Assessing Nuclear Competitions in the 21st Century

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2010

Contract HQ0034-09-D-3007-0003

Center for Strategic and Budgetary Assessments

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CHAPTER 1: OVERVIEW

> We as a society suffer today from what can only be called an extraordinary case of collective nuclear amnesia. A picture of the past has taken shape that has very little to do with what our nuclear past was really like. It is now often taken for granted that even in the 1950s nuclear war was simply "unthinkable" as an instrument of policy; that nuclear forces were never "usable" and served only to "deter their use by others"; and that the threat of "massive retaliation" was at bottom just pure bluff, because the United States would never be the first to launch a nuclear strike. . . . [B]ut one cannot immerse oneself in the sources for this period without coming to the conclusion that something very basic has been forgotten. . . . It is important to see the past as it really was, to understand that thirty-five years ago people lived in a much more frightening world than anything we know today.
>
> — Marc Trachtenberg, 1988/1989[1]

The principal aim of this report is to proffer a realistic framework for assessing the role that nuclear arms are likely to play in international affairs through the middle of the 21st century. Its basic premise is that a great deal about the efficacy and purposes of nuclear forces has changed since the Cold War between the United States and the Union of Soviet Socialist Republics (USSR) ended in December 1991. However, because Trachtenberg's trenchant comment about America's "nuclear amnesia" is even more relevant today than it was in the late 1980s, generating a reality-based approach to thinking about nuclear arms through mid-century will require considerable "remembering" of the world's collective nuclear past. Without some clarity about nuclear history since 1945, it is difficult to appreciate the full import of Paul Bracken's 1999 observation that the "rise of Asian military power" in the early 21st century will herald the beginning of a "second nuclear age" as different as the U.S.-Soviet nuclear competition "was from World War II."[2]

The first step toward offering a framework for addressing nuclear competition in the 21st century is to begin recapitulating enough of the world's nuclear past to appreciate why the current "nuclear age" is so different from that of the Cold War. Toward this end, Chapter 2 explores the main considerations arguing that the world has indeed entered a period in which the assumptions, concepts and theories about nuclear forces inherited from 1947-1991 are in need of com-

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[1] Marc Trachtenberg, "A 'Wasting Asset': American Strategy and the Shifting Nuclear Balance, 1949-1954," *International Security*, Winter 1988/89, p. 49.

[2] Paul Bracken, "The Second Nuclear Age," *Foreign Affairs*, January/February 2000, p. 146. Bracken adapted this article from his 1999 *Fire in the East: The Rise of Asian Military Power and the Second Nuclear Age*. For an antecedent to Bracken's argument, see Fred Charles Iklé, "The Second Coming of the Nuclear Age," *Foreign Affairs*, January/February 1996, pp. 119-128.

prehensive reexamination from first principles. Consider, for example, Cold War notions of nuclear deterrence. By the 1970s nuclear deterrence between the United States and the USSR came to rest on both sides' ability to devastate the other's society after absorbing a first nuclear strike. It is not at all obvious, however, that the rulers of a nuclear-armed North Korea or Iran would be able to acquire such a capability vis-à-vis the United States by 2050—or would be inclined to do so even if they had the resources and technology.

Next, Chapter 3 reviews the bi-partisan American consensus on the efficacy and purposes of nuclear forces in U.S. national security during the Cold War. That consensus largely held from the Democrat administration of President Harry Truman through the Republican administration of President George H. W. Bush. But with the Cold War's abrupt end, this consensus began to unravel and, by 2005, had broken down. As a result, in 2009 the U.S. government, following the abolitionist sentiments of George Shultz, Henry Kissinger, William Perry, Sam Nunn and others, formally embraced as national policy the long-term goal of seeking the peace and security of a world without nuclear weapons.

Chapter 4 explores the adequacy of the various static and dynamic measures developed during the Cold War to assess U.S. and Soviet strategic-nuclear forces. Arguably, these forces were *the* central component of the long-term competition between the United States and the USSR that dominated international relations from 1947 to 1991. Given the sheer volume of the studies and analyses devoted to U.S. versus Soviet strategic-nuclear forces throughout the Cold War era, it is natural to assume that the measures and analytic methods for thinking about nuclear deterrence, stability in crises or wartime, plausible nuclear scenarios, escalation control, war termination, and the potential outcomes of all-out nuclear warfare were adequate. On closer examination, however, static metrics (e.g., the numbers of nuclear warheads or intercontinental delivery vehicles) and the simplistic application of dynamic measures based on all-out exchanges between Soviet and U.S. nuclear arsenals neglected fundamental aspects of the Cold War competition in nuclear arms. Given the greater complexities of the international security environment that has emerged from the U.S. wars in Afghanistan and Iraq since al-Qaeda's September 2001 attacks on the World Trade Center and the Pentagon ("9/11"), a vital task today is to develop better metrics and analytic methods for thinking about nuclear forces in the 21st century—particularly in scenarios involving more than two nuclear-armed states. Good assessments of the roles nuclear arms will play in international affairs generally, and in U.S. national security in particular, will have to address a wider range of more plausible scenarios (rather than concentrating on worst cases), tailor deterrence credibility to a larger set of potential adversaries, take active defenses into account, think about the prospective long-term consequences of actual nuclear use, and develop better understandings of the objectives, perceptions, strategic cultures, dominant scenarios, metrics, and technical calculations of each and every participant in the nuclear competitions of the early 21st century.

Chapter 5 outlines a framework for thinking about nuclear arms and competition between now and 2050. [redacted] the present framework is presented as a series of interrelated assumptions or beliefs about the future. These assumptions and their justifications will be controversial to many. The most fundamental assumption is, of course, that nuclear arsenals are extremely unlikely to have been abolished by 2050. Possibly even more disturbing is Thomas Schelling's conjecture that a world in which the known nuclear arsenals had been eliminated might not in fact be safer than one with *some* nuclear weapons.[3] But like Herman Kahn's discomforting point that there were plausible circumstances during the 1950s in which U.S. or Soviet leaders might decide that nuclear war "was their best alternative,"[4] Schelling's suspicion about the safety of a world without nuclear weapons surely warrants thoughtful consideration and analysis rather than being dismissed out of hand on emotional or ideological grounds. Unsettling as such thoughts about the future of nuclear weapons on planet Earth may be, our intellectual obligation is to explore them in light of the facts and realities of a world order composed of sovereign states.

Finally, Chapter 6 draws some tentative implications and conclusions regarding nuclear competitions in the post-9/11 period. One of the more counterintuitive implications is that arms control may succeed not in abolishing nuclear arms but in constraining worldwide nuclear arsenals to the point where some nuclear use could occur without necessarily annihilating the combatants—at least if they are large nations—or producing a global environmental catastrophe. The obvious downside of this unintended outcome could be that limited nuclear use—perhaps with weapons having relatively small yields and more tailored effects—may become more likely rather than less likely. The upside, however, is that any future use of some nuclear weapons could turn out to be far less destructive than general nuclear war between the United States and the USSR would have been in the 1970s or 1980s. As the Congressional Commission on the strategic posture of the United States concluded in 2009, the "threat of a nuclear Armageddon has largely disappeared."[5] If so, then nuclear arsenals will remain an important, if less central, element of international relations between sovereign states, including the efforts of nations to prevent further proliferation, especially to terrorist organizations.

The most perplexing implication, however, concerns the need to develop better analytic measures and methods for assessing nuclear relationships in the

[3] Thomas C. Schelling, "A World without Nuclear Weapons?" *Daedalus*, Fall 2009, p. 125.

[4] Herman Kahn, "The Nature and Feasibility of War and Deterrence," RAND Corporation, P-1888-RC, January 20, 1960, p. 4.

[5] William J. Perry (Chairman) and James R. Schlesinger (Vice-chairman), *America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States* (Washington, DC: United States Institute of Peace Press, May 2009), pp. 16, 97.

21st century. Consider, for example, a future Russian decision to employ "tactical" nuclear weapons with tailored effects and small yields on Russian territory to prevent the loss of Russian territory to an opponent mounting a conventional invasion. What possible relevance might currently envisioned U.S. nuclear forces have in deterring a Russian use of "precision" nuclear weapons in this situation? Even if the United States still possessed nuclear forces capable of deterring a large-scale Russian nuclear attack on the United States, why would they deter a limited, *defensive* use of low-yield nuclear weapons on Russian soil to defeat an invader bent on seizing territory? Moreover, much the same question can be asked regarding the likelihood that the shrinking U.S. nuclear arsenal would deter the use of a nuclear weapon against U.S. population centers by a terrorist organization like al Qa'ida. At a minimum nuclear deterrence in the 21st century appears to demand some fresh thinking and intellectual effort.

