishment.

Russia, which inherited the Soviet Union's vast nuclear arsenal and stocks of fissile material, recently terminated its nuclear-security cooperation with the United States under the Nunn-Lugar program.

North Korea is on the verge of a strategic breakout both quantitatively (by ramping up its number of warheads) and qualitatively (by mastering warhead miniaturization), and is known, as Secretary of Defense Robert Gates put it, for its willingness to "sell anything they have to anybody who has the cash to buy it."

Iran, the leading state sponsor of terrorism (according to the U.S. State Department) concluded a nuclear agreement with the world's major powers in July 2015 that constrains the Iranian nuclear program, impeding the Tehran regime's access to weapons-usable materials for 15 years.

Since 9/11, the Cold War concept of deterrence has been retooled to address the threats of a new era. Classic deterrence theory distinguishes between two variants. Deterrence by punishment seeks to affect the intention of a state to carry out a hostile act through the credible threat of a punitive response, whereas deterrence by denial seeks to affect the capabilities of the target state (either by blocking the acquisition of those means or through the adoption of defensive measures to render them ineffective).

The vast majority of work done in the nonproliferation area to counter nuclear terrorism falls under the rubric of deterrence by denial. This covers a range of activities, such as export controls to limit access to technology and physical security at sensitive sites to lock down fissile material to prevent illicit diversion. The Obama administration pursued "cooperative threat reduction"—a deterrence by denial strategy—to secure nuclear weapons and materials globally through a series of four Nuclear

Security Summits, which brought together some 50 heads of state and made significant progress (e.g., reducing the number of countries with weapons-usable nuclear materials from 32 in 2010 to 24 by the end of 2015).

To prevent a state from transferring nuclear weapons or technologies to a terrorist group, the United States has employed deterrence by punishment. Dating back to 2006, when North Korea conducted its first nuclear test, U.S. declaratory policy has held that a state that supports or enables terrorist groups to acquire or use nuclear weapons would be held "fully accountable."

Because North Korea is the one state that might sell a weapon or nuclear technology to a terrorist group, this general declaratory policy should be made explicit: The deliberate transfer of nuclear capabilities by the Pyongyang regime to a non-state entity could trigger a non-nuclear, regime-changing response from the United States. A highly contentious issue relating to nuclear leakage is whether potentially negligent states, such as Pakistan, should be held "fully accountable." Technical advances in the area of nuclear "attribution" will increasingly permit experts to determine the source of fissile material should an attack occur. The United States has an interest in publicizing its attribution capabilities so that states of proliferation concern will know that they need to take possibility of detection, and the attendant risk of retaliation, into account. The deterrent threat captured in the calculatedly ambiguous phrase "fully accountable" does not commit the United States to a retaliatory response against the country of origin. The fear of deterrence by punishment could lead countries that are the potential sources of nuclear leakage to implement more effective strategies of deterrence by denial.

An inherent tension exists between the twin variants of deterrence—punishment and denial. An over-emphasis on the punitive threat of the former potentially undercuts the target state's incentive for cooperating in the implementation of the latter. The policy tension between punishment and denial can be managed but not resolved.

The Iran nuclear accord set an important nonproliferation precedent—deterrence by denial through arms control. That approach should be attempted to constrain the nuclear capabilities of two other hard cases, North Korea and Pakistan. In both, the objective would be to cap and secure those countries' nuclear weapons and weapons-usable fissile material. Opting for a negotiated freeze of capabilities recognizes that a full rollback of either North Korea's or Pakistan's nuclear programs is not a diplomatically attainable objective. That said, even the more modest goal of capping and securing their nuclear arsenals would face formidable political obstacles in both countries.

Negotiating a freeze would buy time and prevent the problem from getting worse. China, which has balked at applying meaningful pressure on North Korea to curb its nuclear ambitions, faces a strategic choice of either acquiescing to Pyongyang's strategic breakout or living with its adverse consequences in northeast Asia (e.g., the August 2016 decision to deploy the THAAD antimissile system in South Korea).

The Obama administration has reportedly floated a deal that would cap Pakistani nuclear capabilities (in particular, the expansion into vulnerable tactical nuclear weapons for battlefield use) in return for relaxing the strict controls on nuclear exports to Pakistan. The proposal would essentially trade off Pakistani restraint and transparency for measures to normalize the Pakistani nuclear program. Constraining the Pakistani program so that this fragile state does not become the world's fourth largest nuclear state can only be accomplished within the broader geopolitical context. China, which played a constructive role in negotiating the Iran nuclear deal, should have an interest in avoiding a spiraling arms race in South Asia that increases the risk of nuclear leakage from Pakistan.

Denying ISIS the capabilities of a state is essential. Rolling back the Islamic State's control over territory in Iraq and Syria would block its access to the economic and technological

capabilities of a state. Such a strategy of deterrence by denial would not eliminate ISIS's threat of WMD terrorism, but would substantially reduce it.

A much more likely event of lower consequence would be the detonation of a radiological dispersal device (RDD)—a so-called "dirty bomb"—by ISIS or another terrorist group. RDDs have been called "weapons of mass disruption" because their consequences would be primarily economic and psychological. A strategy of deterrence by denial would aim both to block ISIS's (or any other terrorist group's) access to RDD capabilities and to deploy defenses to prevent a successful attack on a nuclear power plant. The former would entail securing radiological materials as is being done with weapons and weapons-usable materials. But radiological isotopes are in pervasive use throughout society in medicine and business, so a denial approach, while necessary, cannot realistically eliminate the threat.

Nuclear terrorism encompasses a spectrum of threats—the detonation of a nuclear bomb, an attack on a civil nuclear installation, or the dispersal of radiological materials through a "dirty bomb." Each differs in probability and consequence. But the strategies adopted to counter these variegated threats share a fundamental characteristic. Their focus is on state actors, who through their intent or laxness, would be the source countries of the weapons, nuclear technology, and radioactive materials that terrorists would either use to perpetrate attacks or target. This underscores the leitmotif of this monograph: Effective strategies of deterrence, which coherently integrate both the denial and punishment variants, on the state level remain the prerequisite for countering the non-state threat of nuclear terrorism.

Introduction

While judging the United States generally resilient to terrorist attack, President Barack Obama qualified that "a potential game changer would be a nuclear weapon in the hands of terrorists, blowing up a major city."[1] This game-changing scenario, which had been a concern since the 1990s, arose just four months after the president's inauguration in 2009: a CIA intercept between two Taliban leaders in northwestern Pakistan revealed that the terrorist group had acquired "nuclear devices." Though the intercept later proved unfounded, at the time, according to an administration official, "The entire U.S. policy-making community was very alarmed. It was an all-hands-on-deck mentality."[2] In the war against ISIS (the Islamic State in Iraq and Syria), the president has resisted a direct combat role for U.S. forces, but stipulated that the one scenario in which he would send in U.S. ground troops is "if we discovered that [the Islamic State] had gotten possession of a nuclear weapon, and we had to run an operation to get it out of their hands…."[3]

President Obama has warned that Al Qaeda and other terrorist groups "are determined to buy, build or steal" a nuclear weapon and "would have no problem with using it."[4] Preventing a nuclear 9/11 hinges on foiling terrorist efforts to acquire the capability that would allow them to act on their intention. That entails blocking the pathways to terrorist acquisition of a nuclear weapon: transfer—the sale or handoff of a weapon from a nuclear-weapon state; leakage—the theft of a nuclear weapon

The Islamic State in Iraq and Syria (ISIS) seeks to aquire a nuclear weapon to conduct a terrorist attack that would be "truly epic.". Photo courtesy of REUTERS/Stringer

or weapons-grade fissile material; and indigenous production—the construction of a nuclear device from illicitly obtained weapons-grade fissile material.

Each pathway to nuclear acquisition by a non-state terrorist group is contingent on an act of commission or negligence by a state. Nine states—the United States, Russia, China, the United Kingdom, and France (the P5 recognized under the Nuclear Non-Proliferation Treaty, NPT); Israel, India, and Pakistan (which exercised their sovereign right not to join the NPT); and North Korea (a signatory that withdrew from the NPT)—are nuclear-weapon states. The "leakage" of a weapon to a terrorist group would originate from one of these nine states. The pool of states with weapons-grade fissile material in their civilian stocks is much larger—currently 26, down from a Cold War-era high of 57 countries.[5]

In the transformed political environment after 9/11, the Bush administration's concern that Saddam Hussein might acquire and then transfer a nuclear weapon to terrorists drove the administration's decision to launch a preventive war in Iraq in 2003. At that time, Iraq, as well Libya, North Korea, and Iran, constituted the core group of countries designated as "rogue states." These states, all designated as "state sponsors of terrorism" with nuclear aspirations, embodied the "nexus" of proliferation and terrorism. Other countries of concern with respect to nuclear terrorism were Russia (then participating in the Cooperative Threat Reduction Program [Nunn-Lugar] with the United States to secure its massive stocks of weapons and fissile material) and Pakistan (designated a "major non-NATO ally" by the United States amidst the scandal over the A.Q. Khan network's transfer of nuclear technology to Libya, Iran, and North Korea).

If Obama's game-changing scenario came to pass—a nuclear detonation in a major city—what country would be the likely source of that weapon? Attempting to answer that question is

the rationale for this new monograph on nuclear terrorism 15 years after 9/11. The top three suspects would be:

> **Pakistan**—which continues to build up its nuclear arsenal (including the development of battlefield tactical nuclear weapons), employs terrorism as an instrument of state policy, and faces the internal security threat of radical Islamists attempting to infiltrate its nuclear establishment.
>
> **Russia**—which inherited the Soviet Union's vast nuclear arsenal and stocks of fissile material and recently terminated its nuclear-security cooperation with the United States under the Nunn-Lugar program.
>
> **North Korea**—which is on the verge of a strategic breakout both quantitatively (by ramping up its number of warheads) and qualitatively (by mastering warhead miniaturization), and is known, as Secretary of Defense Robert Gates put it, for its willingness to "sell anything they have to anybody who has the cash to buy it."

Missing from this top tier of countries of concern is Iran, the leading state sponsor of terrorism (according to the U.S. State Department) that has also had an active nuclear weapons program. The Joint Comprehensive Plan of Action (JCPOA), concluded between Iran and the world's major powers in July 2015, impedes the Tehran regime's access to highly enriched uranium for 15 years.

Proliferation occurs in states. The nuclear weapons and materials that terrorist groups like Al Qaeda or ISIS seek to acquire exist in states. Effective strategies on the *state* level are the prerequisite for addressing *non-state* threats. A repertoire of tailored strategies focused on states will not eliminate terrorist threats, but would go far in achieving this goal. An ominous aspect of the threat posed by ISIS, which the Obama administration asserts is neither Islamic nor a state, is that

its occupation of territory in Iraq and Syria confers access to an infrastructure (such as the chemistry department at Mosul University) that could allow this non-state actor to acquire state-like WMD (weapons of mass destruction) capabilities. Hence, the centerpiece of the U.S. strategy is to roll back ISIS's territorial gains to mitigate this threat.

The principal routes to nuclear acquisition by a terrorist group—politically motivated transfer or sale, leakage, and indigenous production—can be countered through a retooled Cold War strategy of deterrence targeting states. Al Qaeda and ISIS cannot be deterred from attempting to realize their apocalyptic vision, but the states, which would be the source of the weapons or fissile materials that they would need to carry out nuclear terrorism, are susceptible to deterrence. Classic deterrence theory from the Cold War era, pioneered by political scientist Glenn Snyder, usefully distinguishes between two variants—*deterrence by punishment* and *deterrence by denial*.[6]

Deterrence by punishment—threatening a potentially devastating punitive response to a hostile act—is the variant most commonly associated with this strategy. After North Korea conducted a test in 2006 and became a self-proclaimed nuclear-weapon state, President Bush enunciated a policy of *deterrence by punishment*, which was repeated verbatim by the Obama administration in its *Nuclear Posture Review* of 2010: it threatened "to hold fully accountable any state, terrorist group, or other non-state actor that supports or enables terrorist efforts to obtain or use weapons of mass destruction, whether by facilitating, financing, or providing expertise or safe haven for such efforts." The "fully accountable" formulation was strategically ambiguous—threatening retaliation, but not locking the United States into a particular response. This declaratory policy directed at the countries of concern was essentially a large strategic bumper sticker: don't even think about transferring a nuclear weapon or materials to a non-state

terrorist group. For North Korea, the threat of regime-changing retaliation in this deterrent formulation was tacit but clear. The threat of holding states "fully accountable" creates coercive pressure for states to end their sponsorship of terrorism, and to develop the governmental capacity and political will to exercise sovereign control over nuclear weapons and materials on their territory. Advances in nuclear forensics—attribution technology permitting nuclear materials to be traced back to their source country—promise to increase the credibility of deterrence by punishment

The essential complement to deterrence by punishment is *deterrence by denial*. Whereas the former addresses intention, the latter focuses on denying terrorists access to nuclear weapons or fissile material through physical security measures adopted by states. That was the impetus behind the now dormant Cooperative Threat Reduction program with Russia, initiated at the end of the Cold War to secure the Soviet Union's nuclear arsenal and materials, and, since 2009, four nuclear security summits convened by the Obama administration, which led 15 countries to give up their weapons-grade plutonium and highly enriched uranium. But terrorist acquisition of nuclear capabilities remains an urgent threat. The Nuclear Threat Initiative, a non-governmental organization, estimates that more than 1,800 metric tons of nuclear material, much of it vulnerable to theft, resides in 24 countries.[7]

The Iran nuclear deal is essentially a form of deterrence by denial in that the agreement blocks Iranian acquisition of weapons-grade fissile material and, hence, the threat of transfer or leakage to a terrorist group. The JCPOA, the product of coercive pressure and engagement, could be a precedent for North Korea, which is on the verge of a strategic breakout. With Iran and North Korea, diplomacy to mitigate the nuclear threat has been complicated by the mixed message from Washington as to whether the objective is to change these states' conduct

or their ruling regimes. For example, the U.S.-South Korean military exercises in March 2016 featured a "beheading operation" (often referred to as "decapitation") aimed at the Kim Jong-un regime.[8] In the case of Pakistan, officials have expressed concern that the United States might launch a preventive strike to seize the country's nuclear arsenal.

With these countries of concern, a policy tension exists between the punishment and denial variants of deterrence. An over-emphasis on the punitive threat of the former potentially undercuts the target state's incentive for cooperating in the implementation of the latter. This policy tension can be managed but not resolved. The purpose of this monograph is to identify effective strategies on the state level to address non-state threats. In fashioning such tailored strategies of deterrence, U.S. policymakers must navigate the political space between punishment and denial.

Right: On the floor of The 2016 Nuclear Security Summit, held in Washington, D.C. on March 31 and April 1, 2016. Photo courtesy of whitehouse.gov


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The Nexus of Proliferation and Terrorism

Proliferation Dynamics

A traditional tenet of arms control policy is that proliferation occurs in states. That formulation reflected the long-standing assessment that nuclear weapons would be acquired and controlled exclusively by state actors. John F. Kennedy's famous nightmare vision of a world of 30 states with nuclear weapons by the 1970s, or other predictions of an impending proliferation cascade, did not come to pass.[9] The nine states (the United States, Russia, Britain, France, China, India, Pakistan, Israel, and North Korea) that have "gone nuclear," as well as those seeking to acquire nuclear weapons, represent the full range of regime type—democratic, authoritarian, and military. Democratization can increase political transparency and accountability as well as facilitate open debate and scrutiny of motivation, but it will not, per se, restrain proliferation. Indeed, a majority of the states in the nuclear club are established democracies. The diversity of political systems among nuclear-weapon states underscores that regime *intention*, not regime *type*, is the critical proliferation indicator.

The extensive literature on nonproliferation highlights a range of domestic and international factors that have led states to abstain from or acquire nuclear weapons. For each state facing that choice, the strategic calculus has been highly context-dependent. During the Cold War, the structure of bipolarity inhibited proliferation: the United States and the Soviet Union implemented strategies of extended deterrence within their

competing alliance systems to assuage the security concerns of their smaller allies. For that reason, the North Atlantic Treaty Organization (NATO), which institutionalized the extended deterrent commitment of the United States, has been called one of the most effective nonproliferation instruments in history.

Nuclear abstinence and voluntary reversal have also been attributed to the combination of U.S. pressure in tandem with security guarantees (Taiwan, South Korea); transformations in civil-military relations (Brazil, Argentina); domestic political changes precipitated by a transformation of the international environment (Ukraine, South Africa); and the normative constraint on nuclear acquisition from the Nuclear Non-Proliferation Treaty.[10] In sum, the world is not one of 30 or more nuclear powers because the vast majority of states do not have a national security or other overriding imperative that would compel them to acquire nuclear weapons.

Though regime type does not axiomatically drive a state to acquire nuclear weapons, the character of a regime does fuel the perception of threat by other states. The United States may assert a general interest in nonproliferation as an international norm, but, in practice, it focuses on adversarial proliferators—states that combine capabilities with hostile intent. Hence, with reason, Washington focuses on Iran more than on Israel. The linkage between proliferation and terrorism was reinforced by the fact that the primary countries of proliferation concern (Iran, Iraq, Libya, Syria, and North Korea) had also been designated state sponsors of terrorism by the U.S. Department of State. After 9/11, the nexus was central to the Bush administration's redefinition of threat—and the case for preventive war in Iraq. The concern was that if one of these "rogue states" acquired nuclear weapons, its regime might employ them either directly in a clandestine attack or indirectly by giving or selling them to a non-state terrorist group. This section will focus on the traditional concern about the nuclear terrorist threats linked to state actors—from Stalin's Soviet Union during the Cold War

to the contemporary "rogue state" threat. Whether or not the traditional assumption about nuclear weapons being acquired and controlled exclusively by *states* will continue to hold will be examined in the following section on the evolving urgent threat posed by *non-state* terrorist groups.

June 3, 1961: Soviet Premier Nikita Khrushchev, left, and U.S. President John F. Kennedy
Photo courtesy of www.state.gov

From the Cold War to 9/11

The specter of nuclear terrorism has been a major concern since the creation of the first atomic bomb. In 1946, a year after two atomic bombs were dropped on Japan to end World War II and three years before the Soviet Union tested its own weapon, J. Robert Oppenheimer, the technical director of the Manhattan Project, was asked in a closed Senate hearing whether a

nuclear bomb could be smuggled into New York. Oppenheimer answered, "Of course, it could be done, and [a few] people could destroy New York." Oppenheimer was pessimistic about the practical possibility of preventing nuclear terrorism. When a startled senator asked "what instrument would you use to detect an atomic bomb hidden somewhere in a city," Oppenheimer quipped, "a screwdriver" to open every crate.[11]

The USSR's successful test of an atomic bomb in 1949 fueled concern that the Soviet regime might launch a sneak attack on the United States through nuclear terrorism. A 1950 National Intelligence Estimate (NIE) warned that "the Soviet Union has the capability for clandestine atomic explosions in ports and selected inland areas."[12] An updated NIE on Soviet intentions and capabilities in 1951 identified different smuggling scenarios, including the specter of the Soviet Union's secreting a "disassembled" bomb into "an isolated section of the U.S." Along with capabilities, the CIA estimate also saw potential Soviet intent to utilize this unorthodox mode of attack: "The USSR will have no scruples about employing any weapon or tactic which promises success in terms of over-all Soviet objectives."[13] Against this background of perceived threat from America's Cold War adversary—the second nuclear-weapon state—an interagency group involving the Department of Defense and the Atomic Energy Commission (the precursor to the Department of Energy) examined possible defenses. The resulting Screwdriver report, so-named after Oppenheimer's famous quip, concluded that wide-area detection of nuclear weapons and materials was not technically feasible, but that reasonably good point detection could be provided at key points of entry to detect kilogram-quantities of weapons-grade plutonium and uranium.[14] The recommendations of the *Screwdriver* report were implemented through *Project Doorstep* during the 1950s and 1960s. Among the measures taken to address the covert threat was the setting up of instruments at the main ports of entry used by Soviet-bloc diplomats to detect nuclear materials.

The Cuban Missile Crisis and the Mao regime's testing of an atomic bomb in 1964 generated renewed concern about the vulnerability of the United States to a clandestine nuclear attack from the Soviet Union or China. A 1968 National Intelligence Estimate warned that the Beijing regime might attempt to smuggle a nuclear weapon into the United States to deter the Johnson administration from launching a preemptive strike on China. Though successive NIEs during the 1950s and 1960s laid out various potential scenarios, the CIA never considered such a clandestine attack to be likely—nor does the available evidence (including some archival materials) indicate that the option was ever seriously contemplated by Moscow or Beijing.[15] The general view of state-sponsored nuclear terrorism by the Soviet Union and China was that such an attack would be the prelude to the initiation of general war. Once the United States (and the Soviet Union) acquired secure second-strike capabilities in the 1960s (thereby negating the possibility of a decapitating first strike), the concern about state-derived threats abated.

The signing of the Nuclear Non-Proliferation Treaty in 1968 was a milestone in establishing and codifying nonproliferation as an international norm. The NPT's so-called grand bargain was that five nuclear-weapon states (the United States, Soviet Union, China, Britain, and France) would not assist efforts by non-nuclear states to acquire weapons (Article I) and would make "good faith" efforts to eliminate their arsenals (Article VI). In return, the non-nuclear signatories pledged to forgo weapons acquisition (Article II), and place their civil nuclear facilities under international safeguards (Article III); they would then be permitted to obtain and develop nuclear technology for energy and other peaceful applications (Article IV). The essence of this grand bargain was presaged in Eisenhower's 1953 "Atoms for Peace" plan, which established the linkage between nonproliferation and peaceful use by offering the benefits of nuclear technology to states that renounced nuclear weapons.[16] The Atoms for Peace initiative was viewed by the Eisenhower administration through a Cold War prism in which the priorities

were to maintain U.S. global leadership and reduce Soviet influence. However, as South Asia nuclear expert Peter Lavoy concludes, an "unintended outcome" of the Atoms for Peace's liberal nuclear export policy was the proliferation of worldwide nuclear research and power programs, which, in three states—Israel, Pakistan, and India—led to the diversion of U.S. nuclear assistance to military use.[17] All three countries posed a challenge to the promulgation of an international norm against proliferation by exercising their sovereign right to abstain from the NPT, but none was perceived by the United States as an adversarial proliferator combining nuclear capability with hostile intent.