CHAPTER 2: NUCLEAR FORCES THEN AND NOW

From 1947 to 1991, strategic-nuclear forces were the sine qua non of the long-term competition that emerged between the United States and the USSR after World War II. Over the course of this protracted rivalry, both sides amassed huge arsenals of intercontinental nuclear forces. Figure 1 shows the build up of "strategic" nuclear warheads by the United States and the USSR from the beginnings of the Cold War through 2002, roughly a decade after the Russian Federation replaced the USSR. Both U.S. and Soviet/Russian inventories of operationally deployed strategic-nuclear warheads peaked in the late 1980s, with each side eventually deploying totals well above 10,000 weapons.

Figure 1: U.S. and Soviet/Russian Strategic Warheads, 1945-2002[6]

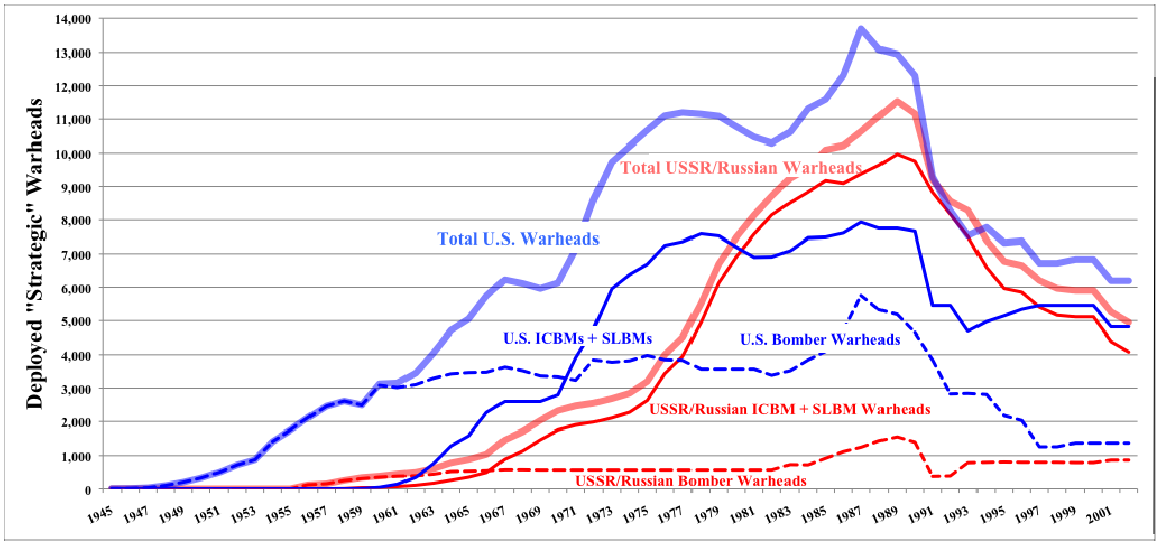
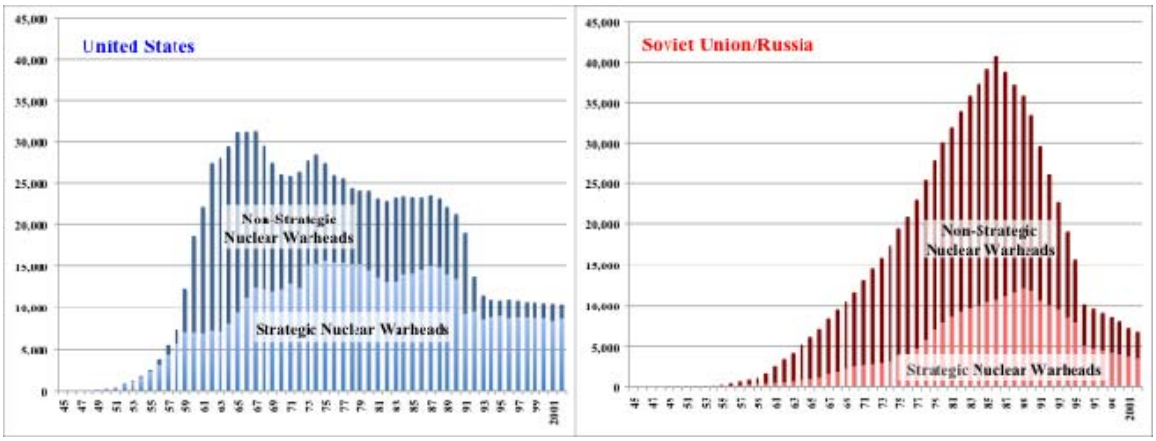


Figure 2 shows the build-up of U.S. and Soviet/Russian "strategic" and "non-strategic" stockpiles of nuclear warheads through 2002. Ignoring warheads awaiting destruction, the U.S. nuclear stockpile peaked at over 32,000 warheads in the late 1960s and the Soviet stockpile at over 40,000 warheads in the mid-1980s. The "non-strategic" warheads in Figure 2 include those associated with air-to-air missiles such as the MB-1 Genie deployed on U.S. interceptors for continental air defense; the U.S. Army's Nike Hercules surface-to-air missiles and long-range atomic artillery; the Gorgon and Gazelle anti-ballistic missile inter-

[6] Natural Resources Defense Council (NRDC), "Archive of Nuclear Data from NRDC's Nuclear Program," http://www.nrdc.org/nuclear/nudb/datainx.asp (accessed March 11, 2010). The overall accuracy of the NRDC databases can be checked by comparing them with declassified Central Intelligence Agency (CIA) national intelligence estimates (NIEs) on Soviet strategic forces as well as with research by Russians who gained access to Soviet sources in the 1990s. See Donald P. Steury, *Intentions and Capabilities: Estimates on Soviet Strategic Forces, 1950-1983* (Washington, DC: Center for the Study of Intelligence, CIA, 1996); and Pavil Podvig (ed.), Oleg Bukarin, Timur Kadyshev, Eugene Miasnikov, Igor Sutyagin, Maxim Tarasenko, and Boris Zhelezov, *Russian Strategic Forces* (Cambridge, MA, and London: The MIT Press, 2001).

ceptors still deployed around Moscow; nuclear-capable fighter-bombers deployed overseas or in forward areas; theater ballistic missiles such as Thor, Pershing and the SS-20; various cruise missiles such as the nuclear variant of the U.S. Navy's Tomahawk cruise missile; torpedoes and depth charges; and demolition land mines, including some light enough to be used by two-man special forces teams. These "theater" or "tactical" warheads are not reflected in Figure 1.

Figure 2: U.S. and Soviet/Russian Nuclear Stockpiles, 1945-2002[7]



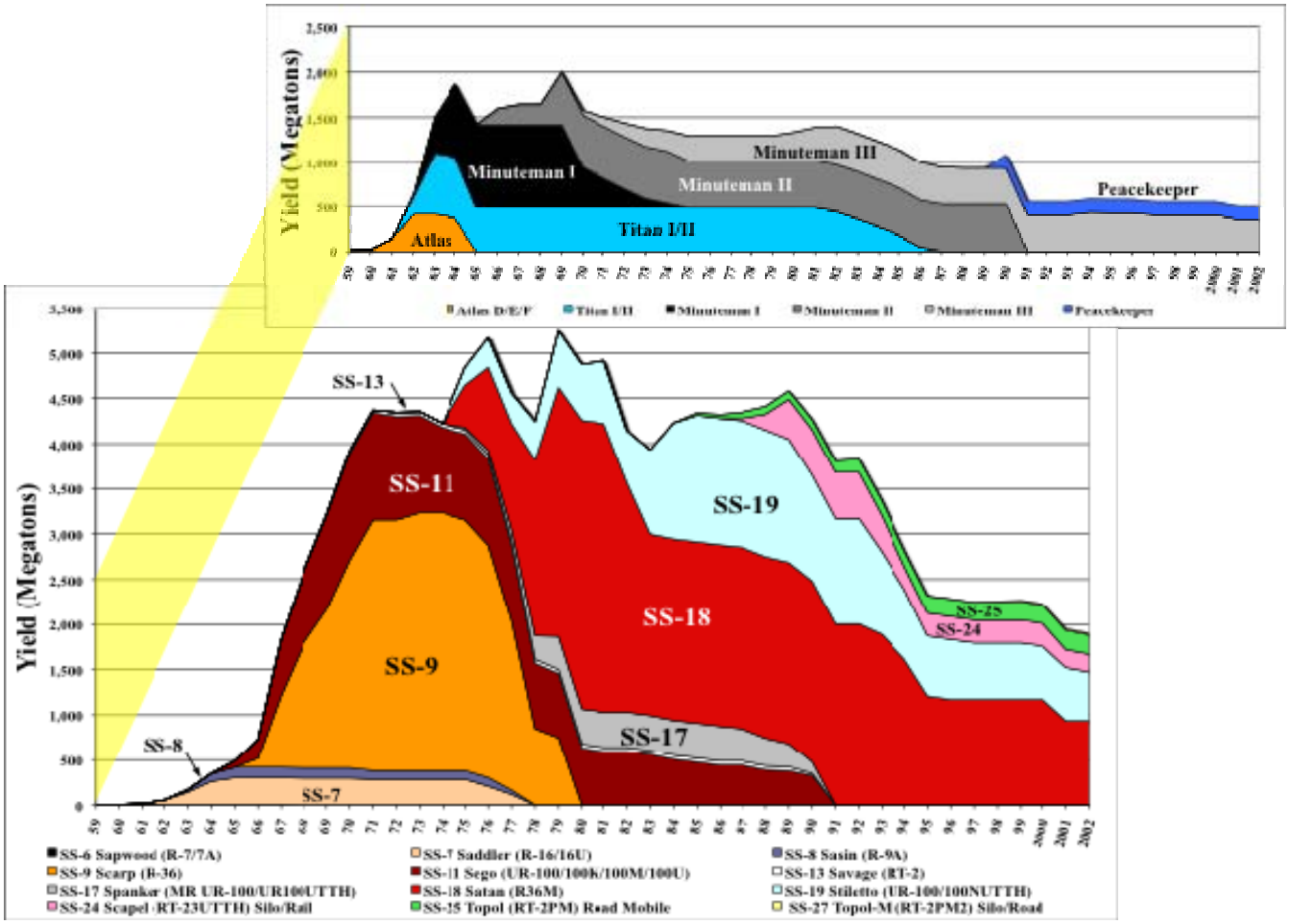
Another limitation of Figure 1's warhead totals is that they assume full generation of both sides' heavy bomber, intercontinental ballistic missile (ICBM) and submarine launched ballistic missile (SLBM) forces. But it is unlikely that both countries would have been able to arm all their nuclear bombers, bring all their ICBMs on line, and get all their ballistic missile submarines to sea at the same time. Granted, it is possible to imagine rare contingencies in which both the United States and the USSR might have fully generated their strategic forces. During the Cold War, one such contingency was a conventional conflict in Central Europe in which the North Atlantic Treaty Organization (NATO) managed to hold west of the Rhine River without resorting to nuclear weapons. Of course, this scenario assumes a Warsaw Pact attack on Western Europe, whereas Soviet scenarios in the Western Theater of Military Operations assumed a NATO attack on Eastern Europe. Thus, while the absolute numbers of U.S. and Soviet warheads in Figures 1 and 2 are undoubtedly somewhat on the high side of likely operational reality, the overall picture of the two Cold War superpowers accumulating huge stockpiles of strategic and non-strategic nuclear warheads is accurate.

Lastly, while static metrics such as the numbers of U.S. and Soviet nuclear warheads over time can suggest broad trends, they are, at best, very crude meas-

[7] NRDC databases: http://www.nrdc.org/nuclear/nudb/datab9.asp (U.S. data), and http://www.nrdc.org/nuclear/nudb/datab10.asp (Soviet/Russian data), accessed April 16, 2010. However, the U.S. data has been adjusted using the Department of Energy's 1994 release of stockpile figures for 1945-1961, and the 2010 release of data for 1962-2009 by the Department of Defense (DoD). See DoE, "Summary of Declassified Nuclear Stockpile Information," 1994; DoD, "Fact Sheet: Increasing Transparency in the U.S. Nuclear Weapons Stockpile," May 3, 2010.

ures of nuclear capabilities. For example, warhead counts give little insight into force readiness, sustainability, or how opposing nuclear forces might perform across a range of plausible scenarios. Nevertheless, public, academic, and even military perceptions of nuclear forces have tended to fixate on these sorts of crude metrics or "bean counts."

Figure 3: U.S. and Soviet/Russian ICBM Megatonnage, 1959-2002[8]



That said, Figure 1 points to other important insights about the nuclear competition between the United States and the Soviet Union and its successor, the Russian Federation. One concerns the non-technical factors that inevitably affect the design and posture of national nuclear forces. During the Cold War, both the United States and the USSR eventually fielded a "triad" of heavy bombers, ICBMs, and nuclear ballistic missile submarines (SSBNs). The United States,

[8] Podvig, et al., *Soviet Strategic Nuclear Forces*, pp. 179-234; NRDC, "Table of USSR/Russian ICBM Forces," http://www.nrdc.org/nuclear/nudb/datab4.asp and "Table of US ICBM Forces," http://www.nrdc.org/nuclear/nudb/datab3.asp (both accessed March 11, 2010). Designations such as the "SS-9 Scarp" for the Soviet R-36 are NATO code names for Soviet missiles. A megaton is the equivalent of a million tons of the explosive trinitrotoluene (TNT), whose chemical formula is $C_6H_2(NO_2)_3CH_3$.

however, relied far more on Strategic Air Command's bomber force than did the Soviets on Long Range Aviation's bomber regiments. Compared to American emphasis on Strategic Air Command (SAC) bombers, Soviet leaders showed a decided preference for ballistic missiles, particularly land-based ICBMs (Figure 3). The main reason for this asymmetry was a deep-seated difference in outlook between the two rivals over the control of nuclear weapons. Whereas U.S. political and military leaders do not appear to have seriously worried that SAC bomber crews flying airborne alert in nuclear-armed bombers would turn their weapons on American targets, Bolshevik leaders took such possibilities seriously.[9] The USSR's Long Range Aviation (LRA) units never adopted the 15-minute ground-alert posture that one third of SAC's bombers began maintaining in 1957, much less the airborne alert initiated in 1961.[10] At the height of the Cuban missile crisis in October 1962, SAC put sixty-six nuclear-armed B-52s in the air around the clock, ready to strike Soviet-block targets, a posture that would have been anathema to the USSR's leaders.[11] As Andrew W. Marshall told a small group at a seminar on active and passive defenses in 1960, in those days it took LRA regiments "six to eight hours to load the planes," which meant that the Soviet bombers were "just sitting ducks."[12]

Not only did the USSR's nuclear forces give greater emphasis to ICBMs, which could be kept under the tight control of the Soviet General Staff, but Soviet leaders were reluctant to follow the Americans in marrying nuclear warheads and delivery vehicles in order to minimize response times. Even after the Cuban missile crisis, Marshall and his RAND colleague Joseph Loftus concluded from their research that even the Soviet ICBM force "had not been designed for quick reaction."[13] Factors as non-technical as the fears of a nation's leaders, then, can affect both the design of a country's nuclear forces as well as their operational readiness.

A further implication of Figure 1 is that once the Cold War ended, both the United States and the Russian Federation quickly began reducing their strategic-nuclear forces. By late January 1992 President George H. W. Bush was sufficient-

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[9] Starting in mid-1962, DoD established a two-man rule for all nuclear operations (Office of the Deputy Assistant to the Secretary of Defense for Nuclear Matters, "Nuclear Chronology: (1960-1969)," at http://www.acq.osd.mil/ncbdp/nm/nuclearchronology3.html (accessed May 25, 2010). The two-man rule required that two authorized individuals be present for the assembly, handling, uploading, and release of nuclear weapons.

[10] Henry M. Narducci, "Strategic Air Command and the Alert Program: A Brief History," Office of the Historian, Headquarters Strategic Air Command, April 1, 1988, pp. 3, 5-6.

[11] Bernard C. Nalty, "The Air Force Role in Five Crises 1958-1965: Lebanon, Taiwan, Congo, Cuba, Dominican Republic," U.S. Air Force Historical Liaison Division, June 1968, p. 43.