During the 1980s, concern about the nexus of terrorism and proliferation focused on certain Third World countries—a group eventually designated by U.S. officials as "rogue states." A critical development in this evolution was the inauguration of the Department of State's official listing of countries employing terrorism as an instrument of state policy. The Secretary of State was mandated by Congress to make this determination on an annual basis under a provision of the Export Administration Act of 1979. The step ushered in a heightened U.S. focus on the problem of state-sponsored terrorism that continued under the Reagan administration. The proliferation of ballistic missile programs in the Third World and the Saddam Hussein regime's use of chemical weapons against Iran during the 1980s symbolized the emerging nexus of terrorism and proliferation.

The term "rogue state" entered the U.S. foreign policy lexicon as the Cold War ended and after the 1991 Gulf War to reverse the Iraqi invasion of Kuwait. Saddam Hussein's Iraq was the rogue archetype: a regime pursuing weapons of mass destruction (WMD) and employing terrorism as an instrument of state policy. The Clinton administration designated the "rogues"—whose core group was Iraq, Iran, North Korea, and Libya—as a distinct category of states in the post-Cold War international system. "Rogue state" was a unilateral

American political concept, without foundation in international law, which was analytically soft and applied selectively against a diverse set of states that were hostile to the United States. The concept also proved problematic in practice. Once a state was relegated to this category "beyond the pale," the default strategy was comprehensive containment and isolation. Diplomatic engagement, as when the Clinton administration concluded a nuclear deal with North Korea in 1994 or sought to explore the possibilities after the election of a "reformist" president in Iran in 1997, was castigated by hard-line critics as tantamount to appeasement. The administration recognized that the term had become a political straitjacket, frustrating its ability to apply differentiated strategies tailored to the circumstances in each country, so it was expunged from the U.S. diplomatic lexicon by the Clinton State Department in June 2000 and replaced with the awkward moniker "states of concern." Though the term "rogue state" was revived by the George W. Bush administration *before 9/11*, the rogue concept was central to its strategy under the Bush Doctrine after the terrorist attacks of September 11, 2001.

The Nexus after 9/11

Despite assertions that "everything has changed," 9/11 did not change the structure of international relations. But it did lead to a redefinition of threat. In its 2002 *National Security Strategy,* the Bush administration explicitly argued that the dangers of the post-9/11 world derived from the very character of America's adversaries—irredeemable "rogue states" and undeterrable terrorist groups, such as Al Qaeda, whose only constraints are practical and technical, not moral or political. WMD proliferation and terrorism created a deadly nexus of capabilities and intentions. U.S. policymakers were driven by the nightmare scenario of a "rogue state" transferring a nuclear, biological, or chemical capability to a terrorist group in order to carry out a mass-casualty attack on the American homeland.

Crowd witnesses South Tower of the World Trade Center collapsing as a result of terrorist attack while North Tower burns on September 11, 2001 at 9:59 am in New York.
Photo Dan Howell / Shutterstock.com

The redefinition of threat precipitated a major shift in strategy. The Bush administration asserted that the Cold War concepts of containment and deterrence were "less likely to work against leaders of rogue states [who are] more willing to take risks" and more prone than an orthodox great power rival (such as the Soviet Union or contemporary China) to use weapons of mass destruction.[18] The 2002 *National Security Strategy* elevated the use of force, as "a matter of common sense and self-defense," not only *preemptively*, against imminent threats (a usage consistent with international law), but also *preventively*, against

"emerging threats before they are formed."[19] This articulation of the so-called Bush Doctrine propelled the shift from a pre-9/11 strategy of *containment and deterrence* to a post-9/11 emphasis on *regime change*. Changing the conduct of rogue states was deemed unlikely and inadequate because their threatening behavior was inextricably linked to the character of their ruling regimes: it derived from "their true nature," as President Bush put it.[20]

Iraq became the test case for the new strategy. Before 9/11, Saddam Hussein was likened by Secretary of State Colin Powell to a "toothache."[21] Afterwards, the asserted nexus between proliferation and terrorism—Saddam's resistance to the WMD disarmament mandated by the UN Security Council, and the Iraqi regime's purported links to Al Qaeda—provided the rationale for a preventive war of regime change. Secretary of Defense Donald Rumsfeld later acknowledged that the decision to go to war was based not on new intelligence, but rather on viewing old intelligence "through the prism of 9/11."[22] In making the case for urgent action, President Bush argued that after 9/11, the United States "cannot wait for the final proof—the smoking gun—that could come in the form of a mushroom cloud. . . ." To those who viewed Iraq as a strategic diversion from the war on terrorism, Bush bluntly countered, "To the contrary, confronting the threat posed by Iraq is crucial to winning the war on terror."[23]

After the successful U.S. military march on Baghdad in April 2003 to oust Saddam, Bush administration officials described the intervention in Iraq as a "type"—a model of coercive nonproliferation through regime change.[24] In the heady weeks after the cessation of "major combat operations," before the onset of the deadly Iraqi insurgency against U.S. forces, President Bush stated that the Iraq precedent had implications for how the United States would approach the challenges posed by other "rogue states," specifically North Korea and Iran. In Iraq, he claimed, America had "redefin[ed] war" by demonstrating the U.S. ability to decapitate a regime

without inflicting unacceptable collateral damage on the civilian population.[25] A senior administration official said that the message of Iraq for Iran's theocratic regime was: "Take a number."[26]

Just eight months after the fall of Baghdad, in December 2003, Libyan dictator Muammar Qaddafi announced that his country was voluntarily terminating its covert WMD programs and submitting to intrusive international inspections to certify compliance. The surprise announcement, which came on the heels of a financial settlement for the terrorist bombing of Pan Am 103 over Lockerbie, Scotland in 1988, was hailed by President Bush as an important step that would permit Libya to "rejoin the international community." If Iraq had set an important precedent—nonproliferation through a change of regime—Libya offered the alternative: nonproliferation through change in a regime.

Bush administration officials claimed Qaddafi's strategic turnabout as a dividend of the Iraq war. Qaddafi had been "scared straight" (as one analyst put it) by the demonstration effect of the regime-change precedent. The Iraq war may have been a necessary condition for Qaddafi's diplomatic volte-face, but it was not sufficient. The crux of the Libyan deal was the Bush administration's tacit but clear assurance of security for the regime: in short, if Qaddafi halted his objectionable external behavior with respect to terrorism and proliferation, Washington would not press for a change of regime in Tripoli. Without such a credible security assurance—if he had believed he was targeted for regime change regardless of any change in his behavior—Qaddafi would have had no incentive to relinquish his WMD arsenal.

The contrasting nonproliferation precedents of 2003—a change of regime in Iraq; a change in a regime in Libya—provided the political backdrop for the escalating nuclear crises with North Korea and Iran. In dealing with the nuclear defiance in Iran and North Korea, the Bush administration was caught between

the precedents set in Iraq and Libya. The administration could not replicate the Iraq precedent of direct military intervention, and it was unwilling to offer Tehran and Pyongyang the security assurance that had sealed the Libya deal. It failed to make clear whether the goal of U.S. policy was to replace regimes or to change their conduct. As a consequence, the administration missed opportunities to test Iranian and North Korean intentions.

Barack Obama campaigned for the presidency on a controversial platform of negotiating with rogue states. The shift was evident in his January 2009 inaugural address, when he offered to "extend a hand [to adversaries] if you are willing to unclench your fist."[27] The Obama administration jettisoned regime change rhetoric and the term "rogue state." Instead, Obama referred to Iran and North Korea as "outlier" states and reframed the challenges they posed in terms of their noncompliance with established international norms rather than in terms of the unilateral U.S. "rogue" concept. The Obama administration offered adversarial governments a structured choice: abide by international norms and gain the economic benefits of "greater integration with the international community," or remain in noncompliance and face international isolation and punitive consequences.

But the outliers rebuffed the extended hand. North Korea conducted its second nuclear test in May 2009, while Iran continued to flout UN Security Council resolutions requiring the suspension of its uranium-enrichment program. Both Pyongyang and Tehran seized on NATO's 2011 intervention in Libya as proof that Qaddafi had been duped by the West when he dismantled his nuclear program. For North Korea and Iran, the rationale that the Libyan military operation was undertaken as a "humanitarian intervention" rather than to achieve nonproliferation ends is an analytical distinction without a political difference. By taking down regimes in Iraq (2003) and Libya (2011), Washington effectively priced itself out of the security assurance market with Iran and North Korea.

The foreign policy dispute between the Obama administration and its critics centered on the appropriateness and efficacy of engaging hostile states—notably North Korea, Burma, Sudan, Syria, and, most pressingly, Iran. But this debate over *means* has been a surrogate for a more fundamental debate over *ends*. The crucial issue remains the *character* of the regimes—the persisting policy tension between the objectives of behavior change and regime change, and whether the former can be achieved only through the latter. Hardliners view engagement as tantamount to appeasement—rewarding "bad behavior"—and doomed to failure. The Obama strategy was described by then Secretary of State Hillary Clinton as "a two-track approach of pressure and engagement."[28] Primary among the administration's "multiple means … to bring [recalcitrant states] into compliance with international nonproliferation norms" have been smart sanctions on the target regime's core interest groups—that is, imposing tangible costs on those responsible for the objectionable behavior.[29] With Iran, for example, the focus was on interest groups such as the Islamic Revolutionary Guard Corps (IRGC), the hard-line military institution that not only controls the country's nuclear program, but also plays a lucrative role in commercial and black-market activities. The aim of the two-track strategy of pressure and engagement was to change the target regime's calculus of decision with respect to its nuclear capabilities.

In the post-9/11 period, "rogue states"—Iraq, Libya, Iran, and North Korea—were the primary focus of U.S. security policy, and the motivating scenario underlying the Bush Doctrine of "preemption" was that these regimes would either directly employ weapons of mass destruction (including nuclear) or deliberately transfer them to an undeterrable terrorist group like Al Qaeda. In launching a preventive war of regime change in Iraq in 2003, the Bush administration argued that the magnitude of the threat—the conjunction of WMD capabilities and the character of the Saddam Hussein regime—negated a reliance on the traditional strategies of containment and deterrence.

Unable to replicate the Iraq model of coercive nonproliferation through regime change, the Bush administration negotiated a verifiable WMD disarmament agreement with Libya that left the Qaddafi regime in power. The Libyan deal was a form of *deterrence by denial* as it limited (and indeed eliminated) the Qaddafi regime's WMD capabilities.

The Obama administration sought to replicate the Libyan model with Iran and North Korea by offering their regimes the structured choice between compliance and isolation. With Iran under the coercive pressure of economic sanctions, the 2013 election of a pragmatic president, Hassan Rouhani, created a political opportunity for revived diplomacy. Protracted negotiations over 20 months culminated in the historic Joint Comprehensive Plan of Action (JCPOA) of July 2015. The JCPOA significantly reduces Iran's potential plutonium route to nuclear acquisition and bought time by blocking Iran's access to weapons-grade enriched uranium for 15 years. These negotiated limits on Iran's nuclear capabilities constituted a form of deterrence by denial.

In contrast to Iran, the two-track strategy of pressure and engagement has not yielded results with North Korea, which crossed the nuclear weapons threshold in October 2006. Diplomacy with Pyongyang has stalled over the Kim Jong-un regime's demand to be accepted as a nuclear-weapon state by the United States and the other Six-Party Talk members as a precondition for the resumption of negotiations. Meanwhile, North Korea has engaged in military provocations along the demilitarized zone with South Korea and conducted additional nuclear and ballistic missile tests. With the option of *deterrence by denia*l through arms control with North Korea blocked, the Obama administration bolstered its essential complement—*deterrence by punishment*. In its 2010 Nuclear Posture Review, the administration "renew[ed] the U.S. commitment [made by the Bush administration after North Korea's 2006 nuclear test] to hold fully accountable any state, terrorist group, or other non-state actor that supports or enables terrorist efforts

to obtain or use weapons of mass destruction, whether by facilitating, financing, or providing expertise or safe haven for such efforts."[30] Though the catalyst for this declaratory policy was *specific*—North Korea's crossing of the nuclear threshold—the deterrent threat to hold any state or non-state "fully accountable" was a generic response to the threat of a "rogue state" deliberately transferring nuclear or other unconventional weapons to a terrorist group. But though this motivating scenario of U.S. strategy was central to the Bush administration's case for a preventive war against Iraq as a matter of urgency, WMD transfer was not the most likely contingency. Indeed, the controversial NIE on Iraq's WMD programs in October 2002 concluded that the one circumstance under which a "desperate" Saddam Hussein might either use WMD against the United States or transfer those capabilities to a terrorist organization was that which the Bush administration was about to embark upon—a march on Baghdad to topple the regime.[31]

More likely than the direct transfer of unconventional weapons from a rogue state to a terrorist group is the inadvertent "leakage" of nuclear and other WMD-related materials to terrorist groups from states that exert inadequate controls over these dangerous technologies. For this pathway to terrorist acquisition, the countries of primary concern are not the "rogues"—Iran and North Korea—but rather Russia and Pakistan. U.S. relations with Russia, which had already deteriorated under Putin in the 2000s, further declined after the Kremlin's aggression in eastern Ukraine and annexation of Crimea. Within that political context, Washington and Moscow did not renew the Cooperative Threat Reduction (CTR) program, which had been established at the end of the Cold War to secure Russian nuclear weapons and fissile materials. The looming question is whether the upgraded CTR-funded security measures at Russian sites will continue—or whether their erosion will increase the risk of leakage. Meanwhile,

Pakistan continues to build up its nuclear arsenal, including the development of battlefield tactical nuclear weapons. Pakistan has had a contradictory relationship with the United States: while designated a "major non-NATO ally" after 9/11, it has employed terrorism as an instrument of state policy against India and was the country to which Osama bin Laden fled from Afghanistan.

The states examined in this study lie at the nexus of proliferation and terrorism, where terrorist acquisition of a nuclear capability could occur either through direct transfer (North Korea and Iran) or indirect leakage (Pakistan and Russia). To address these threats, the United States faces the challenge of managing the policy tension between strategies of *deterrence by punishment* and *deterrence by denial*. An over-emphasis on the punitive threat of the former could undercut the target state's incentive for cooperating in the implementation of the latter. Effective strategies integrating both variants of deterrence should be tailored to the particular circumstances in each state. Such strategies will address the potential threat of state-sponsored nuclear terrorism. The goal is to create a structure of inducements and penalties to eliminate *state sponsorship* of terrorism, and to have *passive sponsors* whose regimes have turned a blind eye to terrorist activities on their sovereign territory desist. Effective strategies on the *state* level to prevent nuclear transfer or leakage will go far in countering *non-state* threats.

Terrorist Intentions and Capabilities

The Rise of Mass-Casualty Terrorism

Threat is the conjunction of hostile intent and the capability to act on it. In his historic Prague speech in April 2009, President Obama declared nuclear terrorism "the most immediate and extreme threat" to global security, and warned that Al Qaeda and other terrorist groups "are determined to *buy, build* or *steal*" a nuclear weapon and "would have no problem with using it."[32]

At the end of the Cold War, the conventional wisdom was that the threat of nuclear war between the great powers had declined, but that the use of a single weapon by a terrorist group had increased. This new calculus of threat reflected the rise of terrorist groups, notably Al Qaeda, with the *intention* of carrying out mass-casualty attacks, and increased concern that they could acquire this *capability* through the sale or handoff (transfer) of a weapon from a state, or the theft ("leakage") of a nuclear weapon or the weapons-grade fissile material that would permit terrorists to construct a rudimentary bomb.

Before the 1990s, the orthodox view was that most terrorist groups were not motivated to carry out operations with the explicit goal of inflicting maximum casualties. Based upon empirical evidence from the 1970s and 1980s, the widely held belief among Western experts was that national self-determination or ethnic-separatist groups (such as the Provisional Irish Republican Army) that employed terrorism

Left: People gathered in front of the Stock Exchange to remember the victims of the terrorist attacks that took place on March 22. Photo taken on March 29, 2016 in Brussels, Belgium. Photo courtesy of CRM / Shutterstock.com

thought that mass-casualty attacks would be counterproductive by generating a public backlash against their cause. Even radical groups, such as the Red Brigades in Italy, and "professional" terrorists, such as "Carlos the Jackal" and Abu Nidal, conformed to this "traditional" model of terrorism in which extraordinary means were incompatible with limited ends.[33] Notwithstanding instances of mass-casualty attacks using high-explosives (e.g., the October 1983 bombing of the U.S. Marine barracks in Lebanon), the conventional wisdom was captured in terrorism expert Bryan Jenkins' classic formulation from the mid-1970s, "Terrorists want a lot of people watching and a lot of people listening and not a lot of people dead."[34] The prevailing rationale that terrorists would eschew mass-casualty attacks using conventional means was extended to their potential acquisition and use of WMD—the misleading popular term that encompasses chemical, biological, radiological, and nuclear (CBRN) weapons.

Developments in the 1990s did not overturn the conventional wisdom but did call its underlying assumptions into question.[35] A major impetus behind this reassessment was three terrorist attacks not linked to a concrete political agenda and explicitly intended to inflict maximum civilian casualties. The increased lethality of terrorist incidents during this period was primarily attributable to a significant increase in terrorist groups whose primary motivation was religion.[36] The first episode occurred in February 1993, when Islamic radicals bombed one of the World Trade Center towers in the hope of toppling it into the other. Two years later, in March 1995, the millennial Japanese religious cult Aum Shinrikyo attacked the Tokyo subway system with sarin gas, killing a dozen persons and injuring an additional 3,700. The third episode came only weeks afterward, in April 1995, when two anti-government, Christian, white supremacists detonated a truck bomb (employing a homemade explosive derived from fertilizer) to destroy the U.S. federal office building in Oklahoma City, killing 168 people. Terrorism expert Bruce Hoffman observes that two other unsuccessful

terrorist attempts, which failed to generate public attention precisely because they *were* unsuccessful, augured the new era of mass-casualty terrorism—an abortive terrorist plot in 1986 to bring down a Pan Am jet, hijacked in Karachi, in downtown Tel Aviv, and a foiled attempt by the Armed Islamic Group in 1994 to crash an Air France jet, hijacked in Algiers, into the Eiffel Tower.[37]

The increasing lethality of terrorism promoted the emerging linkage of the terrorism and proliferation agendas. This new focus was evident in the controversial U.S. cruise missile strikes in 1998 on the al-Shifa pharmaceutical plant in Khartoum, Sudan, in retaliation for the bombing of the U.S. embassies in Kenya and Tanzania by an Al Qaeda cell. The Clinton administration claimed that the plant was controlled by the bin Laden organization and was intended to produce chemical weapons—a conclusion whose supporting evidence is disputed by critics. What is now known is that in the 1990s, when Osama bin Laden was building the Al Qaeda organization and refining its organizing concepts (including the contrived religious rationale for killing civilians in mass-casualty attacks), he expressed an interest in acquiring nuclear weapons. [38]

In 1999, a congressionally appointed national panel on terrorism readiness, chaired by the then Virginia governor James Gilmore, concluded that "previous beliefs about the restraint on terrorist use of chemical, biological, radiological, and nuclear (CBRN) devices may be disappearing," and that "the most likely" terrorist groups to use CBRN were "fundamentalist or apocalyptic religious organizations, cults, and extreme single-issue groups…."[39] But in making that case about emerging threats, the Gilmore Commission presciently sought to counter the growing trend in the public policy debate to view catastrophic terrorism as synonymous with WMD terrorism. It also underscored that higher-probability *conventional* attacks can have catastrophic consequences. For example, citing the hurdles that a terrorist group would encounter in developing an

effective chemical weapon, the report speculated that a terrorist group might instead attempt to engineer a chemical disaster by attacking an industrial plant or storage facility. The Commission rejected the "guiding assumption," evident in U.S. government counter-terrorism planning, "that smaller-scale, non-mass-casualty events are a lesser-included contingency that can be addressed adequately by preparations for higher-end mass-casualty attacks."[40]

After 9/11, the Taliban regime rebuffed the U.S. ultimatum to either hand over Osama bin Laden and dismantle Al Qaeda's terrorist infrastructure in Afghanistan or face regime change. The plausible reasons for the rejection are that the Taliban were reliant on the so-called "Afghan Arabs," who played a key military role in the ongoing civil war with the Northern Alliance, and that the Taliban's fundamentalist ideology was in accord with bin Laden's brand of Islamic extremism. Only after the successful military campaign in late 2001 to overthrow the Kabul regime was the symbiotic relationship between the Taliban and Al Qaeda fully evident. Al Qaeda's infrastructure in Afghanistan included training facilities (through which an estimated 10,000 to 20,000 fighters passed) and laboratories for developing and testing WMD capabilities.[41] Al Qaeda's immediate focus was on chemical and biological weapons, but documents from a Kabul safe house obtained by CNN also ominously confirmed its long-term interest in acquiring a nuclear capability. Al Qaeda may have used the Afghan government's civilian activities as cover for obtaining nuclear know-how and technology. Expert analysis of open-source information by the Institute for Science and International Security "found no credible evidence that either bin Laden or Al Qaeda possesses nuclear weapons or sufficient fissile material to make them…. [But] if they had a secret, fixed base in Afghanistan, over the last several years Al Qaeda and its Taliban allies could have made significant progress on nuclear research."[42]

The importance for Al Qaeda of essentially owning a country from which to operate unfettered cannot be overstated. For that reason, the war in Afghanistan was "a war of necessity," to destroy Al Qaeda's terrorist infrastructure and to deny the protection of a sovereign state to a group bent on perpetrating further mass-casualty attacks. This regime-changing war also established a cautionary precedent and a deterrent against state collusion with non-state terrorist actors.

Though 9/11 overturned the old orthodoxy about terrorism, the Bush administration struggled to articulate a vision of, and a strategy for, what the White House termed the "global war on terrorism." Strikingly, the *National Security Strategy* report of September 2002 mentioned neither "Islamist terrorism" nor "Al Qaeda," the organization headed by Osama bin Laden that had attacked the United States. The document's sweeping characterization of the threat focused not on the perpetrators but on the illegitimate instrument of violence that they employed: "The enemy is not a single political regime or person or religion or ideology. The enemy is terrorism—premeditated, politically motivated violence perpetrated against innocents." The Bush administration's *National Security Strategy* report, repeating a formulation earlier used by the president in his address to Congress after 9/11, did attempt to circumscribe the challenge. In declaring that the United States "is fighting a war against terrorists of global reach," the administration was attempting to distinguish between terrorist groups that aspire to carry out a mass-casualty attack in the United States from distant locations (e.g., Al Qaeda in Afghanistan) and other organizations, such as the Basque ETA in Spain, which employ terrorism to advance limited political objectives within their own state or immediate geographical area.[43] In contrast to the *National Security Strategy,* the *9/11 Commission Report* provided a succinct, focused definition of the threat: "[T]he enemy is not just 'terrorism', some generic evil. This vagueness blurs the strategy. The catastrophic threat at this moment in history is more specific. It is the threat posed by Islamist terrorism—especially the al Qaeda network, its

affiliates and its ideology."[44] Echoing this assessment, National Intelligence Director John Negroponte, the first incumbent of the consolidated post recommended by the 9/11 Commission, told the Senate Select Intelligence Committee in February 2006 that Al Qaeda is the "top priority"—the primary major threat to the United States. According to U.S. intelligence, Al Qaeda was among "nearly 40 terrorist organizations, insurgencies, or cults [that] have used, possessed, or expressed an interest in chemical, biological, radiological, or nuclear agents or weapons…."[45]

The rise of the Islamic State as an offshoot of Al Qaeda in Iraq and the stunning success of its military offensive to occupy territory in 2014 has transformed the regional security environment. ISIS's control over a large swath of territory in Iraq and Syria, including the occupation of a major urban area like Mosul, confers technological and engineering assets of a magnitude traditionally only under the control of a state that could allow it to develop WMD capabilities. ISIS's interest in acquiring WMD capabilities is reflected in its active chemical weapons program. ISIS has used a well-stocked chemistry lab at the University of Mosul to produce hydrogen peroxide-based chemical bombs. The Islamic State reportedly used mustard gas, which experts believe was fabricated in that university lab, against Kurdish fighters in northern Iraq in August 2015.[46] U.S. airstrikes targeted the Mosul campus to attack what the Pentagon described as a weapons-storage facility in March 2016.[47] A hyperbolic article in the Islamic State's propaganda magazine, *Dabiq*, raised the "hypothetical" that ISIS, having seized banks with billions of dollars, could tap sympathizers in "Pakistan to purchase a nuclear device through weapons dealers with links to corrupt officials in the region." The article proclaimed that the terrorist group was seeking "to pull off something truly epic."[48] This proclaimed intention underscores the necessity of denying the Islamic State the capabilities of a state. Such a strategy of deterrence by denial (as discussed in the "Recalibrating Deterrence" section below) would

not eliminate the WMD threat posed by ISIS, but would substantially reduce it.

Pathways to Nuclear Acquisition

After the catastrophic terrorist attacks on 9/11, British Prime Minister Tony Blair declared that the only constraints on Al Qaeda's obtaining and using a nuclear weapon were practical and technical, not political or moral.[49] The same holds today for the Islamic State. What then are the routes by which a terrorist group could acquire a nuclear weapon? The three broad pathways to nuclear weapons acquisition by a terrorist group are: (1) ***transfer***—the deliberate handoff or sale of a weapon from a state; (2) ***leakage***—an unauthorized transfer or theft of a weapon from an inadequately secured site; and (3) ***indigenous production***—manufacture of a nuclear device from leaked weapons-grade fissile material and bomb components.

TRANSFER

After 9/11, the Bush administration's *National Strategy to Combat Weapons of Mass Destruction* declared that "current and potential future linkages between terrorist groups and state sponsors of terrorism are particularly dangerous and require priority attention."[50] The nexus between terrorism and proliferation was the primary impetus underlying the elevation of military preemption as an option in the Bush administration's post-9/11 strategy. The transfer scenario was central to the Bush administration's urgent case for preventive war to topple the Saddam Hussein regime, which was then accused (contrary to the CIA's assessment) of having had direct links to Al Qaeda. The commonly attributed motivation for a "rogue regime" to hand off a nuclear weapon or technology to a terrorist group is a convergence of strategic interest between them. But even when a state-sponsorship link exists, as between Iran and Hezbollah, major constraints exert a powerful deterrent effect.

State sponsors employ terrorist groups as instruments of policy, and that implies a high degree of control. A WMD transfer would be an extraordinary act—both in its escalatory character and in its consequent threat to regime survival. Crossing that Rubicon would mean relinquishing control of the most valuable military asset in the state's arsenal. The transferring state would be taking the risk that the unconventional weapon employed by the terrorist group could not be traced to it and thereby trigger a devastating U.S. retaliatory strike. For example, Iran has not provided chemical weapons to Hezbollah out of concern about regime security. Iran experts Steven Simon and Ray Takeyh note that the Islamic Republic's leadership is "risk-averse to actions that could threaten regime survival—and that the transfer of nuclear arms to potentially uncontrollable clients would expose the regime to an unacceptable risk."[51]

The only strategic interest that could plausibly justify the risk of a state-to-non-state transfer would be regime survival itself. Of particular relevance to this issue is the controversial National Intelligence Estimate of October 2002 on Iraq, which concluded that Saddam Hussein, "if sufficiently desperate … might decide that the extreme step of assisting the Islamist terrorists in conducting a [WMD] attack against the United States would be his last chance to exact vengeance by taking a large number of victims with him."[52] Ironically, the course upon which the Bush administration was about to embark was the very scenario in which a "desperate" Saddam Hussein would most plausibly hand off unconventional capabilities to a terrorist group.

Another possible motivation for WMD transfer to a non-state actor, cited with respect to impoverished North Korea, is economic. North Korea's status as an economic basket case with an advanced nuclear weapons program creates a chilling conjunction of dire need and dangerous capabilities. Past experience makes black-market sales a cause of concern, since the Kim family regime has relied on illicit activities—from passing counterfeit money to selling drugs and ballistic missiles—to maintain power. North Korea has engaged in

covert nuclear commerce on the state-to-state level: with Syria, by providing a prototype nuclear reactor that Israel bombed in September 2007; and with Burma, where suspicions of nuclear cooperation have prompted the Obama administration to express growing concern.[53] As a former U.S. official warned, a desperate, economically destitute North Korea "could be willing to sell anything [to anyone] if the price is right."

LEAKAGE

Though the deliberate *transfer* scenario focused on Iran and North Korea has dominated the post-9/11 security debate, the more likely route by which terrorists might gain access to nuclear weapons or materials would be through unintended l*eakage* from inadequately secured sites. This acute concern centers primarily on Russia (which has an enormous legacy nuclear force and infrastructure from the Cold War) and Pakistan (which is rapidly expanding its nuclear arsenal and is poised to overtake Britain as the world's fifth-largest nuclear power, behind the United States, Russia, China, and France). Moreover, with China's announced plan to provide two civilian nuclear-power reactors to Pakistan, the scope of the potential leakage problem will expand in tandem with Pakistan's increased production of fissile material.[54] In 2004, the existence of a long-suspected nuclear smuggling ring headed by A.Q. Khan, the so-called father of Pakistan's nuclear-weapons program, was publicly confirmed. In a tearful "confession" on Pakistani television, Khan stated that his network had transferred nuclear components to Iran, Libya, and North Korea over a 15-year period, but that the government had not authorized these illicit activities.[55]

In addition to the leakage of sensitive technologies from the A.Q. Khan network to unpredictable states, another highly disturbing development was a reported meeting of Pakistani nuclear scientists with Osama bin Laden only weeks before 9/11. Supporters of the Taliban's ultra-orthodox version of Islamic rule and jihadist causes, the scientists expressed the belief

that Pakistan's nuclear capability is "the property of the whole Muslim community."[56] The episode underscored Al Qaeda's driving intention to carry out a mass-casualty attack employing still more powerful unconventional weapons.

The Islamabad government responded to the embarrassing revelations about the Khan network by instituting additional measures to ensure the physical security of the country's nuclear stockpile against theft and unauthorized use. When questioned about the threat of Pakistani nuclear weapons falling into the hands of the Taliban or Al Qaeda, President Obama expressed confidence in 2009 that "we can make sure that Pakistan's nuclear arsenal is secure, primarily … because the Pakistani army … recognizes the hazards of those weapons falling into the wrong hands. We've got strong military-to-military consultation and cooperation."[57] That assurance notwithstanding, Pakistan expert Stephen Cohen warned that the system of nuclear safeguards "could be circumvented in a determined conspiracy."[58]

INDIGENOUS PRODUCTION

The third pathway to nuclear-weapons acquisition is indigenous production—the possibility that, without the direct assistance of a state, a non-state actor could translate its *aspiration* to acquire an unconventional weapon into the construction of a homegrown WMD *capability*. A 1982 National Intelligence Estimate reflected the prevailing Cold War assessment of the nuclear threat: "During the period of this Estimate, the ability of subnational groups to acquire nuclear materials and to fabricate a workable nuclear device probably will remain low. The technical skills required probably will remain beyond the capabilities of well-known terrorist groups, and special nuclear material will remain difficult to acquire."[59] In October 2001, however, the CIA concluded that "fabrication of at least a 'crude' nuclear device was within Al Qaeda's capabilities, if it could obtain fissile material."[60]

Expert opinion remains divided over the feasibility and likelihood of this acquisition route—specifically, whether the primary constraint on a non-state actor's ability to construct a nuclear weapon is mere access to the requisite nuclear material. On one side are those who argue that terrorists could build a "simple" gun-type device based on illicitly obtained highly enriched uranium.[61] A 1977 report by the U.S. Congress's Office of Technology Assessment famously concluded that "a small group of people (possibly terrorists or criminals), none of whom have ever had access to classified literature, could possibly design and build a crude nuclear explosive device."[62] While enriched uranium would offer the easier pathway to a weapon, some analysts go further, even claiming that the construction of a more complex implosion-type weapon using plutonium was potentially within a sophisticated terrorist group's technical grasp. Other experts, however, are skeptical of this technical assessment. For example, Stephen Younger, a physicist long-experienced in nuclear-weapons design at the Los Alamos National Laboratory, observes: "'Just put a slug of uranium into a gun barrel and shoot it into another slug of uranium' is one description of how easy it is to make a nuclear explosive. Really? … [D]esign problems can be solved by experimentation, as indeed all nuclear states solved them in the design of their own weapons, but that requires a level of technical resources that, until recently, few countries could draw upon…."[63]

In addition to weapons-grade fissile material and a workable bomb design, a terrorist group would require sophisticated machine tools, a high-explosive testing range for triggering the device, and additional infrastructure. But notwithstanding these constraints, nuclear experts Matt Bunn and Anthony Wier conclude: "A nuclear attack might be one of the difficult missions a terrorist group could hope to try, but if a highly capable group acquired a stolen nuclear bomb or enough nuclear material to make one, there can be few grounds for confidence that they would be unable to use it."[64] Concern that a non-state terrorist group could cross this technological threshold to construct a nuclear-weapons capability has

invigorated efforts to globally secure weapons-grade fissile material. President Obama made this one of the pillars of the comprehensive arms control and nonproliferation agenda that he laid out in his Prague speech. A major objective of the four Nuclear Security Summits convened by the Obama administration since 2010 and involving some 50 world leaders has been to secure the estimated 2,000 metric tons of highly enriched uranium and separated plutonium worldwide. An essential complement to securing materials is denying a terrorist group a scientific-technological infrastructure and financing rivaling that of a state—for example, of the kind acquired by the Islamic State through its occupation of Mosul.

"DIRTY BOMBS"

Given the significant hurdles of buying, making, or stealing a weapon, nuclear terrorism is most likely to take the form of a so-called "dirty bomb" (also referred to as radiation dispersal devices, or RDD), which uses dynamite or some other conventional explosive to disperse radioactive material. A dirty bomb would not require weapons-grade fissile material, but could use radioactive sources, such as cesium and strontium, which are employed commercially or in hospitals. The immediate casualties from a dirty bomb attack would result from the blast effect of the device's conventional explosive rather than its radioactive core. The number of victims resulting from a dirty bomb's radiological effects would depend on a number of factors—the most significant of them being the ability of the device to aerosolize the radioactive material, thereby causing further human contamination through dissemination by wind. Though casualty estimates derived from models of RDD attacks vary significantly, they are of a scale such that a report from the National Defense University in Washington, D.C. concluded, "contrary to popular beliefs, RDDs are not weapons of mass destruction."[65] The consequences of a "dirty bomb" attack would be primarily economic, social, and psychological, as local, state, and federal governments undertake a lengthy and expensive clean-up, and civilians shun

areas they consider contaminated even when that clean-up process has been completed. Because public fear of radiation could well trigger mass panic, RDDs have been called weapons of mass disruption.[66] The only dirty bomb incident was carried out by the Chechen resistance movement, whose leaders repeatedly threatened a chemical, biological, radiological, and nuclear (CBRN) attack against Russia in the 1990s. In November 1995, a Chechen separatist leader contacted the media to warn that a dirty bomb containing cesium had been buried in a Moscow park. The Russian authorities deactivated the dirty bomb, which was probably deployed by the Chechens as an instrument of psychological warfare.

Across the spectrum of WMD capabilities, the formidable gap between a nascent capability and a usable weapon has been evident in terrorist efforts to employ biological and chemical weapons against civilian targets. In the few recorded cases, technical and environmental hurdles (e.g., the degradation of bio-agents when exposed to sunlight) impeded the effective dissemination of toxins. For example, Japan's Aum Shinrikyo, after having given up on acquiring a nuclear capability, failed on at least nine occasions to carry out a bio-attack because either the botulinum agents they grew were not toxic or the aerosol sprayers used to spread anthrax clogged and became inoperative. Moreover, when Aum switched over in frustration from bio-agents to nerve gas, the terrorist group resorted to plastic trash bags with poked-out holes to disseminate the sarin gas in the Tokyo attack.[67] The October 2001 anthrax attack on the U.S. Senate and two other sites killed five people and was an additional psychological blow to a nation that only a month earlier had suffered 9/11. Most ominous about the attack was that the toxic agent was highly sophisticated in design, absolutely not the work of an amateur, though its mode of dissemination (letters passing through the postal system) limited the number of persons exposed.

In the post-9/11 era, U.S. intelligence officials have maintained that a terrorist attack using a weapon of mass destruction

is less likely than a conventional attack, and would be far less lethal than a WMD attack carried out by a state. That conclusion highlights the continuing relevance of the Gilmore Commission's 1999 finding: "[The] capabilities required to annihilate large numbers of persons—i.e., to achieve a genuinely mass-casualty chemical and biological weapon or nuclear/radiological device—appear, at least for now, to be beyond the reach not only of the vast majority of existent terrorist organizations but also of many established nation-states."[68] That condition could be changing if terrorists gain access to technologies that would permit the effective dissemination of a radioactive material or a biological or chemical agent over a broad geographical area. In the absence of such a capability, the impact of a chemical, biological, or radiological attack on the U.S. homeland would likely be economic and psychological.

The 9/11 terrorist attacks on New York and Washington utilizing hijacked commercial aircraft loaded with jet fuel (a low-tech cruise missile with a chemical agent) highlight the important distinction between mass-casualty and WMD attacks. Facing difficult hurdles to acquire an effective unconventional weapon, terrorists may alternatively strike vulnerable conventional targets to achieve a truly mass-casualty attack. Among the many such soft targets are chemical plants on the outskirts of major U.S. cities and the railroad tank cars, laden with noxious chemicals, that pass through urban areas. Two particular chemicals used for widespread industrial purposes are phosgene and chlorine, which were employed during World War I to produce chemical weapons. "But whereas a chemical attack during World War I used a few hundred pounds of chemicals, an attack on vulnerable stocks involving hundreds of tons of commercially-used chemicals could have a death toll potentially exceeding that of a low yield nuclear weapon."[69]

Though terrorists can mount mass-casualty attacks using conventional means, apocalyptic groups such as Al Qaeda and the Islamic State retain an interest in RDDs because they are

capable of generating large-scale socio-economic disruption and are far easier to acquire than a nuclear weapon. The Aspen Homeland Security Group soberly concluded: "The acquisition and dispersal of small quantities of radioactive materials such as cesium and cobalt, which are regularly used in medical and industrial activities, are far less technologically challenging than building and detonating a nuclear bomb. It is, therefore, somewhat surprising terrorists have not taken this path."[70] After the Brussels bombing in March 2016, the press reported that an ISIS sympathizer had worked and committed an act of sabotage at Belgium's Doel nuclear power plant before joining ISIS in Syria. Fears that ISIS was plotting an attack on Belgium's nuclear facilities were fueled by a video of a top Belgian nuclear official seized in the apartment of a terrorist suspect.[71] In Iraq, ISIS is reported to have seized 88 pounds of uranium compounds stored at Mosul University, which, though fortunately not weapons-grade, could presumably be utilized in a radiological device.[72]

Implications

The conjunction of terrorist intentions and capabilities that President Obama addressed in his Prague speech continues to define the contemporary threat of nuclear terrorism. Jihadist terrorist groups like Al Qaeda and the Islamic State remain driven, in the words of ISIS's propaganda, "to pull off something truly epic." As these organizations' uncompromising ideology demands the creation of a pan-Islamic caliphate, no way exists to end their terrorism through a political process of negotiation. With these jihadist terrorist *intentions* set and evidently immutable, U.S. policymakers must instead focus on the *capabilities* side of the equation to forestall nuclear terrorism.

The nuclear weapons and materials that a *non-state* actor like Al Qaeda or ISIS seek to acquire exist in *states*. The retooling of a Cold War concept—deterrence—to address the threat of nuclear terrorism in the post-9/11 era underscores the

centrality of state-based strategies. Effectiveness on the *state* level—from ending sponsorship of terrorism to developing governmental capacity and the political will to exert sovereign control over nuclear weapons and materials on states' own territory—is the key to countering non-state threats. A particularly worrisome development since 2014 has been ISIS's occupation of large parts of northern Iraq and Syria. Though U.S. policymakers continue to assert that the Islamic State is not a state, its control of territory has given it access to an infrastructure (such as at Mosul University) that could allow it to acquire state-like WMD capabilities. Hence the centerpiece of the U.S. strategy is to deny ISIS those capabilities by rolling back its territorial gains.

The central argument of this monograph in calling for the recalibration of deterrence is that effective strategies on the state level will not end non-state terrorist threats but would mark significant progress toward that long-term objective. Attention now shifts to four states of concern—Russia, Pakistan, North Korea, and Iran—which could be targets of terrorist efforts to "buy, build, or steal" a nuclear weapon.

Members of French special police forces of the Research and Intervention Brigade (BRI) and forensic experts are seen in a raid zone in Saint-Denis, near Paris, France, after the November 13, 2015 terrorist attacks in the French capital. REUTERS/*Christian Hartmann*

Iran: Denial through Arms Control

Iran embodies the "nexus" of terrorism and proliferation that redefined threat after the 9/11 attacks. The Islamic Republic "remains the foremost state sponsor of terrorism" on the U.S. State Department's annual designation and had a longtime covert program to acquire nuclear weapons.[73] Because of this conjunction, Iran always arises as a country of concern in discussions of nuclear terrorism. An Aspen Homeland Security Group report, assessing possible pathways of terrorist acquisition of nuclear weapons, noted in 2012: "[M]ight hostile nations secretly provide terrorists with such weapons to carry out deniable attacks against their foes? Many analysts see this as one of the dangers posed by Iran's nuclear program."[74]

This nightmare scenario, the plausibility of which is widely doubted by Iran experts, would require the Tehran regime to relinquish operational control of a nuclear or other unconventional weapon to a terrorist client group such as Hezbollah. In addition to the likely political constraints on the transfer scenario, a major consequence of the nuclear agreement—the Joint Comprehensive Plan of Action (the JCPOA)—concluded between Iran and the world's major powers in 2015 is to shut off this pathway of terrorist acquisition in practical terms. Under the nuclear accord, Iran's ability to produce weapons-grade fissile material, and therefore a weapon, is blocked for at least 15 years. If the agreement is successfully implemented, it cuts off the terrorists' pathways to the bomb—transfer, theft, or construction. With respect to nuclear terrorism, the arms-control agreement limiting the

Left: Iran's nuclear facility at Arak, Photo courtesy of en.wikipedia.org

Islamic Republic's capabilities is an instrument of *deterrence by denial*—and moves Iran down the list of "nations of concern."[75]

Revolutionary State or Ordinary Country?

In an April 2010 interview with the *New York Times* about the administration's *Nuclear Posture Review,* President Obama described Iran as an "outlier"—a state flouting international norms by defying its obligations under the Nuclear Nonproliferation Treaty. Senior White House aides confirmed that the use of the term was a calculated departure from the unilateral Bush-era moniker of "rogue state"—that is, reframing the Iranian challenge not in terms of a unilateral American political concept, but instead in terms of its non-compliance with established international norms.76 The shift in nomenclature from "rogue" to "outlier" was intended to convey that a pathway was open for Iran to rejoin the "community of nations" if it complied with nonproliferation norms and ceased to employ terrorism as an instrument of state policy.