[12] Marc Trachtenberg, *History and Strategy* (Princeton, NJ: Princeton University Press, 1991), p. 29.

[13] Trachtenberg, *History and Strategy*, p. 30. For a recent account of China's handling of nuclear weapons, see Mark A. Stokes, "China's Nuclear Warhead Storage and Handling System," Project 2049 Institute, March 12, 2010.

ly convinced that the prospect of a Russian nuclear attack on the United States had grown so remote that he stopped B-2 production at 20 aircraft, cancelled the road-mobile Midgetman ICBM, ended production of new warheads for the Trident II SLBM, limited deployment of the "MX" Peacekeeper ICBM to the 50 Congress had authorized for deployment in Minuteman silos, halted further procurement of the Advanced Cruise Missile, and directed that the number of warheads on Minuteman ICBMs be reduced to one and the number on U.S. SLBMs by about one third.[14] In June, SAC itself was disestablished, its bombers going to the newly created Air Combat Command at Langley Air Force Base (AFB) in Virginia, formerly home of the Tactical Air Command. In September 1991, President Bush pledged to withdraw to the United States all ground-launched short-range nuclear weapons deployed overseas and destroy them along with stockpiles of similar weapons; and to cease deployments of "tactical" nuclear weapons on surface ships, attack submarines, and land-based naval aircraft during "normal circumstances."[15] A week later Soviet President Mikhail Gorbachev responded with reciprocal measures to Bush's Presidential Nuclear Initiatives (PNIs) and, in January 1992, President Boris Yeltsin reaffirmed Gorbachev's commitments, somewhat expanding them. However, data on the destruction of these warheads remains uncertain and, as discussed later, starting in 1998 the Russians began developing a new regional deterrence doctrine that placed increasing reliance on non-strategic nuclear weapons to compensate for conventional inferiority.[16] Finally, in October 1997, the B-1B was completely withdrawn from the nuclear mission under Article IV of the 1993 U.S.-Russian treaty on Further Reductions and Limitations of Strategic Offensive Arms (START II), and in 2005 the last of the Peacekeeper ICBMs were decommissioned in accordance with START II even though the treaty never entered into force.

The trend by the United States and Russia to further reduce their post-Cold War nuclear arsenals continues to this day. The operational U.S. nuclear arsenal appears to be less than 2,500 warheads and the Russian Federation's around 4,600 (Table 1). As of May 2010, the Department of Defense's total for the U.S. nuclear stockpile was 5,113 warheads. Presumably this figure includes active strategic and non-strategic warheads as well as inactive warheads held in reserve. The Russians have yet to release a comparable number. In any case, efforts are continuing to go even further in reducing U.S. and Russian nuclear stockpiles. In April 2010, Presidents Barack Obama and Dmitry Medvedev signed a successor to the 1991 Strategic Arms Reduction Treaty (START)—later

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[14] George H. W. Bush, "Address Before a Joint Session of Congress," January 28, 1992, http://bushlibrary.tamu.edu/research/public_papers.php?id=3886&year=1992&month=1 (accessed March 11, 2009).

[15] See Courtney Keefe, "The Presidential Nuclear Initiatives (PNIs) on Tactical Nuclear Weapons at a Glance," Arms Control Association, at http://www.armscontrol.org/factsheets/pniglance (accessed July 29, 2010).

[16] For a recent review of U.S. and Russian non-strategic nuclear weapons, see Amy F. Woolf, "Nonstrategic Nuclear Weapons," Congressional Research Service, RL32572, January 14, 2010.

renamed START I—in Prague. The New START calls for both countries to reduce their deployed strategic delivery vehicles to 700 and their deployed strategic warheads to 1,550.[17] However, the New START rule that only one warhead will be counted against the warhead total for each deployed heavy bomber will allow the United States and Russia to retain totals in excess of 2,300 strategic warheads, which is higher than the upper end of the 1,700-2,200 warhead range both countries agreed to reach by 2012 when they signed the 2002 Strategic Offensive Reductions Treaty (SORT/Treaty of Moscow).[18]

Table 1: Current U.S. and Russian Warhead Inventories[19]

Country	Strategic	Non-Strategic (Tactical)	Total Operational (Active)	Inactive or Awaiting Dismantlement	Total Warheads
United States	1,968	500	2,468	7,113	9,581
Russia	~2,600	~2,000	~4,600	7,300	~11,900

As of 2010, the majority of the world's nuclear weapons—over 90 percent—were in the U.S. and Russian arsenals, even though both nations have made substantial reductions compared to their nuclear stockpiles during the late Cold War. If both countries do reduce their strategic warhead totals to the levels agreed to by Obama and Medvedev in 2010, and that the United States and Russia dismantle most or all of their non-operational warheads, the worldwide warhead total of nuclear warheads could easily fall below 7,000 nuclear warheads. Even if Iran acquires a small arsenal of atomic weapons (as now seems likely), a worldwide stockpile of 7,000 nuclear warheads would be less than 10 percent of the more than 75,000 amassed worldwide in the mid-1980s. Thus, one difference between the nuclear forces of the late-Cold War and today is that the number of weapons in various national stockpiles is but a fraction of what they were in the 1980s.

[17] "Treaty Between the United States of American and the Russian Federation on Measures for the Further Reduction and Limitation of Strategic Offensive Arms," April 2010, Articles II and III.

[18] The White House, Office of the Press Secretary, "The New START Treaty—Maintaining a Strong Nuclear Deterrent," May 13, 2010, at http://www.whitehouse.gov/sites/default/files/New%20START%20section%201251%20fact%20sheet.pdf (accessed May 17, 2010). New START also allows both countries to retain 100 non-deployed strategic delivery vehicles (ICBMs, SLBMs, and heavy bombers).

[19] Robert S. Norris and Hans M. Kristensen, "Russian Nuclear Forces, 2010," *Bulletin of the Atomic Scientists*, January/February 2010, pp. 74, 76; Pavel Podvig, et al., "Russian Strategic Nuclear Forces" at http://russianforces.org/current/ (accessed May 17, 2010); Hans. M. Kristensen, "United States Discloses Size of Nuclear Weapons Stockpile," May 3, 2010, at http://www.fas.org/blog/ssp/2010/05/stockpilenumber.php (accessed May 17, 2010); DoD, "Fact Sheet: Increasing Transparency in the U.S. Nuclear Weapons Stockpile," May 3, 2010.

Table 2: Current Worldwide Nuclear Stockpiles[20]

Country	"Strategic" Deployed	Non-Strategic Deployed	Warhead Totals
Russia	~2,600	~2,000	~11,900
United States	1,968	500	9,581
France	300	-	300
China	180	-	~240-400[21]
United Kingdom	160	-	225[22]
Israel	80	-	~100-200
Pakistan	70-90	-	~70-90
India	60-80	-	~60-80
North Korea	-	-	<10
Totals	**~5,438**	**~2,550**	**~22,446-22,746**

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Although nuclear arsenals have been greatly reduced since the Cold War ended, the number of countries possessing nuclear weapons has grown, and there

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[20] Federation of American Scientists, "Status of World Nuclear Forces," May 3, 2010 at http://www.fas.org/programs/ssp/nukes/nuclearweapons/nukestatus.html (accessed May 18, 2010); Perry and Schlesinger, *America's Strategic Posture*, p. 111.

[21] Evidence is growing that the PRC stockpile is considerably larger than 240-400 nuclear warheads. The 2nd Artillery Corps now has 5,000 kilometers of tunnels for its ballistic missile forces (L. C. Russell Hsiao, "China's 'Underground Great Wall' and Nuclear Deterrence," *China Brief*, Jamestown Foundation, December 16, 2006), pp. 1-2). Both China's DongFeng-11 (CSS-7) and DongFeng-15 (CSS-6) short-range ballistic missiles (SRBMs) are believed to be nuclear capable. If warheads exist for all CSS-6 and CSS-7 SRBMs estimated to have been produced, that would add over another 1,100 warheads to China's nuclear stockpile. Yang Zheng speculated in 1996 that China's nuclear stockpile was over 2,300 warheads; see "China's Nuclear Arsenal," March 16, 1996 at http://www.network54.com/Forum/211833/thread/1071859757/European+Bunkers (accessed June 23, 2010).