The dilemma is that the Tehran regime views these foreign policy issues—the conduct that makes Iran an "outlier"—as an important source of domestic legitimation. Hence the nuclear issue is "a surrogate for a broader debate about the country's future—about...how it should interact with the wider world," observes Persian Gulf security specialist Shahram Chubin.[77] Iran's instrumental use of terrorism is also a proxy for this more fundamental debate. In Henry Kissinger's apt formulation, "Iran has to make a decision whether it wants to be a nation or a cause."[78] Yet, since the 1979 Revolution that swept the Shah of Iran from power and led to the creation of the Islamic Republic of Iran, the country's ruling regime refuses to make that choice. On the nuclear issue and on other issues affecting Iran's national interests, Tehran fastidiously asserts its rights as a "republic" in an international order of sovereign states. At the same time, the theocratic regime pursues an ideologically driven foreign policy (such as its support of Hezbollah) to

maintain revolutionary élan at home. Tehran's rejection of what it views as a U.S.-dominated international order is at the heart of the Islamic Republic's identity and worldview. Without these "revolutionary thoughts," as President Hashemi Rafsanjani once candidly acknowledged, Iran would become an "ordinary country."[79]

NUCLEAR PROLIFERATION

Iran's competing dual identities—revolutionary state/ordinary country—continually roil the country's politics, including the domestic debate over the nuclear program. After the damning June 2003 report of the International Atomic Energy Agency (IAEA) about Iran's covert nuclear program, President Mohammed Khatami acknowledged the need to balance the country's right to nuclear technology under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) with its responsibilities to the international community: "We have the right to use this knowledge and you [the IAEA and international community] have the right to be assured that it would be channeled in the right way."[80]

President Hassan Rouhani, a centrist who pledged to bridge the political chasm between moderates and conservatives, came to office in 2013, after the disastrous eight-year tenure of hardliner Mahmoud Ahmadinejad, on a platform of resolving the nuclear issue to end the country's isolation and the punishing international sanctions that weakened the economy. Iran's Supreme Leader, Ali Khamenei, gave Rouhani authority to conduct negotiations with the "P5+1" (the permanent members of the UN Security Council—the United States, Russia, China, the United Kingdom, and France—plus Germany) and quieted hardline opposition. When Rouhani attended the World Economic Forum in Davos in January 2014, one participant described his remarks as "an application to rejoin the international community."[81] But while acquiescing to Rouhani's revitalized nuclear diplomacy in the wake of his electoral

mandate, the Supreme Leader remained the final arbiter of any prospective agreement, based on a strategic calculus that has regime stability and survival as its paramount objective. His decision making on the nuclear issue has hinged on how he manages the unresolved tension over Iran's relationship with the outside world, in general, and the United States (the "Great Satan"), in particular. During the nuclear negotiations with the P5+1, Khamenei's dilemma was whether the *economic* benefits of an agreement (sanctions relief) outweighed its *political* costs (alienating hardline interest groups, especially the Revolutionary Guard, upon which the regime's survival depends).

TERRORISM

As with the nuclear issue, Iran's use of terrorism as an instrument of state policy has also been a proxy for the more fundamental debate about Iran's unresolved identity crisis. The U.S. State Department designated Iran as a state sponsor of terrorism in 1984. The move followed a series of terrorist acts in the Middle East (most notably, the October 1983 bombing of the U.S. military barracks in Beirut) in which Iran was directly or indirectly implicated. President Ronald Reagan identified Iran, along with Libya, North Korea, Cuba, and Nicaragua, as "outlaw governments" that constituted "a new international version of Murder Incorporated." In the post-Cold War era, the Tehran regime's support for international terrorism, in tandem with its pursuit of weapons of mass destruction, led the Clinton administration to designate Iran a "rogue state." In 1992, Iran was linked to the bombing of the Israeli embassy in Buenos Aires in March and the murder of Iranian Kurdish leaders in Berlin in September. In June 1996, 19 American military personnel were killed in the bombing of the Khobar Towers in Saudi Arabia, and an Iranian-backed group of Shi'a Muslims was suspected of the attack. After 9/11, the Tehran regime rejected President Bush's "with us or against us" rhetoric—"Who defines terrorism and who is a terrorist?" asked Iranian President Khatami.[82] He reiterated the longstanding Iranian

position that Middle Eastern groups employing terrorism, such as Hamas and Hezbollah, were exercising a legitimate right to oppose occupation. In mid-May 2003, the Bush administration, citing communications intercepts by U.S. intelligence, charged that Al Qaeda operatives based in Iran had been involved in three truck bombings in the Saudi capital of Riyadh that left 34 dead, including 7 Americans.

Though state-sponsored terrorism has declined since 2001, Iran remains its "most active" sponsor, according to the U.S. State Department. But the character of that sponsorship has evolved since the 1990s, when Iran conducted far-flung terrorist operations from Buenos Aires to Berlin. In the post-9/11 era, Iranian-backed terrorism has favored Palestinian groups, including Hamas, which employ terrorism against Israel. Iran's backing of these Palestinian rejectionists is *strategic* because of its perceived utility to the clerical regime as a source of domestic legitimacy—a validation abroad of the revolutionary vision it promotes at home. Support for terrorist groups also is a source of bargaining leverage and deterrence. As then Director of National Intelligence John Negroponte observed in 2006, Iran regards "this capability as a critical regime safeguard by deterring United States and Israeli attacks, by distracting and weakening Israel, and enhancing Iran's regional influence through intimidation."[83] A decade later, Iran's instrumental employment of terrorism continued, as National Counterterrorism Center director Nicholas Rasmussen told the Senate Intelligence Committee that Iran "works through the IRGC-QF [Iranian Revolutionary Guard Corps-Qods Force] and Ministry of Intelligence and Security to support groups that target U.S. and Israeli interests globally."[84] Iran has used terrorist groups as proxies to further its interests while retaining a degree of deniability.

In the transformed security environment after 9/11, concern about an Iranian nexus of terrorism and WMD proliferation was elevated because the key institutional liaison with

terrorist groups—the Revolutionary Guards—also played a key role in the country's pursuit of unconventional weapons (through its acquisition of foreign dual-use technologies, which have both civilian and military applications). The extent of IRGC involvement in the nuclear program is unclear.[85] The Revolutionary Guards control some of Iran's nuclear infrastructure, such as the Fordow enrichment facility located on an IRGC base near Qom.

Yet the Tehran regime, fearing military escalation with the United States or Israel, has also imposed restraints on its surrogates, such as Hezbollah.[86] Thus, Iran has refrained from transferring chemical or biological weapons to its proxies even though it has the capability to do so. This counterfactual suggests not only a low risk-taking propensity, but also a degree of centralized control over the WMD programs and terrorist operations within the IRGC, lowering the risk of unauthorized transfer to or use by a terrorist group.[87] As terrorism expert Daniel Byman observes: "Iran's past behavior suggests it is not likely to provide chemical, biological, radiological, or nuclear weapons to a terrorist group. Because these weapons can be devastating—or, at the very least, psychologically terrifying even when the number directly affected is low—they are far more likely to provoke escalation. In addition, these weapons are widely seen as heinous, potentially de-legitimating both the group and its state sponsor." Byman argues that the one scenario under which these "traditional restraints" would no longer hold would be an invasion of Iran with the objective of regime change.[88]

Nuclear Capabilities and Intentions

BACKGROUND

Suspicions of Iran's nuclear intentions date back to the Shah's era. The initial components of Iran's nuclear infrastructure (a five-megawatt light-water research reactor and related

laboratories at the Tehran Nuclear Research Center) were acquired through nuclear cooperation with the United States under the "Atoms for Peace" program. After acceding to the NPT in 1970, the Shah launched an ambitious plan to develop civil nuclear energy, which envisioned not only reactor construction but the acquisition of nuclear fuel-cycle technology (including uranium enrichment and reprocessing) to reduce the country's reliance on outside assistance. Although "no evidence has emerged confirming that Iran actually began a dedicated nuclear-weapons program under the Shah," concluded an International Institute for Strategic Studies (IISS) report, "… Iranian officials appreciated that the acquisition of enrichment and reprocessing facilities for Iran's civilian nuclear-power program would inherently create a nuclear-weapons option…"[89]

After the 1979 Revolution, Khomeini ordered a halt to construction of German-made nuclear reactors at Bushehr. This gave rise to a belief that the Supreme Leader was anti-nuclear. Yet the memoir of former nuclear negotiator and current Iranian President Hassan Rouhani recounts that, during his exile in Paris, Khomeini rebuffed the recommendation of a visiting Iranian scientific delegation to scrap the nuclear program on economic grounds. Khomeini reportedly recognized the strategic value of keeping the option open.[90] In the mid-1980s, as the clerical regime faced a national security imperative at the height of the attritional Iran-Iraq War, it indeed revived the nuclear infrastructure inherited from the Shah.

Details of Iran's extensive covert program to acquire sensitive nuclear technology surfaced after the IAEA's June 2003 report based on Iranian opposition sources, which had charged Iran with possessing undeclared nuclear facilities and pursuing activities outside the NPT safeguards system.[91] Of particular importance were essential design plans and components that Pakistani black marketer A.Q. Khan provided for a pilot uranium-enrichment plant at Natanz. The currently deployed Iranian centrifuges, the IR-1 and more sophisticated IR-2 models,

are based on the design plans for Pakistani centrifuges, the P-1 and P-2, provided by the Khan network. In the late 1980s, just as the Iran-Iraq War was ending, Iran established a unit to organize covert procurement activities for an undeclared nuclear program within the Physics Research Center (PHRC), under the purview of the research and development arm of the Ministry of Defense. By the late 1990s or early 2000s, the clandestine nuclear program was consolidated under the "AMAD Plan," whose executive affairs were conducted by the "Orchid Office" (so named because of its location on Orchid Street in Tehran).[92]

The AMAD plan's scope of activities included three key projects: converting uranium ore into the gaseous feedstock for centrifuges to enrich uranium at the then covert Natanz site; high-explosive experiments potentially linked to developing the trigger for nuclear weapons; and the redesign of the Shahab-3 missile reentry vehicle to accommodate a nuclear warhead.[93] By the late 1990s, at the height of Khatami's reformist presidency, Iran crossed the important technological threshold of self-sufficiency in centrifuge manufacturing.

NUCLEAR DEBATES

Iran's nuclear program has been characterized by Shahram Chubin as "marked by persistence and incrementalism, by determination rather than urgency."[94] For Iran, the toppling of Iraq's Saddam Hussein regime, which invaded the country in 1980 and used chemical weapons against Iranian forces, undercut the immediate strategic rationale for nuclear weapons. But even before the 2003 war eliminated the Iraqi threat, the clerical regime focused on Israel as an all-purpose bogey to curry favor with the Arab states and to argue that the Israeli threat justifies Iran's long-range ballistic-missile program. The unstated case for Iran's nuclear weapons program is often inferred to be the rough regional neighborhood—the possession of nuclear weapons by Israel, Pakistan, Russia, and the United States. Yet the Islamic Republic's persistent, longstanding

nuclear efforts do not reflect a crash program to acquire a weapon as quickly as possible in the face of an existential threat. Rather, Iran's nuclear motivations appear more akin to India's, which sees nuclear weapons as an indicator of paramount regional position. That implicit rationale for Iran's nuclear weapons program lies in the worldview of regime hardliners, who see the program as the ultimate guarantor of Iran's influence and security and, not incidentally, their own power.

The theocratic regime, dismissing suspicions of its nuclear intentions, has consistently maintained that the country is merely exercising its prerogative under Article IV of the NPT to develop civilian nuclear energy. IAEA concerns about "possible military dimensions," Iran claims, are based on fabricated documents fed to the agency by hostile intelligence services (viz., America and Israel). Activities that the United States views as a violation of nonproliferation norms are defended in Tehran as a sovereign right. From secularists to religious fundamentalists, a broad domestic consensus exists on Iran's right to have civil nuclear energy, and the populace has been receptive to the clerics' critique of the United States' selective concern about nonproliferation norms. Yet this sentiment does not translate into across-the-board Iranian political support for a policy of acquiring nuclear weapons.

The preponderance of Iranian public opinion has supported neither a full rollback of the nuclear program nor a near-term breakout to acquire nuclear weapons. Rouhani's unexpected election created political space for nuclear diplomacy with the P5+1, which yielded a comprehensive agreement in July 2015. Under the deal, Iran retains a bounded uranium-enrichment-program capacity that leaves Iran, as it has been for the last decade, a nuclear threshold state. Iran's mastery of the nuclear fuel cycle creates an inherent "breakout" option for weaponization. A major focus of the negotiations was extending that potential breakout period to at least a year (through agreed

limits on the number and sophistication of centrifuges, as well as on the permissible level of enrichment and uranium stockpile).

For Iran, the nuclear agreement concluded with the P5+1 is compatible with Iran's core national security requirements, as the country faces no existential threat from a foreign power necessitating the urgent acquisition of nuclear weapons. Indeed, to the extent that the Iranian leadership perceives a threat to regime survival, the sources are *internal* rather than external.[95] From a national security perspective, the nuclear hedge (which the Tehran regime retains under the agreement) is Iran's strategic sweet spot—maintaining the potential of a nuclear option, while avoiding the regional and international costs of actual weaponization. As former President Hashemi Rafsanjani candidly admitted in 2005: "As long as we can enrich uranium and master the [nuclear] fuel cycle, we don't need anything else. Our neighbors will be able to draw the proper conclusions."[96]

The JCPOA reaffirmed Khomeini's *fatwa* and the Islamic Republic's NPT commitment that "under no circumstances will Iran ever seek, develop, or acquire any nuclear weapons." Yet despite that bald declaration of intent, the agreement leaves Iran with the capabilities that allow it to retain its hedge option. The accord hedged the hedge, so to speak.

The Nuclear Agreement: A Deal, Not a Grand Bargain

The JCPOA, a detailed 109-page document with five annexes, offers both sides a winning political narrative. The Obama administration can highlight the meaningful constraints the agreement places on Iran's nuclear program—cutting off the plutonium route to a bomb and sharply reducing the number of centrifuges to the sole uranium enrichment site at Natanz—

and the extension to one year of the "breakout" time Iran would need to acquire a nuclear weapon if the Tehran regime made that strategic decision. President Rouhani and his chief negotiator, Foreign Minister Mohammad Javad Zarif, can argue that they codified Iran's sovereign "right" to enrich uranium and stood up to American bullying. President Obama, challenging his critics to offer a better alternative to the deal, argued that the only alternative to diplomacy is force. That option—what, by now, would be the most telegraphed punch in history—has major liabilities. A military strike on Iran's nuclear infrastructure would only delay not end the program, could well escalate into a war with Iran, carries the risk of spewing radioactive toxins into the environment, and could have the perverse effect of domestically bolstering the theocratic regime in the wake of a foreign attack.

None of the JCPOA's prominent critics came out in favor of the military option as an alternative to the deal. Instead, they argued that if tough sanctions created an Iranian incentive for a deal, still tougher sanctions could lead to a better deal. The contradictory argument, as one observer put it, was that Iran is so *irrational* that it constitutes a unique threat, but so *rational* that it would succumb to the coercive pressure of additional sanctions.

The diplomatic endgame in Vienna involved painful compromises. The agreement buys time (10-15 years), but after that period Iran's breakout time will again begin to shrink. In addition, technical questions and concerns (notably on verification and inspections) have been raised, which will put the agreement to the test during its implementation. But the two major criticisms that have been expressed about the nuclear agreement are on grounds beyond its realistic scope. The first broad criticism is that the deal will not lead to a full rollback of Iran's nuclear program. When President Obama assumed office in 2009, Iran had 9,000 centrifuges and was already a nuclear threshold state, since centrifuges that spin to

produce low-enriched uranium for reactors can keep spinning to produce highly enriched uranium for weapons. This was the crux of the dispute between Israeli Prime Minister Netanyahu and President Obama. The former pushed for a full rollback of Iran's nuclear infrastructure to deny Iran any hedge option for a weapon, whereas the latter set the American red line further down the technological continuum at weaponization. The maximalist objective—full dismantlement with zero centrifuges spinning—was no longer an achievable outcome when negotiations with Iran began in 2013.

The second line of criticism has been that the deal does not address Iran's increasingly assertive regional role, including its support for terrorist proxies, such as Hezbollah. From the U.S. perspective, the regional situation with respect to Iran is contradictory: the two are tacitly aligned in Iraq in the fight against ISIS and have parallel interests in Afghanistan, where both want to prevent the resurgence of the Taliban. But where U.S. and Iranian interests diverge—Syria, Yemen, and Lebanon—Washington will have to meet those challenges through a revitalized strategy of containment.

The nuclear agreement is a deal, not a grand bargain. Iran is not the Soviet Union, but that Cold War experience is pertinent, as Washington then pursued pragmatic engagement with the Kremlin on arms control within the context of an overall containment strategy. As a "deal," the nuclear accord is *transactional*, not *transformational* (to use James MacGregor Burns's classic policy dichotomy). U.S. hardliners are critical of the agreement because it does not affect the character of the Tehran regime, which they view as the source of the Iranian threat.

Though the nuclear accord is transactional, it is embedded in the broader issue of Iran's societal evolution. Obama and Iran's Supreme Leader Khamenei are each making a tacit bet. Obama is defending the deal in transactional terms (that it addresses a discrete, urgent challenge), but betting that it will empower

Iran's moderate faction and put the country on a more favorable societal trajectory. Khamenei is making the opposite bet—that the regime can benefit from the transactional nature of the agreement (sanctions relief) and forestall the deal's potentially transformational implications to preserve Iran's revolutionary deep state.

Assessment and Implications

The landmark nuclear agreement blocks the two pathways—plutonium and highly enriched uranium—by which Iran could attain a nuclear weapon for at least 15 years. The plutonium route was closed off when the core of Iran's Arak heavy-water reactor (whose operation could have produced weapons-grade fissile material) was removed in January 2016. Iran's uranium enrichment program was not fully rolled back, but it was significantly limited, both in terms of permissible operational centrifuges (confined to the sole enrichment site of Natanz) and the allowed percentage of enrichment (3.67 percent, a level well short of that necessary for a weapon).

Iran's ability to enrich uranium provides Tehran with an inherent hedge to produce a weapon.

When asked once about the possibility of a military option to resolve Iran's nuclear challenge, the IAEA chief Mohamed ElBaradei observed, "You cannot bomb knowledge"—a reference to Iran's demonstrated capability to enrich uranium. So long as the clerical regime retains power, that threat can be mitigated but not eliminated. The gap between Iran's pursuit of a hedge and the U.S. red line pegged to the technological achievement of weaponization created space for coercive diplomacy to affect Supreme Leader Khamenei's strategic calculus.

Iran's employment of terrorism as an instrument of state policy and pursuit of nuclear weapons inevitably gives rise to

concern about a possible "nexus"—nuclear terrorism. Iran's past behavior, not transferring chemical or biological weapons to Hezbollah when it had the capacity to do so, highlights the *political* constraints—specifically, the realistic fear of a devastating retaliatory strike against Iran by the United States or Israel if a proxy carried out a mass-casualty terrorist attack. Improvements in WMD attribution technology (potentially allowing an unconventional weapon or weapons-grade fissile material to be traced back to its source country) will bolster the credibility of this retaliatory threat, a form of *deterrence by punishment*. That political source of restraint is now bolstered by the *practical* constraints of the nuclear agreement that effectively cut off Iran's routes to a weapon or weapons-grade fissile material. The JCPOA's verification protocols, bolstered by the IAEA's advanced monitoring technologies, are robust but cannot eliminate the possibility of cheating. If the Tehran regime did make the strategic decision to develop new covert facilities for bomb-making, they would be running a great risk of detection; that the uranium enrichment facilities at Natanz and Fordow were both covert sites before their discovery by intelligence services would give the Iranians pause.

The JCPOA required protracted negotiations to achieve what is essentially a straightforward tradeoff between technology and transparency. The difficulty in "getting to yes" is testimony to the proxy status of the nuclear issue in Iranian politics. Iran's identity crisis—revolutionary state/ordinary country—remains unresolved. Iran's support for terrorist organizations like Hezbollah will continue, because regime hardliners, notably the Revolutionary Guards, view that as a source of domestic legitimation. Yet political and practical restraints will bound Iran's relationship with what the U.S. State Department has designated as "foreign terrorist organizations." The negotiated limits on Iran's nuclear program through the JCPOA greatly reduce the risk that a terrorist group would be able, in President Obama's Prague speech formulation, to "buy, steal, or [acquire

the materials to] construct" a weapon from Iran. By negotiating a landmark agreement that significantly limits Iran's nuclear capabilities for an extended period, the United States has achieved a form of deterrence by denial.

Iran's uranium enrichment facility at Natanz (aerial view)

North Korea: A Failed State with Nuclear Weapons

North Korea defies the neat typology of states that American officials have employed since the end of the Cold War. The Democratic People's Republic of Korea (DPRK) is a "failed state," where endemic crop failures have precipitated famine, and chronic fuel shortages have meant that the lights are literally out in the country.[97] Yet this "failed state" also possesses a small nuclear arsenal and is unpredictably aggressive, characteristics that made North Korea a charter member of the countries that the United States designated as "rogue states." The perverse incongruity of nuclear weapons and chronic food shortages is emblematic of the challenge posed by North Korea.

North Korea is on the verge of a strategic breakout. Its mastery of warhead miniaturization and long-range ballistic missile technology—almost certain in the next few years—will allow the North to threaten the U.S. homeland with a direct attack. At the same time, though estimates vary, the DPRK has an arsenal of 10-16 devices and is adding about one weapon every six weeks.[98] The nexus of nuclear weapons and impoverishment has raised the specter of the cash-starved Kim family regime's selling a nuclear weapon to another irresponsible state, or even a terrorist group. As Secretary of Defense Robert Gates bluntly observed, the North Koreans will "sell anything they have to anybody who has the cash to buy it."[99] Preventing North Korean nuclear terrorism will require a strategy incorporating both variants of deterrence—punishment (through a declaratory policy that threatens regime-changing retaliation should the

Left: North Korean leader Kim Jong-un at the launch of a new ballistic missile in this undated photo released by North Korea's Korean Central News Agency (KCNA) on March 4, 2016. REUTERS/KCNA

North transfer a nuclear weapon or materials to a terrorist group) and denial (through defense and revived arms-control negotiations to freeze its nuclear program and forestall a strategic breakout). As with the other states examined in this study, the challenge is managing the tension between these twin policies.