[22] BBC News, "UK To Be 'More Open' about Nuclear Warhead Levels," May 26, 2010, at http://news.bbc.co.uk/2/hi/uk_news/politics/8706600.stm (accessed July 22, 2010).

is concern that if Iran fields nuclear weapons, other countries in the volatile Middle East will feel compelled to follow suit. When President Richard Nixon's administration decided that the United States could live with an undeclared Israeli nuclear capability,[23] the five acknowledged nuclear states were the United States, the USSR, France, the United Kingdom, and China. Ignoring countries such as Saddam Hussein's Iraq, Libya, and Syria that had nuclear programs but never succeeded in detonating nuclear devices, as well as states that formerly possessed nuclear weapons but gave them up and signed the 1968 nuclear Non-Proliferation Treaty (South Africa, Belarus, Kazakhstan, and Ukraine), two other countries have fielded nuclear forces since 1991: India and Pakistan.[24] In addition, North Korea is believed to have exploded very low-yield nuclear devices in 2006 and 2009 (although there is no public information indicating that the North Koreans have fielded an operational nuclear system).[25]

Beyond these quantitative changes in the world's nuclear forces since 1991, the political momentum for the United States to undertake concrete steps toward total nuclear disarmament have grown considerably during the last decade. Particularly influential developments include: the call in January 2007 by George P. Shultz, William J. Perry, Henry Kissinger and Sam Nunn for the United States to set "the goal of a world free of nuclear weapons" and to work "energetically on the actions required to achieve that goal"; the Hoover Institution's October 2007 Reykjavik II conference at which Shultz, Kissinger, Perry and Nunn reiterated their call for the abolishment of nuclear weapons; George Perkovich's and James Acton's 2008 Adelphi paper that attempted to spell out how the conditions to eliminate nuclear weapons could be created and enforced; and, finally, Obama's commitment to pursue the long-term goal of a nuclear-weapons-free world in his April 2009 speech at Hradcany Square in Prague.[26] The latter, of course, made

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[23] Avner Cohen, "Israel Crosses the Threshold," The National Security Archive, Briefing Book No. 189, April 28, 2006, http://www.gwu.edu/%7Ensarchiv/NSAEBB/NSAEBB189/index.htm (accessed March 13, 2010).

[24] When Belarus, Kazakhstan and Ukraine separated from the USSR, they inherited Soviet nuclear weapons that had been deployed on their territory. By 1996 all three new states had transferred these weapons to the Russian Federation by 1996 and signed the Nuclear Non-Proliferation Treaty. The International Atomic Energy Agency (IAEA) is the United Nations entity charged with ensuring that signatory nations abide by the Non-Proliferation Treaty (NPT). In 1993, following the discovery of secret Iraqi and North Korean nuclear weapons programs, the IAEA instituted an effort to better constrain the ability of NPT member states to pursue nuclear weapons. The result was the 1997 voluntary Additional Protocol that expanded the IAEA's inspection protocols. In January 2009, the United States became the 89th country to accept these tougher nuclear safeguards.

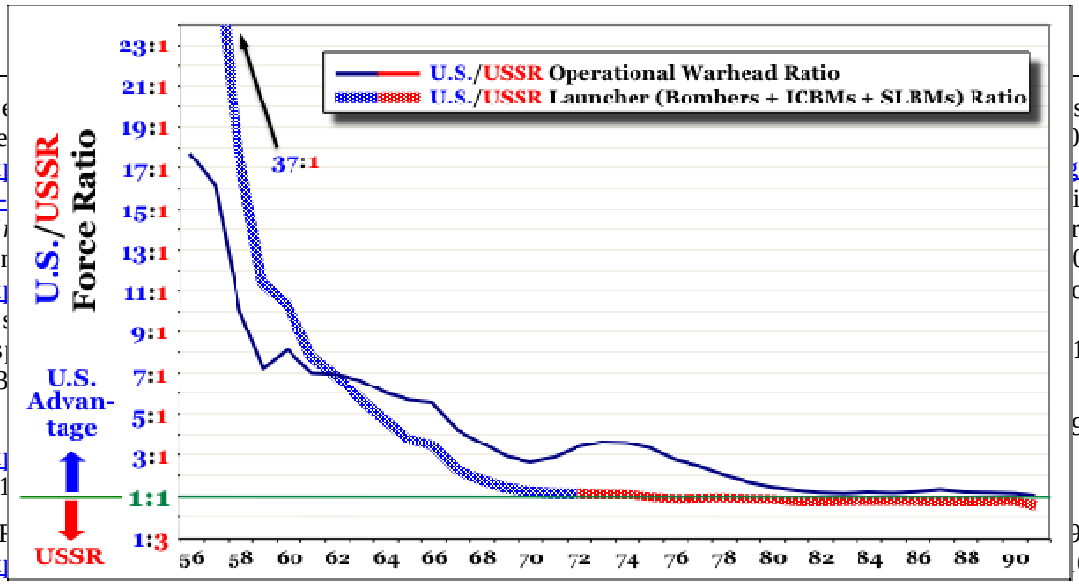
[25] While the yield of North Korea's 2006 test is thought to have been less than a kiloton indicating a partial failure, air sampling of radioactive debris over the Sea of Japan confirmed that the test was a nuclear explosion. North Korea's 2009 test probably had a yield of a few kilotons.

[26] George P. Shultz, William J. Perry, Henry A. Kissinger and Sam Nunn, "A World Free of Nuclear Weapons," *Wall Street Journal*, January 4, 2007, p. A15; "Shultz, Kissinger, Perry, Nunn, and Others Call for Freeing the World of Nuclear Weapons at Hoover Institution Reykjavik II Conference, October 26, 2007, http://www.hoover.org/pubaffairs/whatsnew/10828751.html (accessed March 14, 2010); George Perkovich and James M. Action, *Abolishing Nuclear Weapons*,

the pursuit of a world free of nuclear weapons the stated policy of the U.S. government.

Obama was by no means the first American president to call for the elimination of nuclear weapons. Jimmy Carter, his January 1977 inaugural address, announced that his administration would "move this year a step toward [the] ultimate goal—the elimination of all nuclear weapons from this Earth."[27] In hindsight, Carter made little progress toward this end by the time he left office, and Ronald Reagan had only marginally greater success during the 1980s when the U.S. and Soviet strategic arsenals reached their Cold War peaks. Reagan's strategic defense initiative (SDI) sought to free "the world from the threat of nuclear war," but proved far more challenging technically than initially anticipated.[28] The treaty on intermediate-range missiles he signed with Mikhail Gorbachev in December 1987 did eliminate Soviet and American land-based cruise and ballistic missiles with ranges of 500-5,500 kilometers (270-2,970 nautical miles) and gave both parties the right to on-site inspections and portal monitoring of the other's final assembly facilities for ground-launched ballistic missiles. Nevertheless, the intermediate nuclear forces (INF) treaty did little to eliminate nuclear weapons in general.[29] Wholesale reductions in U.S. and Soviet strategic-nuclear forces did not begin until after the Cold War was winding down.

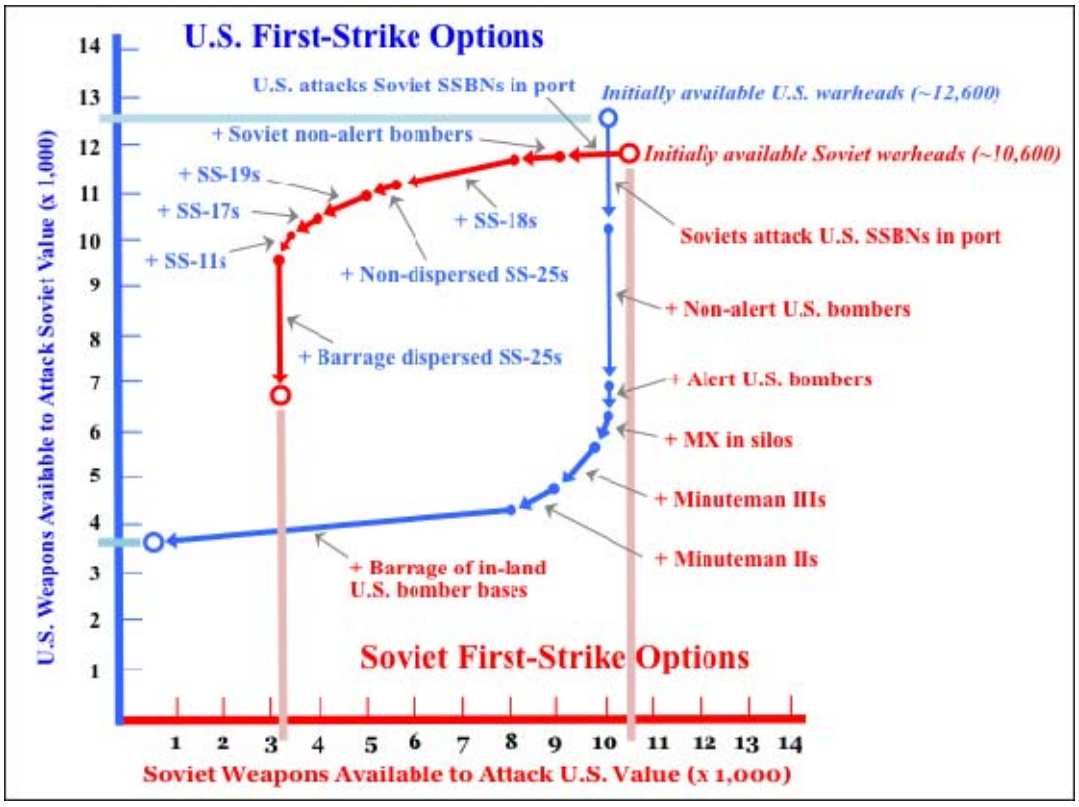
Figure 4: The Emergence of U.S.-Soviet Strategic-Nuclear Parity



[29] "Treaty between the United States of America and the Union of Soviet Socialist Republics on the Elimination of Their Intermediate-Range and Shorter-Range Missiles," December 8, 1987, Articles II and XI, http://www.state.gov/www/global/arms/treaties/inf1.html (accessed March 13, 2010). The agreement, commonly referred to as the Intermediate Nuclear Forces (INF) treaty, went into effect on June 1, 1988. In late 2009, the Obama administration agreed to abandon portal monitoring of the Votkinsk Machine Building Plant where all Russian ICBMs are built due to the impeding lapse of START I (Nicholas Kralev, "Exclusive: U.S. To Stop Counting New Missiles in Russia," *The Washington Times*, updated December 2, 2009, http://www.washingtontimes.com/news/2009/dec/01/us-to-stop-counting-new-missiles-in-russia//print/ (accessed March 14, 2010).

The huge strategic-nuclear arsenals the United States and the USSR amassed during the period 1945-1991 are widely viewed as the result of out-of-control arms racing and the inclination of both sides toward massive overkill. However, there was an underlying, if somewhat perverse, logic to the build-up of U.S. and Soviet intercontinental nuclear forces through the late 1980s. Especially after the Soviets achieved rough nuclear parity in the early 1970s (Figure 4), the stability of mutual deterrence came to be grounded on each side's ability to inflict a devastating retaliatory nuclear attack on the other's society after absorbing a first strike. Assured retaliation, the bedrock of Cold War mutual deterrence, required the United States and the USSR to build up large, diverse nuclear forces precisely so that leaders on neither side could reasonably expect their countries to escape thermonuclear annihilation if they attempted to execute a nuclear first strike against the other. Arms racing and overkill were part of the story, but certainly not all of it, especially in terms of the stability of the U.S.-Soviet nuclear relationship.

Figure 5: First-Strike Stability Draw-Down Curves[30]



[30] Glenn A. Kent and David E. Thaler, "First Strike Stability: A Methodology for Evaluating Strategic Forces," RAND R-3765-AF, August 1989), pp. 32-34. Figure 4 assumes the actual U.S. and Soviet forces that existed in the late 1980s. By factoring in costs and damages, Kent and Thaler were able to construct a quantitative first-strike-stability index.

In the late 1980s, Glenn Kent and David Thaler at the RAND Corporation conducted an analysis of the force requirements for what they termed "first-strike stability." Figure 5 shows the drawdown curves for both Soviet and U.S. strategic-nuclear forces in response to a range of increasingly comprehensive counterforce strikes by the other. After each side had conducted the most extensive counterforce first strike possible, the other side, they estimated, would still retain over 3,000 weapons for a counter-value retaliatory strike. Since a primary Cold War objective of both the United States and the USSR was to avoid nuclear war, both sides had strong incentives—particularly after the 1962 Cuban missile crisis—to risk a disarming first strike. Worth noting is that Kent's and Thaler's metric involves judgments about force performance and is a far more satisfactory measure of opposing U.S. and Soviet nuclear capabilities than the "bean counts" in Figures 1 and 2.

To argue that the large strategic-nuclear forces the United States and the Soviet Union amassed by the 1980s for first-strike stability was motivated by more than uncontrolled arms racing is not to deny that there was a hefty degree of overkill on both sides. [redacted] In addition, U.S. planning for nuclear war in the early 1960s, when the first Single Integrated Operation Plan (SIOP) was approved, demanded probabilities of 90 percent or more that individual nuclear weapons would reach their planned targets and detonate.[34] Once President Eisenhower formally approved the creation of the JSTPS under SAC domination in August 1960, "SAC's com-

[31] Lord Penny, D. E. J. Samuels and G. C. Scorgie, "The Nuclear Explosive Yields at Hiroshima and Nagasaki," June 1970, *Philosophical Transactions of the Royal Society of London*, Vol. 266, pp. 367, 419. Their estimate for the yield at Nagasaki is 20 ± 2 kilotons.

[redacted]

[33] Lynn Eden, *Whole World on Fire: Organizations, Knowledge, and Nuclear Weapons Devastation* (Ithaca, NY: Cornell University Press, 2004), pp. 283-284, 302-303.

[34] David Alan Rosenberg, "The Origins of Overkill," *International Security*, Spring 1983, pp. 5-7.

mitment to maximizing the impact of available forces accounted for the level of overkill institutionalized in the SIOP."[35]

If anything, the Soviets had even deeper compulsions toward massive investments in ICBMs and overkill. The Soviet military believed, in accordance with scientific Marxism, that historical processes, including warfare, were governed by objective laws; in the case of military art, if you could operationalize those laws, you would have a top-down, prescriptive basis for success in wartime.[36] In the Soviet view, the most important general law of war was the dependence of the course and outcome of combat on the correlation of forces and means between belligerent forces.[37] Their military theorists produced a well-developed calculus for the correlation of forces that used quantitative and qualitative indices to capture the key strengths of different forms of combat, including nuclear war, and they believed that there was a direct relationship between the correlation of forces at the start of combat, as measured by appropriate indices, and the probability of mission success.[38] For both nuclear and non-nuclear combat, Soviet planners generally sought to achieve initial force correlations corresponding to at least a 90 percent probability of success.[39] Implicit in this engineering approach to the conduct of war was that there might be contingencies in which a preemptive Soviet nuclear strike at the outset of conflict could produce a more favorable outcome than allowing the opponent to strike first. Further, as Fritz Ermarth observed in the late 1970s, while strategic stability was central to American thinking about nuclear arms, the concept was "hardly identifiable in Soviet military writings."[40] Inevitably this engineering approach to the conduct of war demanded very large strategic-nuclear forces and redundant targeting.

Note, too, that once the U.S.-Soviet treaty on anti-ballistic missile (ABM) systems went into effect in October 1972, the Cold War competition in strategic-nuclear arms was largely confined to offensive systems only. The preamble to the ABM Treaty, which Richard Nixon and Leonid Brezhnev had signed in Moscow

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[35] Rosenberg, "The Origins of Overkill," p. 65. Rosenberg adds, however, that it was the condition of plenty in nuclear weapons and delivery vehicles that made the extent of overkill possible (ibid.).

[36] [redacted] See also Dima Adamsky, *The Culture of Military Innovation: The Impact of Cultural Factors on the Revolution in Military Affairs in Russia, the US, and Israel* (Stanford, CA: Stanford University Press, 2010), pp. 46-48.

[redacted]

[39] For a conventional case in point, see Lieutenant General Yu. Kardashevskiy, "Plan the Destruction of Targets by Fire Creatively," Военный вестник *[Military Herald]*, No. 7, July 1978, Table 1, p. 109. In this article, a fire superiority of 5-to-1 was recommended to achieve a probability of mission success of 0.92.