The Nuclear Challenge

North Korea's nuclear program was launched in 1964, when the Kim Il-sung regime established a nuclear facility at Yongbyon (60 miles from Pyongyang) with a small research reactor provided by the Soviet Union.[100] North Korea signed the Nuclear Nonproliferation Treaty (NPT) in December 1985, reportedly in response to pressure from the Soviet Union and Moscow's promise of four light-water nuclear power reactors.[101] (Afterwards, however, the Kim Il-sung regime pursued dilatory tactics to block implementation of the NPT, taking nearly seven years to provide a required inventory of its nuclear materials and facilities.) In 1986, North Korea completed an indigenously engineered five-megawatt nuclear reactor at Yongbyon that was well suited to the DPRK: it depended only on locally obtainable natural uranium, rather than imported heavy water and enriched uranium. U.S. concern about North Korea's nuclear intentions was triggered two years later with the construction of a new Yongbyon facility to chemically extract weapons-grade plutonium from the spent nuclear reactor fuel. Such a reprocessing facility served no purpose other than to support a nuclear weapons program. A CIA National Intelligence Estimate (NIE) concluded that the North Koreans, during a 1989 shutdown of the Yongbyon reactor, could have separated enough plutonium from spent fuel rods for two nuclear weapons.[102] In addition to the Yongbyon site, North Korea began construction of two larger reactors (estimated at 50 and 200 megawatts) which, when operational, would have created a "nuclear factory" yielding plutonium sufficient for

the fabrication of about 30 Nagasaki-sized nuclear weapons annually.[103]

Nuclear Crises (1994, 2002)

The first nuclear crisis with North Korea was precipitated by Pyongyang's announcement in April 1994 that the Yongbyon reactor would be shut down so that some 8,000 spent fuel rods, containing sufficient plutonium for several bombs, could be removed. To meet the North Korean nuclear challenge, the Clinton administration adopted a strategy of coercive diplomacy based on economic sanctions, after considering, and rejecting, the alternative of a preventive military strike on the Yongbyon nuclear installation. The overriding concern for U.S. officials, in effectively removing the military option from consideration, was that air strikes could have a "catalytic" effect triggering a general war on the Korean peninsula.

Intensive negotiations, jumpstarted by a visit of former President Jimmy Carter to Pyongyang, culminated in the U.S.-DPRK Agreed Framework of October 1994. The accord embodied a series of carefully calibrated, reciprocal steps that would be implemented over a decade-long period, and that could be halted or broken off in the event of Pyongyang's non-compliance. North Korea pledged to remain an NPT party and to cease reprocessing, and traded off its three reactors and reprocessing facility for two 1000 megawatt proliferation-resistant light-water reactors (which were to be constructed by an international consortium comprising the United States, Japan, and South Korea). The United States also offered the DPRK a "negative security assurance," pledging that it would not use nuclear weapons against North Korea while it remained an NPT party. Finally, Washington and Pyongyang committed to open diplomatic liaison offices as a first step toward "full normalization" of political and economic relations, though the Clinton administration linked that broader goal to further

progress in North-South Korean relations. Congressional Republicans castigated the Agreed Framework as essentially an act of appeasement, while Clinton administration officials argued that the accord made the best of a bad set of options inherited from the George H.W. Bush administration. As U.S. chief negotiator Robert Gallucci acknowledged, "[E]veryone was reluctant about the Agreed Framework."[104]

President George W. Bush's inclusion of North Korea in the "axis of evil" after 9/11 as part of a hard-line strategy was undergirded by an intelligence assessment that the DPRK system was under extraordinary stress.[105] North Korea "is teetering on the edge of economic collapse," Deputy Secretary of Defense Paul Wolfowitz argued, and that "is a major source of leverage."[106] The premise that North Korea was on the verge of collapse was marshaled in support of a strategy of comprehensive containment to squeeze the Pyongyang regime and thereby hasten that collapse. Conversely, this assessment of regime vulnerability suggested that the alternative engagement strategy, which would incorporate economic carrots to induce a change in North Korean behavior, could have the perverse effect of propping up the "teetering" regime.

The second nuclear crisis with North Korea unfolded in October 2002, when the United States confronted North Korea about a covert uranium-enrichment program, which would offer the DPRK an alternative route to nuclear weapons acquisition. As Washington confronted Pyongyang through diplomatic channels, the Bush administration terminated the Agreed Framework, which had frozen the plutonium program. The diplomatic confrontation over North Korea's uranium-enrichment activities turned into a much more urgent situation involving its renewed acquisition of plutonium. In 2003, North Korea withdrew from the NPT and prepared to reprocess 8,000 fuel rods that had been stored in cooling ponds pursuant to the Agreed Framework, and to extract sufficient plutonium for approximately six nuclear weapons. Preoccupied in Iraq

and without a viable military option, the Bush administration acquiesced to this breakout of North Korea's plutonium program.

Three years later, in October 2006, North Korea conducted a nuclear test and became the world's ninth nuclear-weapon state. This bold move overturned the U.S. assumption that a Chinese "red line" would deter Pyongyang from crossing the nuclear threshold. In response, the UN Security Council, with Chinese and Russian support, imposed sanctions to block the Kim Jong-il regime's importation of luxury goods and authorized the United States and other states to interdict North Korean shipping to prevent "illicit trafficking in nuclear, chemical or biological weapons, as well as their means of delivery and related materials."[107] In February 2007, during Six-Party Talks (involving North Korea, the United States, China, South Korea, Japan, and Russia), North Korea agreed to dismantle the Yongbyon nuclear facility and to make a full disclosure of its past and present programs. In October 2008, after North Korea had halted activities at Yongbyon and released a document about its nuclear history (though omitting disclosure of its uranium enrichment program and its nuclear exports to other countries), the Bush administration removed the DPRK from the U.S. list of state sponsors of terrorism.[108]

North Korea's crossing of the nuclear threshold, raising the grim prospect of the cash-starved Kim regime selling a nuclear weapon to a terrorist group, prompted President Bush to enunciate a policy of deterrence by punishment: "The transfer of nuclear weapons or material by North Korea to states or non-state entities would be considered a grave threat to the United States, and we would hold North Korea fully accountable for the consequences of such action."[109] While Bush's statement specifically referenced North Korea, the administration subsequently broadened that formulation into a general policy.[110] Yet the difficulty of enforcing red lines was evidenced in 2007, months after the North Korean nuclear test and the Bush

administration's deterrent threat, when Pyongyang conducted a *state-to-state transfer* with Syria by providing a prototype nuclear reactor. The Bush administration, hesitant to attack Syria in the wake of the WMD intelligence fiasco in Iraq, was also concerned it could trigger an escalation in Syrian meddling in Iraq, which the United States was desperately attempting to stabilize in the face of a determined Sunni insurgency. Israel bombed the Syrian nuclear facility, which had not yet become operational, in September 2007.

From "Strategic Patience" to Strategic Breakout

President Obama campaigned on a platform of diplomatically engaging adversary states. His inaugural address metaphor of extending a hand to unclenched fists was a stark contrast to the Bush administration's regime-change rhetoric. Dropping the "rogue state" rubric, Obama referred to North Korea and Iran as "outliers"—states defying international nonproliferation norms. In practice, the emphasis on behavior change signaled a willingness to offer North Korea an assurance of regime security to seal a denuclearization deal. But the Obama administration's gesture of conciliation was met by renewed North Korean provocations to force concessions, including international recognition of the DPRK's status as a de facto nuclear-weapon state. In 2009-2010, the fist remained clenched. North Korea carried out long-range ballistic missile launches, a second nuclear test, an attack on a South Korean naval vessel (killing 46 sailors), and the shelling of a South Korean border island.

After the May 2009 nuclear test, President Obama, framing the issue in terms of the Kim Jong-il regime's violation of international norms, declared: "By acting in blatant defiance of the United Nations Security Council, North Korea is directly and recklessly challenging the international community…. Such provocations will only serve to deepen North Korea's

isolation."[111] The administration, adopting a stance that officials characterized as "strategic patience," maintained the emphasis on changing Pyongyang's behavior and ruled out any concessions merely to bring North Korea back to the negotiating table. U.S. intelligence analysts speculated that the spike in North Korean belligerence was linked to domestic politics; the ailing Kim Jong-il, who was reported to have suffered a stroke in August 2008, sought to bolster the position of his eventual heir, third son Kim Jong-un.[112]

When Kim Jong-un succeeded Kim Jong-il after his death in December 2011, the window for diplomatic engagement appeared to open. A "Leap Day" agreement was reached between U.S. and North Korean diplomats on February 29, 2012, under which the North would suspend ballistic missile tests and open itself to international inspections in return for the resumption of U.S. food aid. But within two weeks, the "Leap Day" agreement fell apart when Pyongyang announced plans to launch a satellite using a ballistic missile covered under the moratorium. During a visit to South Korea, President Obama said the days of "rewards for provocations" were over.[113] In February 2013, North Korea conducted its third nuclear-weapon test amidst evidence from commercial satellite imagery that its 5MW plutonium-producing reactor at Yongbyon had been restarted. The Kim Jong-un regime also reportedly expanded the country's uranium enrichment capacity with the installation of additional cascades of centrifuges at its Yongbyon facility.[114] These developments raised the specter of North Korea's considerably expanding the size of its nuclear arsenal.

A Johns Hopkins University study approximates the current number of North Korean nuclear weapons at 10-16 devices (comprised of 6-8 fashioned from plutonium and 4-8 from weapons-grade uranium). The report estimates that the North's nuclear arsenal (depending on the growth scenario) could range from 20 to 100 weapons by 2020.[115] Additionally, in early 2015, American and South Korean intelligence officials

concluded that North Korea, which by that point had conducted four nuclear tests, had crossed another important threshold—mounting a small nuclear warhead on a missile capable of hitting Japan. In February 2016, a month after a fourth nuclear weapons test, North Korea launched a small satellite on a three-stage ballistic missile, but experts believe the deployment of an intercontinental ballistic missile capable of striking the U.S. homeland is several years away.[116] The North's robust development program has also included preliminary testing of submarine-launched and land-mobile ballistic missiles.

North Korea is working toward a strategic breakout that poses a twin threat. Qualitatively, the North's mastery of warhead miniaturization and intercontinental ballistic missile technology will allow the Kim Jong-un regime to threaten a nuclear strike on the U.S. homeland in the near future. Quantitatively, the uninterrupted growth of North Korea's nuclear arsenal elevates the risk that this unpredictable regime could sell a nuclear device or weapons-grade fissile material to a terrorist group.

Nuclear Weapons and Regime Security

For a beleaguered regime whose paramount concern is survival, domestic politics appear *the* key determinant of foreign policy. The conditions that led some Western analysts to categorize North Korea as a "failed state" manifested themselves in the 1990s, when an economy that had stagnated during the 1980s sharply declined, with national output contracting by roughly one-half. North Korean society was further beset by a mass famine that resulted in deaths estimated as high as one million; average life expectancy dropped by more than six years during the 1990s.[117] With national output plummeting, Pyongyang made the stunning public admission in 1993 that the North Korean economy was in a "grave" state.[118]

For Kim Il-sung, the "Great Leader" who founded the North Korean state, domestic exigencies created an imperative for

external engagement. The "Great Leader" moved to ease relations with the outside world, which meant putting the nuclear program on the negotiating table with the United States as a means of alleviating the country's acute economic crisis. But the strategy carried the risk of political contagion that could weaken the regime's totalitarian grip over North Korean society. The ruling elite have been insulated from the adverse consequences of North Korea's failed autarkic policies through a "court economy" that distributes food and foreign consumer goods to the regime's most loyal cadres.[119] But because North Korea, unlike oil-exporting Iran, does not have a ready source of hard currency, the regime has engaged in criminal activities (including counterfeiting and drug smuggling) to sustain its court economy.

North Korea's nuclear intentions must be viewed through the prism of regime security. The nuclear program is, at once, a driver of the country's international isolation and the primary source of its bargaining leverage with the outside world. Does the Kim regime regard nuclear weapons as a deterrent capability vital to regime survival or as a bargaining chip to extract economic inducements from the United States, South Korea, and Japan? An International Institute for Strategic Studies study of North Korea's WMD programs concluded, "The historical record suggests that the answer is both, and the emphasis that Pyongyang places on one or the other varies with domestic conditions and external circumstances."[120]

The second nuclear crisis, in October 2002, over the covert uranium enrichment program played out against the backdrop of U.S. preparations for a war of regime change in Iraq and President Bush's inclusion of North Korea in the "axis of evil." The chief North Korean nuclear negotiator told his U.S. counterpart, "If we disarm ourselves because of U.S. pressure, then we will become like Yugoslavia or Afghanistan's Taliban, to be beaten to death."[121] A senior DPRK official lectured visiting U.S. congressional staff members that Washington should

"stop trying so hard to convince us to abandon our nuclear program and start thinking about how you are going to *live with a nuclear North Korea.*"[122]

Since conducting its first nuclear test in 2006, North Korea has demanded that it be accepted as a nuclear-weapon state—a condition flatly rejected by the Bush and Obama administrations. After the NATO intervention in Libya in 2011, North Korea said that Qaddafi had been "tricked into disarmament" in 2003 through a U.S. assurance of regime security.[123] The Libyan intervention offered the North a useful pretext for hanging on to its deterrent. In 2013, the Kim Jong-un regime declared that its nuclear arsenal was "not a bargaining chip" and would not be relinquished even for "billions of dollars."[124] Nonetheless, North Korea has pursued negotiations in response to an internal crisis (such as the famine in the 1990s) to extract additional aid from South Korea, Japan, and the United States. As a seasoned U.S. negotiator put it: North Korea does not respond to pressure, but without pressure North Korea does not respond. The question is whether the combination of coercive diplomacy and revitalized diplomacy can forestall North Korea's imminent strategic breakout.

Assessment and Implications

The North Korean nuclear crisis is embedded in the broader issue of regime survival. Though the privations of North Korean society have led to periodic predictions of regime collapse, the Kim family regime has proved remarkably resilient. The dilemma is that the regime-change and proliferation timelines are not in sync. Though the threat posed by North Korea derives from the character of its regime, U.S. policymakers cannot wait for an indeterminate process of regime change to play out while the Kim Jong-un regime achieves a strategic breakout.

In 1999, former Secretary of Defense William Perry conducted a policy review for the Clinton administration concluding that

the North's economic weakness, though unlikely to lead to regime collapse, did create a motivation for the Pyongyang regime to negotiate. "[W]e must deal with the DPRK regime as it is," Perry argued, "not as we might wish it to be."[125] The Perry report advocated a strategy of comprehensive engagement that linked North Korean denuclearization (through compliance with the Agreed Framework) to the normalization of relations with the United States.

Three years later, in 2002, Deputy Secretary of Defense Paul Wolfowitz spoke of a "teetering" North Korea whose economic weakness was a "source of leverage." This premise suggested that the nonproliferation and regime-change timelines could be brought into sync. The United States could eliminate the North Korean nuclear threat through a comprehensive squeeze strategy to bring down the "rogue" regime. In short, a "hard landing" for the North Korean regime was inevitable, and the United States could hasten that outcome. The assessment also strongly argued against the alternative strategy of engagement, because any inducements offered to the Kim Jong-il regime to promote its compliance with international nonproliferation norms would merely serve to prop up a vulnerable regime. That perception of a regime living on borrowed time removed the urgency and utility of nuclear agreements with North Korea. Indeed, in October 2002, the revelation of DPRK's covert uranium-enrichment program led the Bush administration to declare the Agreed Framework "dead." To confront the North Koreans about a uranium-enrichment program of *unknown* scope, the Bush administration terminated the nuclear agreement that had frozen a plutonium program of *known* scope.

Underlying the Obama administration's offer to Pyongyang of normalization of relations for denuclearization was an assessment that the nuclear and regime-change timelines were not in sync, and that the two issues therefore needed to be decoupled. The Obama administration sought to test North

Korea's intentions by offering a structured choice to obtain a nuclear agreement curtailing the DPRK's capabilities in the near term; it relegated the internal process of societal change to play out on an indeterminate timetable. North Korea's second nuclear test, in May 2009, was a direct rebuff to the new U.S. administration's overture. Pyongyang's hardened position indicated an emphasis less on using its nuclear program as a bargaining chip to extract concessions than on obtaining international recognition as a de facto nuclear-weapon state. Secretary of State Hillary Clinton, reiterating the U.S. objective of denuclearization, rejected Pyongyang's nuclear assertiveness: "Its leaders should be under no illusion that the United States will ever have normal, sanctions-free relations with a nuclear-armed North Korea."[126]

The Pyongyang regime has been able to defy the international community because it has also been able to defy its chief patron, China. The North Korean nuclear test in 2006 crossed what Western analysts widely viewed as a Chinese red line given Beijing's logical apprehension that Pyongyang's provocative action could drive Tokyo and Seoul to reconsider their non-nuclear status. The Kims have likewise rebuffed Chinese calls for economic reforms and have maintained the North Korean economy's "military first" orientation. In North Korea expert Andrei Lankov's succinct judgment, "Reforms mean death."[127] Kim Jong-un has maintained this defiant rejection of economic reform, while a senior North Korean official told the Chinese in May 2016 that the country's policy of expanding its nuclear arsenal was "permanent."[128] Against the backdrop of the Kim regime's political intransigence and military advances, Secretary of State John Kerry called North Korea "the most important proliferation problem" in East Asia and underscored that China has "the most leverage" to address it.[129]

China has long viewed an uneasy status quo in North Korea as preferable to change. A so-called "hard landing"—regime

collapse—would, at minimum, create a refugee crisis and risk triggering a conflict on the Korean peninsula. Alternatively, a "soft landing"—peaceful reunification between North and South Korea—would end North Korea's status as a buffer state and leave China with a formidable pro-Western regional power—and perhaps U.S. troops—on its border. Facing unacceptable alternatives, Beijing made a strategic decision to prop up the vulnerable Kim family regime through economic assistance (food and fuel) and investments in politically connected North Korean trading companies. China turned a blind eye to UN sanctions adopted after the 2006 and 2009 nuclear tests by allowing the transshipment of North Korean military goods and technology to Iran, and by serving as the primary conduit for luxury goods to maintain the lavish lifestyle of the regime's elite. China's sustaining assistance has allowed the North Korean regime to avoid the hard choice between impoverished autarky and destabilizing integration into the international system. In so doing, Beijing effectively undercut the ability of the international community to bring meaningful pressure to bear on Pyongyang to alter its conduct. Will North Korea's imminent strategic breakout alter China's strategic calculus?

The projected growth of North Korea's nuclear arsenal creates an increased risk of nuclear terrorism. Since 9/11, North Korea has both offered assurances that it would not transfer nuclear weapons to terrorists and threatened to do so. In 2005, two years after the U.S. invasion of Iraq to topple the Saddam Hussein regime, a North Korean vice foreign minister warned that the regime had no plans to transfer but would not rule it out "if the United States drives [us] into a corner."[130]

Director of National Intelligence James Clapper warned about "the possibility that North Korea might again export nuclear technology."[131] Though information about North Korea's record of nuclear exports is scant, two prominent *state-to-state* transfers are known: first, in 2001, the Pyongyang regime sold

uranium hexafluoride (the feedstock for centrifuges) to Libya via Pakistan's A.Q. Khan; and second, in September 2007, the Israeli Air Force bombed a nuclear reactor in Syria (not yet operational) provided by North Korea.[132] The urgent threat is that the North's increased production of weapons-grade uranium potentially creates "a new cash crop" for the financially strapped regime.[133]

After North Korea's nuclear test in 2006, the Bush administration declared that the Kim regime would be held "fully accountable" if it transferred nuclear weapons or material to states or non-state entities. But "fully accountable" can mean a host of things. An alternative to calculated ambiguity would be an explicit red line: the deliberate transfer of WMD capabilities by a *state* to a *non-state* actor could trigger a non-nuclear, regime-changing response from the United States. Such a stance, which goes beyond current U.S. declaratory policy, could prove an effective form of *deterrence by punishment*. Further advances in nuclear forensics—the ability to attribute fissile material to its country of origin—would bolster the credibility of this threat.

Tightened UN Security Council sanctions, passed in March 2016 after North Korea's fourth nuclear weapons test, requires states to inspect all cargo passing through their territory to or from the DPRK.[134] This interdiction measure, in tandem with sanctions curtailing North Korea's access to funding and technology for its nuclear program, falls under the rubric of deterrence by denial. As with the four other major UN sanctions imposed on North Korea since 2006, effectiveness depends on Chinese enforcement, which has been tepid. China has turned a blind eye to the DPRK's sophisticated procurement network utilizing front companies and transshipment arrangements to import sensitive dual-use (i.e., civilian and military) technologies prohibited under UN sanctions.[135]

The most effective form of deterrence by denial would be an agreement, such as that concluded with Iran, to curtail North Korea's nuclear capabilities. Though U.S. and

North Korean diplomats met secretly to discuss a possible resumption of negotiation, a diplomatic impasse has persisted over Pyongyang's non-starter insistence that the DPRK be recognized as a nuclear-weapon state.[136] Yet, "strategic patience" has resulted in acquiescence, as North Korea builds up its nuclear arsenal and makes substantial progress in miniaturizing warheads and acquiring an intercontinental ballistic-missile capability.

With North Korea on the verge of a strategic breakout, the United States should pivot to serious diplomacy. The objective should be to prevent this quantitative and qualitative breakout by negotiating a freeze on North Korea's nuclear and missile programs. Siegfried Hecker, former director of the Los Alamos National Laboratory, calls these goals the "Three No's": (1) no new production of weapons-usable fissile material; (2) no testing of weapons or ballistic missiles; and (3) no exports of nuclear technology or weapons.[137] A freeze would preclude the additional testing that North Korea still needs to master miniaturization and reliable long-range missiles. If a freeze could be negotiated, its implementation would pose major verification challenges.

North Korea's strategic breakout would be a game-changer not only for the United States, but would also have adverse consequences for China (such as U.S. deployment of the THAAD antimissile system to South Korea). The United States and China have a mutual interest in preventing a North Korean strategic breakout. This conjunction of interest creates the political space for coordinated diplomacy to freeze North Korean capabilities. That will require China's applying meaningful pressure on the Kim Jong-un regime—not to promote regime collapse (with its attendant negative consequences for Beijing), but to accept a capping of its capabilities. China faces the choice of either working with the United States to prevent North Korea's nuclear breakout or living with its strategic consequences in northeast Asia as South Korea and Japan invariably respond.