[40] Fritz Ermarth, "American and Soviet Strategic Thought," *International Security*, Autumn 1978, p. 145.

the preceding May, asserted that limiting anti-ballistic missile systems "would be a substantial factor in curbing the race in strategic offensive arms" and increase strategic "stability" in the sense of decreasing the likelihood of nuclear war.[41] The view that missile defenses were destabilizing and dangerous was perhaps most forcefully articulated by McNamara in June 1967 during a meeting between President Lyndon Johnson and Soviet Premier Alexei Kosygin in Glassboro, New Jersey. While Kosygin did not accept McNamara's argument at the time, the view the U.S. defense secretary advanced at Glassboro was later enshrined in the 1972 ABM Treaty.[42]

The 1972 treaty did not, of course, entirely prohibit missile defenses. Each country was permitted to have two limited ABM systems, with no more than 100 interceptors each, to protect its capital and ICBM launch areas—provided the sites were at least 1,300 kilometers apart. The same year the ABM treaty was completed, 64 exo-atmospheric Galosh (SH-01/ABM-1) interceptors with 2-3 megaton warheads went into service at four sites around the Soviet capital as interceptors for the A-35 ABM system. In the late 1980s, the Soviets upgraded Moscow's ABM defenses to the A-135 system with 38 exo-atmospheric Gorgon and 64 endo-atmospheric Gazelle interceptors, both of which were also armed with nuclear warheads. While the United States initially went forward with a treaty-compliant Safeguard system to defend its ICBM fields in Montana and North Dakota, in November 1975 Congress voted to terminate the deployment only weeks after the system became operational.[43] Later, Reagan's Strategic Defense Initiative Organization (SDIO) began a research program to develop a national missile defense capability for the United States while remaining within the limits of the ABM treaty, which prohibited nation-wide defenses.

The United States adhered to the ABM Treaty until December 13, 2001, when President George W. Bush announced that the United States was withdrawing from it.[44] But it was not until December 2005 that SDIO's successor organization, the Missile Defense Agency (MDA), had enough operationally configured ground-based interceptors in silos (eight in Alaska and two in California) to provide a limited capability for midcourse intercept against an attack with one or two

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[41] "Treaty Between the United States of American and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems," signed May 26, 1972, http://www.state.gov/www/global/arms/treaties/abm/abm2.html (accessed March 17, 2008).

[42] Donald R. Baucom, *The Origins of SDI, 1944-1983* (Lawrence, KS: University of Kansas Press, 1992), p. 34. In response to McNamara, Kosygin pounded the tabled and declared, "Defense is mnoral; offense is immortal!" (ibid.).

[43] Baucom, *The Origins of SDI, 1944-1983*, pp. 96-97. Safeguard included the high-altitude Spartan and low-altitude Sprint interceptors, both of which utilized nuclear warheads like the Soviets' Galosh, Gorgon, and Gazelle.

[44] "President Discusses National Missile Defense," The White House, December 13, 2001, http://georgewbush-whitehouse.archives.gov/news/releases/2001/12/20011213-4.html (accessed March 15, 2010).

missiles from North Korea.[45] This capability, however, offered no real defense against a major attack with scores, much less hundreds, of ICBMs. Today only Russia and China have the capability to conduct a large-scale ballistic missile attack against U.S. territory. But large-scale attacks by either country are considered "very unlikely" and no longer the focus of the U.S. ballistic missile defense (BMD) program.[46] Using kinetic kill vehicles rather than nuclear warheads, missile defense remains technically challenging and expensive. Nevertheless, the emergence of national and theater BMD systems is a significant departure from the Cold War nuclear era as well as a continuing bone of contention with the Russians.

The point of revisiting Cold War thinking about deterrence, strategic stability, the origins of overkill, and ballistic missile defense is to highlight their questionable relevance in the post-9/11 nuclear age. Start with the United States. A major thrust of the 2001 Nuclear Posture Review (NPR) was to "reduce" U.S. dependence on offensive nuclear weapons and "improve" the ability of the United States to deter attack in the face proliferating weapons of mass destruction (WMD).[47] In addition, the report stated that the United States would "no longer plan, size or sustain its forces as though Russia presented merely a smaller version of the threat posed by the former Soviet Union."[48] To achieve these goals, the NPR established a "New Triad" composed of offensive strike systems (both nuclear and non-nuclear), defenses (both active and passive), and a revitalized nuclear infrastructure, all bound together by enhanced command and control (C^2), intelligence and planning.[49] The thrust of these ideas was that the United States' Cold War strategic posture, which had relied exclusively on offensive nuclear forces, was inappropriate for deterring potential U.S. adversaries in the 21st century, which might include terrorist organizations and rogue states. Thus, a "broader array of capability" was needed "to dissuade states from undertaking political, military, or technical courses of action that would threaten U.S. and allied security."[50] Or, as defense secretary Robert Gates later stated, the goal of the

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[45] MDA, "Tenth Interceptor Emplaced for the Ballistic Missile Defense System," 05-FYI-0071, December 20, 2005, http://www.mda.mil/global/documents/pdf/05fyi0071.pdf (accessed March 17, 2010).

[46] Department of Defense (DoD), "Ballistic Missile Defense Review Report," February 2010, p. 4, http://www.defense.gov/bmdr/BMDR%20as%20of%2026JAN10%200630_for%20web.pdf (accessed March 17, 2010).

[47] DoD, "Excerpts of Classified Nuclear Posture Review/S," January 8, 2002, p. 1, http://www.imi-online.de/download/Nuclear_Posture_Review.pdf (accessed March 15, 2010. On January 9, J. D. Crouch held a DoD press conference to provide an overview of the NPR, which had been submitted to Congress on December 31, 2001. The excerpts cited above were released at that time.

[48] DoD, "Excerpts of Classified Nuclear Posture Review/S," p. 1.

[49] J. D. Couch, "Findings of the Nuclear Posture Review," DoD briefing slides, January 9, 2002, Slide 9.

[50] DoD, "Excerpts of Classified Nuclear Posture Review/S," p. 1.

New Triad was (and remains) "to reduce our emphasis on nuclear weapons for deterrence and provide the President more non-nuclear deterrence options and responses to potential crises."[51] The New Triad, with its emphasis on dissuasion, represents a further departure from the deterrent concepts, focus, and aims of U.S. strategic-nuclear forces during the Cold War.

The extent of the various differences between the Cold War nuclear era and the current one becomes even clearer when one considers the following question. Precisely how is the New Triad supposed to deter or dissuade rogue states such as North Korea or Iran from acquiring nuclear weapons, much less deter or dissuade terrorist organizations like al Qa'ida from attacking the civilian populations and infrastructure of United States or its allies? At this juncture, there is considerable evidence that Soviet leaders, going at least back to Nikita Khrushchev, and American leaders as far back as Eisenhower, were extremely disinclined to risk nuclear war in light of the destructive potential of the other's offensive nuclear forces. On the American side, Eisenhower's view as president was that "any major nuclear conflict between the United States and the Soviet Union would soon be an unimaginable catastrophe for both sides—virtually suicidal for each society and many others as well."[52] For much the same reason, Reagan's 1983 Strategic Defense Initiative aspired to develop the capability to intercept and destroy nuclear-tipped ballistic missiles before they could reach American soil.[53] On the Soviet side, in October 1962 Khrushchev chose to remove the Soviet R-12 and R-14 ballistic missiles he had secretly sent to Cuba in exchange for American promises to remove U.S. Jupiter missiles from Turkey and forego any future U.S. invasion of Fidel Castro's Cuba rather than risk nuclear war with the United States.[54] [redacted] And

[51] Robert M. Gates, speech at the Carnegie Endowment for International Peace, Washington, DC, October 28, 2008, http://www.defenselink.mil/speeches/speech.aspx?speechid=1305 (accessed May 24, 2010).

[52] Robert R. Bowie and Richard H. Immerman, *Waging Peace: How Eisenhower Shaped an Enduring Cold War Strategy* (Oxford: Oxford University Press, 1998), p. 179.

[53] Early in his presidency, Reagan concluded that in a nuclear war the United States would lose 150 million people—Ronald Reagan, Douglas Brinkley (ed.), *The Reagan Diaries* (New York: Harper Perennial, 2009), p. 52. After watching the ABC program "The Day After" about the impact of a nuclear exchange on Lawrence, Kansas, Reagan's reaction was that he had to do all he could "to see there is never a nuclear war" (ibid., p. 186).