The nuclear agreement with Iran is a relevant precedent. As with Iran, the goal of reinvigorated nuclear diplomacy with North Korea would be to buy time and prevent a deteriorating situation from getting worse. Negotiating with North Korea has its pitfalls: Pyongyang has cheated on past agreements and any American concessions, such as providing sanctions relief in return for a freeze, will be characterized as propping up an odious regime. While North Korea has stated that it is "not interested" in an Iran-type deal and that its situation was "quite different," Chinese Foreign Minister Wang Yi stated that the nuclear agreement concluded between Iran and the world's major powers (the P5+1) in 2015 was a "positive reference" for negotiations with Pyongyang.[138]

A Harvard Kennedy School study on preventing nuclear terrorism laid out alternative futures for 2030: a "high-security scenario," in which North Korea's nuclear capabilities have been "verifiably eliminated or capped at a low level, pending elimination"; and a "low-security scenario," in which the North "continues to expand its arsenal, to well over 100 nuclear weapons."[139] A complete rollback of North Korea's nuclear program in the near term is not feasible with a regime that regards nuclear weapons as both a deterrent vital to regime survival and a bargaining chip to extract economic concessions. That policy duality for North Korea has its analogue in the United States' twin strategy of deterrence—a "punishment" variant that threatens regime-changing retaliation should a North Korean-origin nuclear weapon or weapons-grade fissile material be transferred to a terrorist group; and a "denial" variant (through a negotiated freeze) that requires North Korean compliance and entails U.S. concessions (i.e., sanctions relief) that are potentially regime-extending. A negotiated freeze to cap the DPRK's nuclear and missile capabilities would offer both North Korea and the United States positive narratives: Pyongyang would claim that the world had recognized North Korea as a nuclear power; alternatively, the United States could assert that the freeze significantly constrains North Korea's

program, prevents a strategic breakout that could threaten the U.S. homeland, and is an interim step toward the eventual goal of denuclearization.

A former senior U.S. official once quipped: problems have solutions; dilemmas have horns. North Korea's nuclear challenge poses a dilemma because it is embedded in the broader question of the North's societal evolution. For the United States, managing this tension (as it works toward a negotiated freeze of North Korea's program) will require Washington to decouple the nuclear issue from the question of regime change and rely on internal forces as the agent of societal change.

Russia: The End of Cooperative Threat Reduction?

The specter of an inadequately secured Russian nuclear weapon's falling into terrorist hands dates to the end of the Cold War. Just after the failed August 1991 coup by Soviet regime dead-enders to oust President Mikhail Gorbachev, the Kremlin leader responded with silence to a question from visiting U.S. Senator Sam Nunn as to whether he had lost command and control of the USSR's nuclear forces during the crisis.[140] The Soviet empire, which disintegrated into 15 successor states four months after the coup, comprised one-seventh of the Earth's land mass and possessed a Cold War nuclear arsenal estimated at 35,000 weapons, 1,000 tons of highly enriched uranium, and 100 tons of plutonium.[141] Citing the magnitude of the threat posed by post-Soviet "loose nukes," Senators Nunn and Richard Lugar convinced a reluctant U.S. Congress to fund the Cooperative Threat Reduction (CTR) program to dismantle Soviet nuclear weapons and secure weapons-grade fissile material.

What began as an emergency measure in 1991 in response to an urgent threat evolved into a $2 billion comprehensive program spanning more than two decades. During that period, Russia deactivated 7,600 nuclear warheads and secured 24 nuclear weapons storage sites, as well as eliminating huge stockpiles of chemical weapons and ballistic missiles. In October 2012, the Russian government announced that it would not renew the Nunn-Lugar CTR program upon its expiration in 2013. Though narrowly justified in terms of the country's improved nuclear security situation, President Vladimir Putin's

Left: Military parade in Red Square, Moscow.
Photo courtesy of http://en.kremlin.ru/events/president/news/

decision reflected the downturn in U.S.-Russian relations and his regime's broader push to curtail American influence in various spheres of Russian public policy.[142]

Former Secretary of Defense William Perry referred to the Cooperative Threat Reduction program as "defense by other means."[143] By significantly reducing the threat that a Russian "loose nuke" could be illicitly transferred by sale or theft to a terrorist group, CTR was an effective form of *deterrence by denial*. The end of CTR raises concerns about Russian backsliding—whether, for example, the financially strapped Putin regime will continue to fund the U.S.-financed security upgrades at Russian nuclear sites. Some experts already see an uptick in the threat. Though the formal CTR program has lapsed, Russia and the United States continue to cooperate on a narrower range of issues—for example, on negotiating and implementing the nuclear agreement with Iran, removing the Assad regime's chemical weapons from Syria, and the new START agreement. Yet the scope of that cooperation will be affected by the overall state of the bilateral relationship, which has deteriorated still further with Russia's military intervention in Ukraine in 2014. The discord has spilled over into the counterterrorism realm as Russia, charging that the U.S. media had "demonized" Putin, boycotted the U.S.-sponsored Nuclear Security Summit in April 2016.[144] Notwithstanding Russia's political isolation over Ukraine and talk of a renewed Cold War, there remains a powerful mutuality of interests between Russia and the United States to collaborate on preventing nuclear terrorism. That vital commonality creates political space in this contentious new era for a fresh approach—a rebooted strategy of cooperative nuclear threat reduction.

Russia's Nuclear Legacy

The Soviet Union became the world's second nuclear-weapon state in 1949, when it conducted a successful test several years ahead of American intelligence estimates. From that initial test

(designated Joe-1, for Stalin, by U.S. officials) grew a gigantic Soviet nuclear arsenal. According to a non-governmental survey of global nuclear weapons inventories compiled by Robert Norris and Hans M. Kristensen of the Federation of American Scientists, in 1959, a decade after the first test, the number of Soviet nuclear weapons was estimated at 1,060; in 1962 (the year of the Cuban Missile Crisis), 3,322 weapons; in 1972 (the year of U.S.-Soviet détente and the first strategic arms control agreement), the level had jumped to 14,478; in 1986, the number of Soviet nuclear weapons peaked at 45,000.[145]

The Soviet arsenal was comprised of both *strategic* nuclear weapons (deployed on the Soviet version of the U.S. "triad"—ICBMs [intercontinental ballistic missiles], bombers, and submarines) and *tactical* nuclear weapons for battlefield use. In 1991, when Presidents George H.W. Bush and Mikhail Gorbachev signed the Presidential Nuclear Initiatives committing both sides to reduce substantially their tactical nuclear weapons stocks, the then Soviet Union was estimated to have between 14,000 and 21,700 "non-strategic" (tactical) warheads—that is, one-half to two-thirds of the country's total nuclear arsenal.[146] The Soviet state created an archipelago of "closed" nuclear cities for fabricating bomb components and fissile material and assembling weapons. (Russian nuclear scientists working in the closed town of Arzamas-16, where the first Soviet weapon was designed, nicknamed their facility "Los Arzamas.") This vast Soviet military infrastructure was complemented by an enormous civil nuclear power program, which encompassed additional fuel-cycle facilities (for plutonium and enriched-uranium production) and some three dozen operating nuclear reactors at 10 sites.

The Soviet nuclear test in 1949 gave rise to concern that the Stalin regime might attempt to smuggle an atomic bomb into Washington to carry out a decapitating surprise attack on the U.S. government. This scenario prompted Oppenheimer's quip that the only effective countermeasure to nuclear smuggling

was a "screwdriver" to open every crate entering the United States. Throughout the 1950s and 1960s, the CIA considered a clandestine attack possible but not plausible. Soviet and East bloc diplomatic archives, which became accessible to historians after the Cold War, do not indicate that this option was seriously considered by the Kremlin (or later by the Chinese, for that matter). Analytically though, even if Moscow had contemplated such a covert plan, it would not have fallen under the rubric of state-sponsored nuclear terrorism. Instead, the clandestine option would simply have offered the Soviet leadership an alternate means of delivering a nuclear weapon on U.S. soil as the initiating blow of a general war. What put to rest concern about this hypothetical option was the deployment in the 1960s of second-strike nuclear forces (i.e., hardened ICBM sites and submarine-based ballistic missiles) that could survive a surprise attack and deliver a devastating retaliatory strike.

During the Cold War, the primary concern relating to nuclear weapons security was not the contemporary threat of a "loose nuke" falling into terrorist possession. Rather, it was fear of the accidental or unauthorized use of a weapon by a rogue or unwitting commander somewhere across the vast Soviet nuclear complex. This focus was born of American concern about its own arsenal. In the early 1960s, the perceived risk of accidental nuclear use, or even war, arising from the Berlin and Cuban missile crises led Secretary of Defense Robert McNamara to support the installation of a "permissive action link" on every warhead in the U.S. arsenal to ensure that nuclear use could only occur through a deliberate decision taken by the president.[147] McNamara's immediate concern was foreign access, given reports of lax security over stockpiles of U.S. tactical nuclear weapons at NATO bases in Europe. President Kennedy ordered that all U.S. nuclear weapons in Europe should be equipped with "permissive action links," or PALs, a device attached to or built into a nuclear warhead that precludes the arming and detonation of the weapon without inputting an authorization code. In December 1962, Pentagon

General Counsel John T. McNaughton gave a speech that laid out the new nuclear security program whose centerpiece was PALs and concluded with a direct appeal to the Kremlin: "It is hoped that the Soviet Union will see the logic behind these policies and take comparable steps."[148] Early attempts by American officials to engage their Soviet counterparts on PAL technologies were snubbed. As Harvard's Graham Allison observed, "Skeptical of the Americans' preoccupation with technological solutions, the Soviet Union counted on people rather than on technology to control its nuclear arsenal."[149]

The autocratic Soviet leadership was fixated on maintaining central control over their nuclear arsenal. Special KGB forces were involved in custodianship over nuclear weapons, which were stored in fortified bunkers guarded by ethnic Russians (considered more politically reliable).[150] In addition, the Kremlin reportedly held the codes for activating nuclear weapons even more tightly than did Washington during the Cold War. This Communist Party control even extended to an ability to circumvent the military chain of command and directly launch some missiles from the Soviet capital (though intelligence experts were divided on whether this was operational or a precautionary backup).[151] In an authoritative study published just after the dissolution of the Soviet Union, nuclear command and control expert Bruce Blair offered this assessment: "Most Russian nuclear forces—all strategic weapons and most tactical weapons—must receive unlock codes from higher authority, without which the weapon cannot physically be dispatched or detonated…. However, many strategic weapons…and most tactical weapons lack sufficient PAL protection."[152] The threat captured in Senator Nunn's unanswered question to President Gorbachev was whether a nuclear security system predicated on tight centralized control could be maintained under the chaotic conditions of the post-Soviet era.

Nuclear Security and Threat Reduction

The multifaceted strategy to mitigate the threat of nuclear terrorism in the former Soviet Union has fallen under the rubric of *deterrence by denial*. As the post-Cold War era dawned, the essential first prong of this denial strategy was to circumscribe the scope of the threat. When the USSR disintegrated in December 1991, the urgent question regarding the disposition of the Soviet arsenal was how many of the 15 successor states would retain nuclear weapons. At the time, three of the newly independent states—Belarus, Ukraine, and Kazakhstan—had approximately 3,400 strategic nuclear weapons (capable of striking the United States) and more than 3,000 tactical nuclear weapons deployed on their territory. The United States and Russia diplomatically engaged these states to conclude the Lisbon Protocol of May 1992, which committed the three to transfer all weapons to Russia and to accede to the Nuclear Non-Proliferation Treaty as non-nuclear weapon states. By the end of 1992, all tactical nuclear weapons had reportedly been returned to Russia.[153] Despite some political balking by Belarus and Ukraine, the process of transferring the strategic weapons to Russia was completed in November 1996. Through the implementation of the Lisbon Protocol, Russia emerged as the sole successor nuclear weapon-state to the Soviet Union—a huge diplomatic achievement whose outcome was not a given when the USSR broke up.

The second element of threat reduction was nuclear arms control to reduce the number of warheads in the Russian stockpile. The Lisbon Protocol committed the newly created Russian government to implement the Strategic Arms Reduction Treaty (START) of 1991, under which the United States and then Soviet Union agreed to reduce their deployed strategic nuclear weapons from 10,000 to 6,000. In 2010, after two abortive efforts (START II and III), the United States and Russia finally agreed on an additional deep cut in their nuclear arsenals with the signing of the "New START," which

decreased the number of deployed strategic weapons to 1,550. As referenced above, Russian tactical (i.e., non-strategic) weapons were substantially reduced through the previously cited series of reciprocal unilateral actions with the United States—Presidential Nuclear Initiatives (PNI)—initiated in 1991 under Gorbachev and which continued into the Putin era. The vast majority of Russian tactical nuclear weapons were pulled from deployment and dismantled, with their nuclear cores blended down from weapons-grade fissile material into fuel for nuclear-power generation. By 2014, through the PNI agreement, the number of Russian tactical nuclear weapons had declined from the estimated Cold War range of 14,000 to 21,700 to approximately 2,000 warheads.[154] By reducing the number of weapons, and therefore the risk that one might be acquired by terrorists, these arms control measures were a form of *deterrence by denial*.

The third part of the strategy to mitigate the threat of nuclear terrorism occurring in or emanating from the former Soviet Union was the Nunn-Lugar Cooperative Threat Reduction (CTR) program. Congressional critics of CTR funding questioned financially supporting the security structure in other states rather than directly enhancing U.S. military capabilities. But CTR's utility was underscored by a Department of Energy task force in January 2001 (nine months before the 9/11 terrorist attacks) that declared: "The most urgent unmet national security threat to the United States today is the danger that weapons of mass destruction or weapons-usable materials in Russia could be stolen and sold to terrorists or hostile nation states and used against American troops abroad or citizens at home."[155] A primary CTR mission was to assist Russia in the dismantlement of nuclear weapons and their delivery vehicles and associated infrastructure pursuant to the START agreement. As of February 2013, the CTR program had helped the Russian nuclear authorities deactivate 7,613 warheads.[156]

The essential complement to disassembly was securing weapons-grade fissile material from dismantled warhead cores. Nunn-Lugar funds supported transportation of 92 train loads of Russian nuclear warheads from their operational locations to secure storage sites. The U.S. Department of Energy partnered with its Russian counterpart, Rosatom, to improve security at 31 civilian and 11 military sites housing more than half of the former Soviet Union's 600 metric tons of weapons-usable nuclear materials.[157] Washington and Moscow concluded a landmark 20-year "megatons to megawatts" agreement under which Russia blended down 500 tons of fissile material from decommissioned nuclear warheads and sold the fuel to the United States to generate electricity from civil nuclear reactors. Another major CTR initiative focused on supporting and redirecting former Soviet nuclear weapons scientists facing an uncertain future to counter the potential risk of their selling their WMD expertise to a terrorist group or "rogue state."

Putin's decision in October 2012 to discontinue the Nunn-Lugar Cooperative Threat Reduction program occurred against the political backdrop of deteriorating U.S.-Russian relations. The move reflected his rejection of Russia's perceived junior partner status and of allowing the United States to leverage its CTR assistance to intervene in the functioning of sensitive Russian national security agencies. The bilateral nuclear security cooperation that continued was further curtailed by Moscow in response to the imposition of U.S. sanctions on Russia for its aggression in Ukraine. In a sign of political pique, as noted above, Russia boycotted the 2016 global Nuclear Security Summit convened by the Obama administration in Washington.

When suspended in 2014, the Nunn-Lugar CTR program had compiled an impressive record of accomplishment—assisting Russia to deactivate over 7,600 nuclear weapons and to implement comprehensive security and accounting upgrades for all but a small fraction of the sites housing weapons-usable material and nuclear warheads.[158] Despite assurances from

Russia that high security standards would be maintained, the threat of backsliding is a major concern, given the government's fiscal plight precipitated by the downturn in the price of oil. Indeed, by early 2015, new security upgrades had been canceled at some of Russia's "closed nuclear cities," and a project to convert highly enriched uranium into non-weapons grade fissile material was ended.[159] A high-level U.S. Energy Department advisory panel concluded in August 2014, "Russia continues to have the world's largest stockpiles of nuclear weapons, separated plutonium, and highly enriched uranium (HEU) in the world's largest number of buildings and bunkers—and a variety of vulnerabilities remain that a sophisticated conspiracy could exploit."[160]

Assessment and Implications

With Russia, the potential pathway of nuclear acquisition by terrorists is neither transfer nor sale (as a deliberate act of state policy), but theft—either of a weapon or the fissile material to construct a crude one. The risk of theft arises from both within and outside Russia's nuclear infrastructure. The magnitude of the insider threat in Russia is reflected in the statistic that from, 2009 to 2012 alone, Rosatom fired 276 manager or executive-level employees because of corruption charges. Russian organized crime has penetrated some of the country's closed nuclear cities, which increases the risk that an insider could be bribed to perpetrate nuclear theft.[161] With respect to the external threat, Russia's nuclear facilities have been probed by Chechen terrorists, who have conducted mass-casualty attacks and aim to take the battle from the Caucasus to Russia proper.

When considering the risk of nuclear theft, one must distinguish between warheads and weapons-grade fissile material. The risk of a terrorist group's being able to steal and then detonate a nuclear weapon is low. The stockpile of Russian warheads, other than those deployed on intercontinental and submarine-launched ballistic missiles, is stored in special high-security

facilities. Moreover, all strategic and most tactical nuclear weapons (whose numbers have been substantially reduced through U.S.-Russian arms control agreements) are equipped with modern technical safeguards (such as PALs).[162] More plausible than the theft of a warhead is that of weapons-grade fissile material taking into account their sheer volume in Russia (an estimated 679 tons of highly enriched uranium and 128 tons of plutonium—with only 15-30 kg and 5-10 kg, respectively, needed for a bomb) and the large number of sites at which these materials are stored.[163] To put the risk in perspective, among the 30 countries where the International Atomic Energy Agency (IAEA) monitors stocks of HEU and plutonium, the agency has confirmed at least 20 instances of theft or loss, but not involving militarily significant quantities.[164] Notwithstanding the technical hurdles, a terrorist group could possibly construct a so-called improvised nuclear device if it acquired the requisite weapons-grade fissile material.

During the Cold War, the doctrine of mutual assured destruction, which made nuclear war between the superpowers unthinkable, was a quintessential strategy of deterrence by punishment. By contrast, in the post-Cold War era, the United States and Russia (as the sole nuclear successor state to the Soviet Union) pursued a cooperative strategy of deterrence by denial. In addressing the primary pathway by which a Russian nuclear weapon or weapons-grade fissile material could be acquired by terrorists—theft—a policy of deterrence by punishment is not credible and could be counterproductive. If a terrorist attack involving a stolen Russian nuclear weapon occurs, the United States would not plausibly retaliate in kind against Russia, which retains a nuclear arsenal that could deliver a devastating retaliatory strike. The calculus of decision with respect to the transfer or sale of a nuclear weapon by North Korea would be wholly different. That scenario—nuclear terrorism resulting from a deliberate act of state policy—would warrant a regime-terminating response.

Despite the deterioration in bilateral relations over Ukraine, the United States and Russia have cooperated on discrete WMD-related issues of mutual interest. On Syria, after the Assad regime used chemical weapons against the civilian population in August 2013, the Obama administration and Putin regime reached an agreement to dismantle Syria's chemical weapons program. The successful destruction of 1,290 metric tons of Syria's chemical agents by a June 2014 deadline was a significant accomplishment. But that cooperation with Russia has not extended into joint action to end the Syrian civil war, with Secretary of State John Kerry observing, "The worst of the [chemical] weapons are gone, but the despicable [Assad] regime and the crisis it has created remain and require our collective focus."[165] Likewise, on Iran, Russia played a constructive role as part of the P5+1 negotiating group (whose other members were the United States, Britain, France, Germany, and China) in achieving the breakthrough agreement to constrain the Tehran regime's nuclear program. The Syria and Iran precedents point to the possibility that Russia might join revived multilateral nuclear diplomacy toward North Korea to prevent a strategic breakout.

The end of the Nunn-Lugar Cooperative Threat Reduction program as originally conceived two decades ago was probably inevitable. Even had the bilateral relationship not deteriorated, Russia had grown resentful and suspicious of an asymmetrical donor-recipient relationship. When the Russian government announced the discontinuation of the Nunn-Lugar program, Russia's nuclear agency, Rosatom, declared that nuclear cooperation could be reestablished "on the basis of equality, mutual benefit, and respect." With a clear reference to Ukraine, the Rosatom statement further declared that such a new approach to nuclear security "should not depend on situational changes of political environment."[166] Despite the major negotiated reductions in U.S. and Russian arsenals since the end of the Cold War, nuclear tensions have risen—witness Putin's nuclear sabre-rattling in conjunction with

Russia's invasion and annexation of the Crimean peninsula in 2014 and Russia's ambitious nuclear modernization program to compensate for shortfalls in its conventional military forces. During the Cold War, arms control negotiations, pursued to stabilize what strategist Albert Wohlstetter referred to as "the delicate balance of terror," served as the primary forum for superpower dialogue. A constant tension was whether such talks should be linked to behavior in other areas—for example, Soviet adventurism in the Third World during the 1970s. Though outside events affected the overall bilateral relationship, an explicit linkage to arms control was eschewed by both superpowers because of their overriding mutuality of interests. The same urgency holds true today with respect to the prevention of nuclear terrorism.

The basis for revived U.S.-Russian cooperation exists in the Global Initiative to Combat Nuclear Terrorism, an international partnership of 86 nations established by the United States and Russia in 2006 to strengthen global capacity to prevent, detect, and respond to nuclear terrorism; and in UN Security Council Resolution 1540, which requires member states to prevent the proliferation of weapons of mass destruction to non-state actors.[167] The International Atomic Energy Agency, which Russia alluded to in announcing its decision not to participate in the 2016 Nuclear Security Summit, could be positioned to facilitate revived nuclear cooperation. Former senators Sam Nunn and Richard Lugar, co-chairs of the non-governmental Nuclear Threat Initiative (NTI), have proposed an agenda for a new U.S.-Russian partnership on nuclear security: "accelerating efforts to repatriate and eliminate U.S. and Russian-origin highly enriched uranium from other countries; collaborating on research and development of innovative nuclear security technologies; expanding nuclear security best-practice exchanges; and utilizing the extensive U.S. and Russian technical expertise to help support nuclear security improvements in other countries with nuclear materials."[168] A recent monograph on preventing nuclear terrorism by Harvard University's Belfer Center argues

for "a package of cooperation" on security that would also encompass nuclear energy, which would be an incentive of particular economic interest to Rosatom.[169] The policy challenge is whether such pragmatic cooperation to address an urgent persisting threat can be reestablished and insulated from the vicissitudes of the troubled U.S.-Russian relationship.

Below: Abandoned Nuclear Weapon Storage Facility - Northern Russia
Photo courtesy of Lana Sator


GHAURI

Pakistan: The Most Dangerous Country

Pakistan exemplifies the defining threat of the post-9/11 era—the nexus of nuclear proliferation and terrorism. In 2007, at the height of U.S. military operations in Iraq, the cover of *Newsweek* magazine declared, "The Most Dangerous Nation In the World Isn't Iraq. It's Pakistan."[170] That same year a poll of terrorism experts by *Foreign Policy* magazine found three-quarters viewing Pakistan as the country most likely to transfer nuclear technology to terrorists in the next few years.[171] The probable pathway of terrorist acquisition of a nuclear device or weapons-usable materials in Pakistan would be through theft ("leakage") rather than a deliberate act of state policy (as is the concern, notably, with North Korea). This apprehension arises from the dangerous conjunction of a fragile state with the world's fastest growing nuclear arsenal (including less secure tactical nuclear weapons for battlefield use) and a nuclear establishment vulnerable to penetration by homegrown radical Islamists.

The nuclear issue is embedded in the broader context of a U.S.-Pakistani relationship roiled by contradictions. Each country views the other as both a partner and a threat. Pakistan was designated "a major non-NATO ally" after 9/11 but was also the country to which the leader of the terrorist group that perpetrated those attacks was eventually tracked down and killed. The United States has provided pragmatic assistance to Pakistan to secure nuclear weapons, while the Islamabad regime remains obsessed by the specter of a U.S. strike, which predated the bin Laden mission in 2011, to seize the country's

Left: An army vehicle carrying the long range surface-to-surface "Ghauri" missile passes a portrait of the nation's founder, Mohammad Ali Jinnah, during a military parade to mark Pakistan day in Islamabad. Photo courtesy of Reuters.

nuclear arsenal. This core contradiction creates a major dilemma for U.S. policymakers attempting to fashion an effective deterrent strategy, integrating both cooperative and potentially punitive elements, to mitigate the risk of nuclear terrorism emanating from Pakistan.

Crossing the Nuclear Threshold

The origins of Pakistan's nuclear program date to the 1950s, when the country joined President Dwight Eisenhower's "Atoms for Peace" program for civil nuclear cooperation. For energy-dependent Pakistan, nuclear power offered an attractive option and was also a prestigious symbol of modernity. Pakistan's Atomic Energy Commission (PAEC) was established in 1956, and the country's first nuclear installation, a U.S.-supplied five-megawatt research reactor, became operational in 1965. In October 1964, China conducted its first nuclear weapons test—a major milestone affecting the security environment in South Asia. Pakistan's Foreign Minister, Zulfiqar Ali Bhutto, anticipating that India (which had facilities not under IAEA monitoring or safeguards) would cross the nuclear threshold in response, advocated that the Islamic Republic establish a nuclear weapons program. In 1965, Bhutto made the now renowned statement of intent to the Manchester Guardian: "If India makes an atom bomb, then even if we have to feed on grass and leaves—or even if we have to starve—we shall also produce an atom bomb as we would be left with no other alternative. The answer to an atom bomb can only be an atom bomb."[172] The "bomb lobby" led by Bhutto also advanced this option in recognition of the growing asymmetry of conventional military power between India and Pakistan and as an avenue of expanding security cooperation with China to hedge against sole reliance on the United States.[173]

Pakistan's humiliating military loss to India in December 1971, which resulted in the independence of the former East Pakistan as Bangladesh, catapulted Bhutto to the presidency and gave

fresh impetus to the country's nuclear weapons program. In the immediate aftermath of the war, Bhutto convened Pakistani nuclear experts and reportedly repeated his dramatic formulation that the country would "eat grass," if necessary, to acquire an atomic bomb. At this seminal conference, in early 1972, Bhutto called on the country's nuclear scientists to develop the latent capability—a hedge, in nonproliferation terminology—to allow Pakistan to respond "if something happens," a clear reference to the prospect of India's crossing the nuclear weapons threshold. India conducted a "peaceful nuclear explosion," in May 1974, thereby becoming the first nuclear-weapon state outside the Nuclear Non-Proliferation Treaty (NPT). India's 1974 test was the action-forcing event shifting Pakistan's 1972 "capability decision" into a "proliferation decision."[174] A U.S. State Department classified analysis of the Pakistani weapons program concluded in 1983 that "nuclear design and development work [began] soon after the Indian test."[175] A historical irony is that U.S. officials speculated in 1976 that the establishment of a multinational facility for producing nuclear fuel in the Shah's Iran, with which the United States was cultivating a strategic relationship, could offer Pakistan, then the country of primary proliferation concern to the United States, an alternative to developing its own capability.[176]

Pakistan initially pursued the plutonium route to weapons acquisition, but, after encountering constraints (such as foreign export control regulations impeding access to technology), focused its efforts on the uranium-enrichment pathway. That option was a fortuitous opportunity seized through the efforts of A.Q. Khan, the Pakistani nuclear physicist hailed as a national hero at home, while vilified by the United States for his black-market proliferation assistance from the 1980s onward to "rogue states," such as Libya, North Korea, and Iran. In 1974, Khan having worked in the Netherlands for URENCO, a uranium-enrichment corporation, returned to Pakistan with purloined centrifuge designs and nuclear-industry contacts and jumpstarted the country's uranium-enrichment program.

By early 1984, Khan asserted in an interview that Pakistan had reached an important milestone—possessing the capability to construct a nuclear weapon—based upon its uranium-enrichment production and weapons-design progress.[177] Pakistan's fabrication of weapons-usable, highly enriched uranium flouted its assurance to the United States that only reactor-grade, low-enriched uranium would be produced. A study by the International Institute for Strategic Studies concluded that Pakistan reached the nuclear weapons threshold around 1985-86.[178] A now declassified U.S. National Intelligence Estimate in 1986 determined that Pakistan was figuratively only "two screwdriver turns" away from an assembled weapon.[179]

China reportedly played an essential role in Pakistan's acquisition of nuclear weapons. In addition to facilitating Pakistan's mastery of uranium enrichment, the Beijing regime provided proven weapons designs. The Chinese decision to extend this critical assistance, which began in the late 1970s, reflected the importance the Beijing leadership attached to its geostrategic relationship with Pakistan vis-à-vis India, as well as China's skeptical attitude toward what it perceived as a discriminatory U.S. nonproliferation policy. With a stock of highly enriched uranium and weapons design, the key missing element was a delivery system. Pakistan's original plan was to configure the 40 F-16s procured from the United States in the mid-1980s for nuclear-weapons delivery. The F-16s were a tangible symbol of the Reagan administration's support for Pakistan at the height of the decade-long conflict to reverse the Soviet invasion of Afghanistan. But U.S. delivery of a final installment of 28 aircraft was eventually blocked by congressional legislation (the "Pressler amendment") that linked military and economic aid to a presidential certification that Pakistan did not "possess a nuclear explosive device." In 1990, President George H.W. Bush did not reissue that certification and the jet aircraft transfers halted. With that mode of nuclear-weapons delivery blocked, Pakistan turned to ballistic missiles as an alternative. In the early 1990s, China reportedly

sold Pakistan about 30 M-11 ballistic missiles and provided technical assistance to develop an indigenous production capability.[180]

Pakistan ended its nuclear ambiguity in May 1998 when it conducted six explosions on the heels of renewed Indian testing. Pakistan's foreign secretary declared that the purpose of the tests was to demonstrate the "credibility of the country's nuclear deterrent."[181] Pakistan also commissioned its first plutonium production reactor to create that alternative pathway for the acquisition of weapons-usable fissile material. In 2002, General Khalid Kidwai told an interviewer that Pakistan's "nuclear weapons are aimed solely at India" and "would be used only if the very existence of Pakistan as a state is at stake." He cited several contingencies that could trigger nuclear use: if India destroys the bulk of Pakistan's conventional forces, engages in economic strangulation, or foments large-scale internal subversion in Pakistan.[182] Pakistan's nuclear intentions arose from what its military and civil leaderships perceived as an existential threat to the Islamic Republic posed by India. But beyond general statements by officials about "credible minimum deterrence," Pakistan has not enunciated a formal nuclear doctrine.

Proliferation and Terrorism

An Obama administration official made the startling observation that Pakistan was on pace to becoming the fourth largest nuclear power—eventually eclipsing Britain and France, and trailing only the United States, Russia, and China.[183] A 2015 study by the Federation of American Scientists' Hans Kristensen and Robert Norris estimated the Pakistan nuclear arsenal at 100-120 weapons and with sufficient weapons-usable fissile material to top 200 devices.[184] Chinese-provided nuclear reactors, in tandem with a reprocessing facility to separate plutonium from spent reactor fuel, could permit Pakistan to increase significantly its annual warhead production. The

upper bound of the program is unclear because Pakistan's worrying development of tactical nuclear weapons for battlefield use has been justified by the Islamabad regime as essential for maintaining a credible nuclear deterrent in the face of Indian conventional superiority. This dramatic growth of Pakistan's nuclear stockpile (with the attendant security concerns addressed below) highlights the challenge of "vertical proliferation."

Pakistan, through the A.Q. Khan network, has also been a source of "horizontal proliferation" by facilitating the efforts of other countries to acquire nuclear weapons. In the post-9/11 era, U.S.-Pakistan relations were rocked by revelations about Pakistan's transfer of nuclear technology through the black-market network of A.Q. Khan to the states of primary proliferation concern to Washington—North Korea, Iran, and Libya.[185] The Khan network transferred uranium-enrichment technology to North Korea, thereby permitting the Pyongyang regime to develop that alternative to its existing plutonium program. North Korea's development of a covert uranium-enrichment program precipitated the nuclear crisis with the United States in 2002 that led to the abrogation of the 1994 Agreed Framework. Under a barter arrangement, North Korea reportedly provided ballistic-missile technology to Pakistan in return for this uranium-enrichment assistance. In the case of Iran, Khan provided bomb-related drawings, centrifuge components, and a secret list of worldwide suppliers. Iran's uranium-enrichment program, the primary focus of the Joint Comprehensive Plan of Action negotiated between Iran and the world's major powers in 2015, was largely based on models and designs obtained from Pakistan.[186] Likewise, with Libya, starting in the mid-1990s, the Khan network received about $100 million for a nuclear-weapons starter kit: some 4,000 centrifuges and the drawings to turn uranium into crude warheads. Fortunately, Libya did not have a cadre of trained scientists to exploit this technology, a telling sign of which was that much of the equipment never made it out of packing crates.[187]

The U.S. and British intelligence services uncovered the disturbing evidence of Pakistan's "onward" proliferation to third parties through their penetration of the A.Q. Khan network and their extraordinary access to the Libyan WMD programs after Qaddafi's decision in December 2003 to undergo complete and verifiable disarmament. Pakistan's then president, Pervez Musharraf, assured President George W. Bush that Pakistani officials had not been involved in these illicit activities, and that information obtained from Khan's interrogation would be shared with the U.S. government. Many longtime Pakistan watchers were skeptical that Khan's actions could have occurred without some official involvement or, at the very least, acquiescence. Musharraf was caught between the contending pressures of U.S nonproliferation demands and strong nationalist support for the father of his country's nuclear program. The Bush administration, which desperately sought Pakistani cooperation on both terrorism and proliferation, evidently decided not to sanction Pakistan for past behavior, with a view toward uncovering the scope of past illicit activities and preventing a future recurrence. The decision prompted speculation that the primacy of the counterterrorism agenda affected how hard Washington pressed Musharraf on proliferation.

Even more ominous than the evidence of technology transfers to states were contacts with widely viewed "undeterrable" non-state actors—specifically, the report that two Pakistani nuclear scientists had met with Osama bin Laden in Afghanistan in August 2001. With the 9/11 attacks planned and only weeks away, the Al Qaeda leader was already exploring ways to obtain nuclear, chemical, and biological weapons to mount still deadlier attacks. These scientists, who supported the Taliban's ultra-orthodox version of Islamic rule and jihadist causes, expressed the belief that Pakistan's nuclear capability is "the property of the whole Muslim community."[188] The ostensibly humanitarian non-governmental organization that was the umbrella for this contact included a former commander of Pakistan's notorious Inter-Services Intelligence (ISI) spy agency.[189] Although the Musharraf regime subsequently placed the scientists under

house arrest, this pre-9/11 episode underscored the profound danger posed by the potential "leakage" of Pakistani nuclear know-how or weapons-related technology to Al Qaeda or another Islamic extremist group through the action of rogue elements within its nuclear establishment. In 2013, a U.S. State Department report described the Khan network as "defunct" and that "[t]here is no indication" that the Pakistani government "has supplied nuclear weapons-related materials to other countries or non-state actors" since the network was "exposed and shut down in 2004."[190]

Pakistan's attitude toward terrorism has been ambivalent. While thousands of its citizens have been killed in sectarian-motivated terrorist attacks, the Islamabad regime has been accused of being a "passive sponsor" of terrorism by turning a blind eye to homegrown extremists and employing terrorism as an asymmetrical weapon against India in the ongoing Kashmir dispute. A 2015 State Department report stated that Pakistan has "not taken sufficient action against … externally-focused groups such as Lashkar-e-Tayyiba (LeT) …, which continued to operate, train, organize, and fundraise in Pakistan."[191]

Nuclear Security

During the 1980s and 1990s, U.S. strategy to prevent Pakistan from developing and testing nuclear weapons emphasized the threat of sanctions—a form of deterrence by punishment. After the May 1998 tests, pursuant to U.S. nonproliferation legislation, President Clinton imposed additional sanctions to those in effect since 1990 when the Pressler amendment was triggered. Those nuclear-related sanctions were waived by President Bush in the immediate aftermath of the 9/11 attacks to gain Pakistani cooperation in the war against Al Qaeda and the Taliban regime in Afghanistan. Rather than futilely attempting to coerce Pakistan to roll back its nuclear program, Washington instead initiated a highly classified program to cooperate with the Islamabad regime to secure the country's

nuclear stockpile. In short, the Bush administration did a turnabout, reorienting the deterrent strategy from punishment to denial. As David Sanger and William Broad reported in the *New York Times*, the United States provided $100 million of assistance to help with physical security and the training of Pakistani security personnel. The Obama administration continued the cooperative program, with State Department, Energy Department, and intelligence officials meeting secretly, in locales around the world, with senior Pakistani officials from the Strategic Plans Division (SPD), the key institutional actor in Pakistan's nuclear chain of command.[192]

In addition to overseeing the movement, deployment, and use of nuclear weapons, the SPD is also responsible for the security of the arsenal against both internal and external threats. Physical security of nuclear sites rests upon a multilayered defense that includes an elite 20,000 member military force, modern surveillance equipment, and an inventory system to track warhead components. SPD also has a vetting program to assess the political affiliation, religious beliefs, financial status, and psychological health of its personnel.[193] To prevent the accidental or unauthorized employment of nuclear weapons, Pakistan developed PALs, "permissive action links," without U.S. assistance. The detonation of a weapon reportedly requires a 12-digit alphanumeric code, which can only be released by the National Command Authority (NCA), the supreme body chaired by the Pakistani prime minister. According to Pakistani officials, the NCA employs a system requiring two or three people in the chain of command to authenticate launch codes for nuclear weapons.[194]

To further reduce the risk of unapproved use, warhead components are stored separately from delivery vehicles. But that key security feature may be changing as Pakistan moves toward tactical nuclear weapons deployed in the field. The U.S. fear is that these smaller, short-range weapons are more vulnerable to theft by a determined outsider or a rogue

insider with radical sympathies.[195] This shift could exacerbate an existing vulnerability—Pakistan's reliance on ground transportation to move warheads from site to site, which it does as a precaution against preemptive attack and seizure. Pakistani officials, some of whom view the United States as a greater threat to their nuclear assets than terrorist groups, consider mobile warheads shuttled around in trucks more secure than those in a garrisoned arsenal. But that security system rests on the assumption that determined jihadists cannot gain insider knowledge of the transportation routes.[196]

Dramatic events in recent years have accentuated the concern over terrorist infiltration of Pakistan's nuclear establishment. In January 2011, the governor of Punjab was assassinated by one of his own bodyguards who accused him of blasphemy.[197] In September 2014, Al Qaeda militants, assisted by some Pakistani naval personnel, attempted to seize a Pakistani frigate to use the anti-ship missiles against U.S. vessels, but they were repulsed after a suicide bombing and a prolonged firefight.[198] Nuclear security is further potentially compromised by widespread corruption: in 2015, Pakistan ranked 117th of 168 countries in Transparency International's Corruptions Perception Index. U.S. officials continue to express confidence in the security of Pakistan's nuclear stockpile. In October 2015, White House Press Secretary Josh Earnest stated, "[T]he government of Pakistan is well aware of the range of potential threats to its nuclear arsenal, and we continue to be confident that Pakistan has a professional and dedicated security force that understands the importance and the high priority that the world places on nuclear security."[199] But U.S. officials also acknowledge the limits of their knowledge. The $100-million assistance program during the George W. Bush and Obama administrations was a form of "cooperative threat reduction," but unlike the Russian experience with the Nunn-Lugar program, U.S. experts were not granted access to Pakistani nuclear sites. A Pakistani military official stated that access

to Pakistan's nuclear weapons facilities was a "red line" that Islamabad would not cross.[200]

The limits of Pakistani cooperation with the United States on nuclear security are a reflection of Islamabad's suspicion of U.S. intentions. This distrust was further heightened by the U.S. Special Forces mission to kill Osama bin Laden in May 2011, which was undertaken without the foreknowledge of Pakistani officials. National embarrassment that the world's most wanted terrorist was living in Abbottabad about a mile from Pakistan's counterpart to West Point quickly gave way to fury over the violation of the country's sovereignty. When then Senator John Kerry, the chairman of the Senate Foreign Relations Committee, visited Islamabad two weeks after the bin Laden raid, the furious Pakistani leadership demanded a written guarantee that the United States would never launch a similar mission to grab or secure Pakistan's nuclear arsenal, even if the country had descended into chaos during an internal crisis.[201]

The U.S. intelligence community's "black budget" for 2013, a copy of which was obtained by the *Washington Post,* belied the confidence about Pakistan's nuclear security expressed publicly by U.S. officials. The document warned that "knowledge of the security of Pakistan's nuclear weapons and associated material encompassed one of the most critical set of . . . intelligence gaps." Those blind spots were especially worrisome, the document said, "given the political instability, terrorist threat and expanding inventory [of nuclear weapons] in that country." The magnitude of concern within the intelligence community is such that the budget section for preventing the illicit transfer of nuclear weapons is divided into two categories: Pakistan and all other countries.[202]

Assessment and Implications

In 2016, the Nuclear Threat Initiative's annual *Nuclear Security Index* ranked Pakistan dead last for "security and control

measures" out of 23 countries with weapons-usable materials, and second to last (with only Russia worse) for the "risk environment."[203] Pakistan embodies the jarring juxtaposition of a fragile state threatened by homegrown jihadist terrorists and "the world's fastest-growing nuclear stockpile."[204]

The United States never employed a classic *deterrence by punishment* strategy, such as threatening a military strike on Pakistan's nuclear sites to prevent weapons acquisition. However, the Bush and Clinton administrations did impose punitive economic sanctions on Pakistan in accordance with the Pressler amendment. After 9/11, when Washington's counterterrorism priorities trumped nonproliferation concerns, U.S. strategy emphasized *deterrence by denial*, dependent on cooperation, to secure the Pakistani arsenal. But mutual suspicion limits cooperation because each views the other as both partner and threat. In the United States, the complicity of Pakistan's ISI in the harboring of Osama bin Laden is suspected, but unproven.[205] In Pakistan, the daring U.S. helicopter assault to kill the leader of Al Qaeda reaffirmed Pakistani fears and is viewed as a potential precedent for seizing Pakistan's nuclear arsenal.

The risk of nuclear theft is increasing as the number of warheads grows and Pakistan develops, and possibly deploys, tactical nuclear weapons for battlefield use. To the extent that Pakistan has a formal nuclear doctrine, it has been conveyed by officials under the rubric "credible minimum deterrent." But with the development of tactical nuclear weapons, Pakistan is jettisoning minimalism for what it perceives to be the requirements of credibility. General Khalid Kidwai of Pakistan's National Command Authority, defending the introduction of tactical nuclear weapons in Pakistan's inventory, argued that this new battlefield capability had "blocked the avenues for serious military operations by the other side," and that "the debate has been hi-jacked towards the lesser issues of command and control, and the possibility of their falling into

wrong hands. [That] is unfortunate, because it has distracted and diverted attention from the real purpose of [tactical nuclear weapons]—reinforcing deterrence [and] preventing war in South Asia…."[206] The new emphasis on credibility over minimalism has implications for the trajectory of the Pakistani nuclear program. Its ceiling in terms of numbers of warheads is not obvious, hence fueling the prediction that Pakistan's arsenal may well eventually surpass those of Britain and France.

The $100 million assistance package that the Bush and Obama administrations provided Pakistan to secure its nuclear arsenal was a form of *deterrence by denial* similar to the cooperative threat reduction program mounted with Russia after the Cold War. The Obama administration sought to revive periodic engagement to improve bilateral relations with Pakistan after they sunk to their nadir with a series of bilateral crises, including the bin Laden mission, in 2011. The administration pursued what the *New York Times's* David Sanger called "a transactional relationship that almost amounts to work-for-aid"—dropping the rhetorical pretense of "major non-NATO ally" and limiting cooperation to specific projects.[207] As with Iran, the Obama administration sought to limit the scope of Pakistan's nuclear program. A high priority of the secret talks, whose existence was leaked to the press in October 2015, is forestalling the deployment of tactical nuclear weapons that are more vulnerable to theft or unauthorized use, and whose deployment on the battlefield could provoke inadvertent escalation in a crisis (such as those in 1999 and in 2000-2002) with India. Perhaps in response to these U.S. concerns, Pakistan has built, but reportedly not deployed, tactical nuclear weapons. A key element of the deal offered by the Obama administration would be the relaxation of strict controls placed on Pakistan by the Nuclear Suppliers Group, a group of countries that oversees the export of nuclear technology.[208]

An arms limitation agreement, such as that floated by the Obama administration, would be a form of deterrence by denial

in that it would bound Pakistani capabilities, but not seek the now diplomatically unobtainable objective of a full rollback of the country's nuclear weapons program. Nonproliferation experts Michael Krepon and Toby Dalton argue that Pakistan's quest to be regarded as a "normal nuclear state" could be conferred if Islamabad accepted several rigorous conditions, including a commitment by Pakistan to forgo "full spectrum" deterrence (entailing the deployment of tactical nuclear weapons) in lieu of "strategic" (i.e., minimum) deterrence vis-à-vis India.[209] This alternative future would require a major shift in Pakistan's strategic calculus—with South Asia's geopolitics and Pakistan's domestic politics militating against change. Voluntary restraint to cap capabilities by Pakistan is difficult to envision while India continues to build up its nuclear forces in response to China.

China, Pakistan's s major strategic backer, has a mutual interest with the United States in preventing nuclear terrorism or war in South Asia, and Washington should encourage Beijing, at a minimum, to exert leverage on Pakistan's national security managers to ensure nuclear security. Washington's approach toward Pakistan's expanding nuclear program falls under the rubric of *deterrence by denial*. But the general declaratory policy in the U.S. *Nuclear Posture Review* of 2010—namely, that any state facilitating terrorist access to nuclear weapons or materials will be held "fully accountable"—is a form of *deterrence by punishment*. The calculated ambiguity of that formulation does not lock the United States into any automatic retaliatory response, but, for the Islamabad regime, the couched threat creates an additional incentive to secure the country's nuclear arsenal, lest it be held responsible should a weapon acquired by a terrorist group through "leakage" be attributed to Pakistan.

Pakistan's nuclear threat is embedded in the wider context of U.S.-Pakistani relations, which are at an inflection point. After 9/11, the U.S. counterterrorism agenda and the war

in Afghanistan trumped nonproliferation interests. With the United States ramping down its involvement in Afghanistan and Pakistan ramping up its nuclear capabilities, these priorities have been shifting. But getting leverage on Pakistan's nuclear challenge will require addressing the broader geostrategic environment—that is, harnessing what should be China's and India's shared interests in forestalling a nuclear breakout in a fragile state on their borders.

Above: Pakistani missiles on display in Karachi.
Photo courtesy of By SyedNaqvi90 at English Wikipedia, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=32511123


Nuclear
Security
Summit
Washington, 2010

Recalibrating Deterrence: Between Punishment and Denial

Deterrence after 9/11

Since 9/11, the Cold War concept of deterrence has been retooled to address the threats of a new era. Effective strategies on the *state* level to prevent nuclear terrorism are the prerequisite for addressing *non-state* threats, such as those posed by Al Qaeda and ISIS. Nuclear acquisition by a terrorist group requires state involvement, whether as an act of state policy or a failure to exercise sovereign control over weapons and weapons-usable fissile material on its territory. State-focused strategies will not eliminate non-state threats, but will go far in achieving that objective.

DETERRENCE BY DENIAL

Millennial terrorist groups aspiring to conduct mass-casualty attacks, like Al Qaeda and ISIS, may not be deterred by the threat of retaliation, but states, existing in an international system with laws and norms to govern state behavior, are subject to leverage to affect their behavior. In 2004, the United Nations Security Council unanimously passed Resolution (UNSCR) 1540 that recognizes non-state WMD terrorism as a threat to international peace and requires member states to adopt and enforce corresponding domestic regulatory measures. A violation of UNSCR 1540 would be referred to the Security Council for appropriate punitive action under the

Left: The first Nuclear Security Summit, held in Washington DC on April 12-13, 2010. Photo courtesy of www.state.gov

UN Charter's Chapter VII. UNSCR 1540 added an additional normative and legal layer to the nonproliferation regime, but a compliance gap remains because international law, with respect to states' joining or abstaining from treaties, is voluntary. Most notably, three nuclear states—India, Pakistan, and Israel (undeclared but widely acknowledged)—exercised their sovereign right not to accede to the NPT.

The principal pathways for a non-state actor to acquire a nuclear weapon or weapons-usable materials from a state—*transfer or leakage*—have been countered, respectively, by two updated variants of traditional deterrence. *Deterrence by punishment* seeks to affect the *intention* of a state to carry out a hostile act through the credible threat of a punitive response, whereas *deterrence by denial* seeks to affect the *capabilities* of the target state (either by blocking the acquisition of those means or through the adoption of defensive measures to render them ineffective).[210]

The vast majority of work done in the nonproliferation area to counter nuclear terrorism falls under the rubric of *deterrence by denial*. This covers a range of activities, including export controls to limit access to technology and physical security at sensitive sites to lock down fissile material to prevent illicit diversion, an objective pioneered through the U.S. Cooperative Threat Reduction program, which the Obama administration has proposed expanding to regions beyond its original focus on the former Soviet Union. But some forms of deterrence by denial can be non-cooperative—a notable example of which is the interdiction of contraband cargoes through the multinational Proliferation Security Initiative to prevent the trafficking of WMD technologies.

The Obama administration pursued "cooperative threat reduction"—a deterrence by denial strategy—through a series of four Nuclear Security Summits, the last of which was held in Washington in April 2016 that brought together some 50 heads of state. A signature accomplishment of the summit process has been the reduction in the number of countries

with weapons-usable nuclear materials from 32 in 2010 to 24 by the end of 2015.[211] Overall the summits resulted in the removal of approximately 3,000 kilograms of highly enriched uranium (HEU), enough for some 100 bombs. But to put that in perspective, that amount accounts for only 4 percent of global HEU stocks because the summit initiative focused only on "civilian" programs and excluded those devoted to military use. Meanwhile, Pakistan, China, India, and Japan are planning facilities that will add to their stocks of plutonium. In addition, Russia, which has some of the largest stockpiles of HEU and plutonium, boycotted the 2016 summit in Washington to express Putin's political pique with the United States over Ukraine sanctions.[212] Still, the Nuclear Security Summit process, the future of which is in question with the end of the Obama presidency, globally extended the cooperative security approach. Increased efforts by states to secure nuclear weapons and weapons-usable materials will impede the ability of a non-state terrorist group to buy, build, or steal a bomb.

DETERRENCE BY PUNISHMENT

The impetus for the Bush administration's administration decision to launch a preventive war to topple the Saddam Hussein regime in Iraq in 2003 was the nightmare scenario that a "rogue state" would transfer a nuclear weapon to a terrorist group. Yet the Bush administration did not issue a deterrent threat to prevent such a transfer from state to non-state actor until the North Korean nuclear test in October 2006. Dating back to the collapse of the Agreed Framework in 2003, President Bush had warned North Korea that its efforts to acquire nuclear weapons would "not be tolerated."[213] Nonetheless, North Korea greatly augmented its stock of weapons-grade fissile material by separating plutonium from its Yongbyon reactor's spent fuel rods. Only after North Korea actually conducted a test in October 2006 and became a self-proclaimed nuclear weapon state did President Bush enunciate a policy of deterrence by punishment: "The transfer of nuclear weapons or material by North Korea to states or non-state entities would be considered

a grave threat to the United States, and we would hold North Korea *fully accountable* for the consequences of such action."[214] While Bush's statement specifically referenced North Korea, the administration subsequently broadened that formulation into a general policy.[215] Yet the difficulty of enforcing red lines was evidenced in 2007, months after the North Korean nuclear test and the Bush administration's deterrent threat, when Pyongyang conducted a state-to-state transfer with Syria by providing a prototype nuclear reactor. Citing concerns about the "low reliability" of intelligence, the Bush administration did not respond militarily, but Israel took unilateral action, bombing the Syrian site in September 2008.[216]

The Obama administration's *Nuclear Posture Review* of 2010 included a verbatim repetition of the Bush policy on transfer: "renewing the U.S. commitment to hold fully accountable any state, terrorist group, or other non-state actor that supports or enables terrorist efforts to obtain or use weapons of mass destruction, whether by facilitating, financing, or providing expertise or safe haven for such efforts." But what precisely does "fully accountable" mean in practice? To the dismay of arms control proponents who hold that the sole purpose of nuclear weapons should be to deter other states' nuclear weapons, the Obama administration's calculated ambiguity left open "the option of using nuclear weapons against foes that might threaten the United States with biological or chemical weapons or transfer nuclear material to terrorists."[217] For North Korea, an alternative to calculated ambiguity would be an explicit red line: the deliberate transfer of WMD capabilities by the Pyongyang regime to a non-state entity could trigger a non-nuclear, regime-changing response from the United States. Such a stance, which goes beyond current U.S. declaratory policy, could prove an effective form of *deterrence by punishment.*

"No leader of any nuclear country other than North Korea," nuclear expert Michael Levi observed, "has any meaningful incentive to deliberately transfer nuclear weapons or materials

to a terrorist group."[218] For those other countries, a highly contentious issue relating to nuclear leakage is whether potentially negligent states, such as Pakistan, should be held "fully accountable." Technical advances in the area of nuclear "attribution" will increasingly permit experts to determine the *source* of fissile material should an attack occur. Toward that goal, the Bush administration established the National Technical Nuclear Forensics Center within the Department of Homeland Security in 2006. According to this DHS unit's mission statement, "Nuclear forensics may support attribution efforts that serve to bolster U.S. defenses against nuclear threats, across a wide spectrum, by *encouraging* nations to ensure the security of their nuclear and radiological materials or weapons to help prevent unwitting transfers to third parties through loss of control."[219] The United States has an interest in publicizing its attribution capabilities so that states of proliferation concern will know that they need to take possibility of detection, and the attendant risk of retaliation, into account.[220] In the thorny case of Pakisan, political scientist Caitlin Talmadge argued, "It is difficult to imagine that the Pakistani government would turn a blind eye to a future A.Q. Khan if it believed that nuclear material or technology could be traced definitively back to Pakistan and that its people and infrastructure would suffer the consequences if those items were used in an attack against the United States."[221]

But should states be encouraged or threatened to get them to safeguard nuclear materials? A highly controversial proposal would extend the deterrent threat to these countries by enunciating a policy of "expanded deterrence" under which the country of origin of the fissile material used in a nuclear terrorist strike on the U.S. homeland would be held responsible.[222] Yet despite improving attribution capabilities, the United States might be unable to determine the source of the material after an attack, and would not want to be locked into automatic retaliation against a negligent state, such as Russia, which has a large nuclear weapons stockpile of its own. Opponents of "expanded deterrence" hold that "threatening retaliation against

countries like Russia and Pakistan in response to terrorist attacks stemming from lax security practices is unwise. It undercuts efforts to work cooperatively with those states to improve their nuclear security, dissuades [them] from informing others if they discover that their nuclear weapons or materials [have been] stolen, [thereby] undermining any efforts to recover them, and makes it difficult to work with [them] in the aftermath of an attack to prevent further detonations."[223]

Yet the deterrent threat captured in the calculatedly ambiguous phrase "fully accountable" does not commit the United States to a retaliatory response against the country of origin. This declaratory policy straddles the alternatives of "expanded deterrence" and that of non-retaliation. The aim would be to compel countries that need to improve fissile material security to do more to deny terrorists access to nuclear and other WMD capabilities. In short, the fear of *deterrence by punishment* could lead countries that are the potential sources of nuclear leakage to implement more effective strategies of *deterrence by denial*. An inherent tension exists between the twin variants of deterrence—punishment and denial. An over-emphasis on the punitive threat of the former potentially undercuts the target state's incentive for cooperating in the implementation of the latter. As discussed below, the policy tension between punishment and denial can be managed but not resolved.

Deterrence and Threat Reduction

DETERRENCE BY DENIAL THROUGH ARMS CONTROL

The countries of primary concern with respect to the nexus of proliferation and terrorism—Pakistan, North Korea, and Iran—are each at an inflection point.

Pakistan presents the striking contrast of a fragile state with a struggling economy (ranked 170th among states in per capita GDP) that is on a trajectory to become the world's fourth largest nuclear-weapon state. Its doctrine of credible deterrence has

entailed the development of tactical nuclear weapons more vulnerable to theft. Pakistan, rated second lowest for "risk environment," faces a formidable homegrown jihadist threat that threatens the country's domestic stability.

North Korea, an essentially failed state with a GDP estimated at a paltry $40 billion, is nonetheless on the threshold of a game-changing strategic breakout with nuclear weapons and intercontinental ballistic missiles that will allow the Kim Jong-un regime to directly threaten to the U.S. homeland.

Iran concluded the Joint Comprehensive Plan of Action with the world's major powers (the P5+1) that will hinder its access to weapons-usable nuclear materials for 15 years. By bounding Iran's capabilities, this arms control agreement was a form of *deterrence by denial*. The nuclear agreement was transactional (since it addressed a discrete urgent threat to prevent an Iranian nuclear breakout to the bomb), but it was not transformational (as the accord was limited to just the nuclear portfolio). Iran remains designated a state sponsor of terrorism by the U.S. State Department, but the JCPOA, if successfully implemented, radically reduces the risk of Iran transferring a nuclear weapon or weapons-usable materials to a terrorist group.

The Obama administration's strategy of "pressure and engagement" to attain the nuclear accord with Iran exemplified the successful management of the twin variants of deterrence—punishment and denial. The administration did threaten deterrence by punishment—widely interpreted as a potential military strike on Iran's nuclear infrastructure—if Iran crossed the technological threshold of weaponization. President Obama also clarified the mixed message of the Bush administration—making clear that the U.S. goal was to change Iranian behavior (by bringing Iran's nuclear program into compliance with its NPT obligations), not the maximalist objective of regime change. By narrowing the focus to Iranian conduct that violated established international norms, the Obama administration generated multilateral support, which

critically included Russia and China, to exert meaningful pressure on Iran.

The Iran nuclear accord set an important nonproliferation precedent. Could that approach—deterrence by denial through arms control—be applied to constrain the nuclear capabilities of two other hard cases, North Korea and Pakistan? In both, the objective would be to cap and secure those countries' nuclear weapons and weapons-usable fissile material. Opting for a negotiated freeze of capabilities recognizes that a full rollback of either North Korea's or Pakistan's nuclear programs is not a diplomatically attainable objective. That said, even the more modest goal of capping and securing their nuclear arsenals would face formidable political obstacles in both countries.

North Korea is the one state that would plausibly sell a nuclear weapon or technology to a terrorist group. The consequences of whether the North has an arsenal of 20 or 100 weapons by 2020 (i.e., the low and high projections of the recent Johns Hopkins study cited earlier) are enormous. Negotiating a freeze would buy time and prevent the problem from getting worse. China, which has balked at applying meaningful pressure on North Korea to curb its nuclear ambitions, faces a strategic choice of either acquiescing to Pyongyang's strategic breakout or living with its adverse consequences in northeast Asia (e.g., the August 2016 decision to deploy the THAAD antimissile system in South Korea). A negotiated freeze offers both North Korea and the United States positive narratives: Pyongyang would claim that the world had recognized North Korea as a nuclear power, while the United States could assert that the freeze forestalls a direct threat to the U.S. homeland and is an interim step toward the eventual goal of denuclearization. Deterrence by denial through arms control would be complemented by deterrence by punishment—a declaratory policy that threatens regime-changing retaliation should the North transfer a nuclear weapon or materials to a terrorist group.

To counter the threat of nuclear leakage in Pakistan, the United

States implemented a policy of deterrence by denial in the country through a $100 million program to secure Pakistan's nuclear laboratories and weapons (e.g., by separating warheads from triggers and missiles). Yet U.S. officials remain concerned about scientists who support radical Islamic causes infiltrating Pakistan's nuclear establishment, and, more broadly, about the remote (but not unthinkable) possibility of an acute regime-threatening political crisis during which nuclear security is breached and a warhead falls into the hands of Islamic extremists.[224] Indeed, the unilateral U.S. military strike on Osama bin Laden's compound in Abbottabad that violated Pakistani sovereignty heightened the preexisting Pakistani apprehension about such a U.S. commando threat to their nuclear arsenal. Hence, in a statement to parliament after the bin Laden raid, the Pakistani Prime Minister, Yusuf Raza Gilani, reaffirmed Pakistan's strategic relationship with the United States, but went on to warn, "Any attack against Pakistan's *strategic assets* [code for the country's nuclear arsenal] whether overt or covert will find a matching response. Pakistan reserves the right to retaliate with full force."[225] The bin Laden episode and its aftermath reflected the political tension inherent in a relationship in which each views the other both as partners and threats.

The Obama administration has reportedly floated a deal that would cap Pakistani nuclear capabilities (in particular, the expansion into vulnerable tactical nuclear weapons for battlefield use) in return for relaxing the strict controls on nuclear exports to Pakistan. The proposal would essentially trade off Pakistani restraint and transparency for measures to normalize the Pakistani nuclear program, essentially on par with the nuclear cooperation deal the Bush administration concluded with India in 2006. Pakistan would reject such an agreement if India continues to build up its nuclear arsenal and forward deploys forces that leverage its conventional superiority over Pakistan. In short, the negotiation of a cap on the Pakistani program so that this fragile state does not become the world's

fourth largest nuclear state can only be accomplished within the broader geopolitical context. China, which played a constructive role in negotiating the Iran nuclear deal, should have an interest in avoiding a spiraling arms race in South Asia that increases the risk of nuclear leakage from Pakistan.

Also at a political inflection point is ***Russia***, which made vital progress in securing its weapons and weapons-usable materials after the Cold War, but has now ended the Cooperative Threat Reduction program and runs the risk of backsliding. The Nuclear Threat Initiative's' Security Index ranked Russia as having the worst "risk environment" among 24 countries with weapons-usable nuclear materials. Russia's attitude is contradictory: on the one hand, the Putin regime helped achieve the nuclear deal with Iran as a member of the P5+1; on the other hand, it boycotted the Nuclear Security Summit convened by the Obama administration in April 2016. Given the overriding importance of nuclear security and counterterrorism, the United States should not link cooperation with Russia in this realm to other issues, such as Ukraine. Even during the Cold War, the United States and Soviet Union pursued nuclear arms control and eschewed linkage to other issues, such as Vietnam, because of their strong mutuality of interests. In the current era, however, as a political matter, the open question is whether pragmatic cooperation to address the urgent persisting threat of nuclear terrorism can be reestablished and insulated from the vicissitudes of the troubled U.S.-Russian relationship.

THE ISLAMIC STATE AND WMD TERRORISM

President Obama has stated that the Islamic State in Iraq and Syria (ISIS) is neither Islamic nor a state. But by occupying territory in Syria and Iraq and declaring that geographical area a caliphate, ISIS has assumed some of the attributes of a state. By contrast, Al Qaeda under Osama bin Laden preferred operating in a weak state like Afghanistan and viewed the establishment of a caliphate as a visionary goal. ISIS's control of a major city like Mosul provides this terrorist organization

technological and engineering assets of a magnitude comparable to a state that could allow it to develop WMD capabilities. ISIS, which has a declared interest in acquiring WMD capabilities, has an active chemical weapons program. ISIS exploited a well-stocked chemistry lab at the University of Mosul to produce mustard gas for use against Kurdish fighters in northern Iraq. ISIS propaganda has touted the possibility that, with the funds seized from banks in Mosul and other cities, the terrorist organization could tap its sympathizers in Pakistan to purchase a nuclear weapon from corrupt officials. Rolling back ISIS's control over territory in Iraq and Syria would block its access to the economic and technological capabilities of a state. Such a strategy of deterrence by denial would not eliminate ISIS's threat of WMD terrorism, but would substantially reduce it.

This study has focused on the role of deterrence in preventing catastrophic nuclear terrorism by a non-state actor involving an actual weapon bought or stolen from a state. This nightmare scenario is the classic deterrence dilemma—mitigating the threat of a low-probability event of highest consequence. A much more likely event of lower consequence would be the detonation of a radiological dispersal device (RDD)—a so-called "dirty bomb"—by ISIS or another terrorist group. After ISIS's deadly attack in Brussels in March 2016, Belgian investigators discovered that the terrorist cell that conducted the operation had also surveilled a nuclear power plant and videotaped a scientist at a nuclear research facility.[226] ISIS is motivated to conduct a dirty bomb attack in the United States or Europe because it would generate the group's desired result—mass terror.[227] RDDs have been called "weapons of mass *disruption*" because their consequences would be primarily economic and psychological. Though the cleanup of radioactive materials wrapped into an RDD's conventional explosive could cost billions of dollars, fatalities would likely be limited to those in the blast zone. More serious would be an attack on a nuclear power plant.

A strategy of deterrence by denial would aim both to block ISIS's (or any other terrorist group's) access to RDD capabilities and to deploy defenses to prevent a successful attack on a nuclear power plant. The former would entail securing radiological materials as is being done with weapons and weapons-usable materials. But radiological isotopes are in pervasive use throughout society in medicine and business, so a denial approach, while necessary, cannot realistically eliminate the threat. As a dirty bomb event is more likely than not to occur in the future, governments should mount a public education campaign on RDDs, and how they differ from nuclear weapons, to stave off mass panic in the wake of an attack.[228] A telling indicator of the urgent concern about the dirty bomb contingency is that at the Nuclear Security Summit in April 2016 world leaders were asked to role-play in a scenario devised by the White House in which a terrorist group acquires radioactive isotopes stolen from a hospital and plots an attack. The United States and Britain are planning a joint wargame to assess the resilience of nuclear power stations to a terrorist attack.[229]

Nuclear terrorism encompasses a spectrum of threats—the detonation of a nuclear bomb, an attack on a civil nuclear installation, or the dispersal of radiological materials through a "dirty bomb." Each differs in probability and consequence. But the strategies adopted to counter these variegated threats share a fundamental characteristic. Their focus is on state actors, who through their intent or laxness, would be the source countries of the weapons, nuclear technology, and radioactive materials that terrorists would either use to perpetrate attacks or target. This underscores the leitmotif of this monograph: Effective strategies of deterrence, which integrate both the denial and punishment variants, on the *state* level remain the prerequisite for countering the *non-state* threat of nuclear terrorism.

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