[54] Michael Dobbs, *One Minute to Midnight: Kennedy, Khrushchev, and Castro on the Brink of Nuclear War* (New York, Alfred A. Knopf, 2008), p. 112, 295-296, 324-325.

[redacted]

Gorbachev's judgment was that "only a madman would unleash nuclear war."[56] Indeed, at the November 1985 U.S.-Soviet summit in Geneva, he and Reagan agreed that "a nuclear war cannot be won and must never be fought."[57] Much earlier, this view had been grudgingly accepted by senior generals of the Soviet General Staff (although not necessarily by Soviet army generals) [redacted] Thus, a strong case can be made that nuclear deterrence worked during the Cold War, at least in the case of general nuclear war between the United States and the USSR. There is also evidence that the Soviets also realized that even a conventional attack that engaged vital U.S. interests "had to be limited in scope or be carried out by proxy, else both countries would start to climb the nuclear escalation ladder," and neither side really thought escalation could be controlled.[59]

To raise the pivotal question about deterrence and dissuasion in the post-9/11 nuclear era, though, is it at all likely that if Osama bin Laden had known about the United States' New Triad, that knowledge would have deterred or dissuaded al Qa'ida from attacking the World Trade Center and the Pentagon on September 11, 2001? Islamic jihadists appear utterly undeterred by the new U.S. strategic posture. Nor has the New Triad deterred or dissuaded North Korea from testing two nuclear devices or had any discernible impact on Iran's nuclear program. Nor did the new U.S. strategic posture deter Russia from using conventional forces to seize the Georgian provinces of Abkhazia and South Ossetia during the 2008 Olympic Games in Beijing. The extension of the U.S. nuclear umbrella to NATO is generally thought to have worked during the Cold War because of the fear that a Warsaw Pact conventional assault on Western Europe would escalate into a general nuclear exchange between the United States and USSR. But with the threat of general nuclear war far more remote than it was even during the détente periods of the U.S.-Soviet rivalry, Cold War notions of extended deterrence and dissuasion implicit in the 2001 Nuclear Posture Review appear to have limited relevance to the nuclear era of the early 21st century.

A further departure from the Cold War nuclear age stems from renewed Russian interest in nuclear use that has emerged over the last decade. In June 1999 the Russian military ran an exercise, Zapad-99 (West-99), which began with

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[56] Mikhail Gorbachev, *Perestroika: New Thinking for Our Country and the World* (New York: Harper & Row, 1987), p. 219.

[57] "Joint Soviet-United States Statement on the Summit Meeting in Geneva," November 21, 1985, http://www.reagan.utexas.edu/archives/speeches/1985/112185a.htm (accessed May 24, 2010).

[redacted]

[59] Peter D. Zimmerman, "Debating Nuclear Deterrence," New York Review of Books blog, May 2010, at http://www.nybooks.com/blogs/nyrblog/2010/may/12/debating-nuclear-deterrence-symposium/ (accessed June 27, 2010). Zimmerman's observations are based on his discussions with Soviet physicists Evgeny Velikhov and Roald Sagdeev, as well as with Russians involved in the START I negotiations during 1984-1986. During START I Zimmerman was the chief scientist of the Arms Control and Disarmament Agency.

an attack by NATO on the Russian Federation. In the final stage of the exercise, the Russian Army was, in the words of Defense Minister Igor Sergeyev, "forced to launch nuclear strikes first which enabled it to achieve a breakthrough in the theater situation" and restore Russian territory.[60]

Since Zapad-99, reliance on theater or tactical nuclear weapons to offset unfavorable correlations of forces vis-à-vis NATO or China at the conventional level has been integrated into a broad range of possible conflict scenarios by the Russian military.[61] In a January 2008 speech, General Yuri Baluyevsky, then chief of the Russian General Staff, explained that Russia reserved to itself the option of a preemptive nuclear first strike to defend its sovereignty and territorial integrity.[62] More recently, in February 2010, a new version of the Russian Federation's military doctrine appeared on Medvedev's presidential website. While the document highlighted avoiding nuclear conflict as "the most important objective of the Russian Federation," it went on to state that the

> Russian Federation retains the right to use nuclear weapons in response to the use against it and (or) its allies of nuclear and other types of weapons of mass destruction as well as in case of aggression against the Russian Federation with the application of conventional weapons when its very existence is threatened.[63]

The latter contingency—nuclear first use to offset conventional weakness when the survival of the Russian state is at stake—is precisely what the Russian military has been exploring in exercises since Zapad-99. According to Dima Adamsky's research, Russia has two deterrence strategies: "a global one, aimed at deterring nuclear aggression by means of a threat of massive nuclear launch-on warning and retaliation strikes; and a regional one, aimed at deterring and terminating large-scale conventional aggression through a threat of limited nuclear demonstration and deescalation strikes."[64] The mainstream assumption in Russian thinking about regional nuclear deterrence seems to be that the threat of or actual limited use of nuclear weapons "will terminate conventional hostilities with-

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[60] Mark Schneider, "The Nuclear Forces and Doctrine of the Russian Federation," United States Nuclear Strategy Forum Publication No. 0003, National Institute Press, 2006, p. 8.

[61] Dr. Nikolai Sokov, "Chronology of Significant Military Maneuvers," August 2004, online at <http://www.nti.org/db/nisprofs/russia/weapons/maneuver.htm>.

[62] Stephen J. Cimbala, "Nuclear First Use: Prudence or Peril?" *Joint Forces Quarterly*, 4th Quarter 2008, p. 27.

[63] "Военная доктрина Российской Федерации [Military Doctrine of the Russian Federation]," February 11, 2010, trans. Natalya Anfilofyeva, paragraphs 16 and 22, http://news.kremlin.ru/ref_notes/461 (accessed March 16, 2010).

[64] Dima Adamsky, "Workshop Read-Head Paper," Long Term Strategy Group (LTSG), August 16, 2010, p. 1. This paper was excerpted from the conclusion of LTSG monograph by Adamsky.

out escalation to a massive nuclear exchange."[65] Whereas the United States has been moving in the direction of limiting reliance on nuclear weapons, there are those in Russia who have evidently found new utility in them.

While President Obama acknowledged in his 2009 Prague speech that the goal of a nuclear-weapons-free world will not be reached quickly—perhaps not even in his lifetime[66]—the United States "is the only declared nuclear power that is neither modernizing its nuclear arsenal nor has the capability to produce a new nuclear warhead."[67] No one in the United States has either designed a new nuclear weapon since the 1980s or built one since the early 1990s.[68] By contrast, the Russians have been designing a new generation of nuclear weapons with low yields, the capability to neutralize hard or deeply buried targets, "clean" qualities that would minimize collateral damage, and electro-magnetic-pulse effects optimized to shut down enemy command, control, and communications (C3) as well as other electrical equipment.[69] China, too, has reportedly embarked on an ambitious path to design and field new nuclear weapons.[70]

The Cold War nuclear era was dominated by the long-term competition in strategic-nuclear arms between the United States and the Soviet Union. Both nations sought, first and foremost, to deter a nuclear attack by the other. Overkill notwithstanding, the fielding of large, diverse nuclear forces by both sides eventually led to a stable relationship of mutual deterrence based on the ability to annihilate the other's society after absorbing a nuclear strike. Underlying concepts such as deterrence, an assured retaliatory capability, and first-strike stability came to be reasonably well developed and understood. Little of this, however, appears to apply to the current nuclear era. While the New Triad U.S. officials advanced in late 2001 was intended to strengthen both deterrence and dissuasion, American adversaries have increasingly sought ways and means to attack U.S. forces and territory despite the existence of the New Triad or, within it,

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[65] Adamsky, "Workshop Read-Head Paper," p. 2. The details of nuclear use to deescalate or terminate a conventional regional conflict were left in a classified annex to the February 2010 edition of Russian military doctrine that appeared on Medvedev's website.

[66] "Remarks by President Barack Obama," April 5, 2009.

[67] Gates, speech at the Carnegie Endowment for International Peace, October 28, 2008.

[68] Gates, speech at the Carnegie Endowment for International Peace, October 28, 2008.

[69] John S. Foster, "The Nuclear Weapons Horizon," *Comparative Strategy*, Vol. 26, No. 1, January 2007, p. 90. The new generation of nuclear weapons the Russians developed from 1998 to around 2005 has been termed a "nuclear scalpel" based on their potential to terminate regional conflicts (Adamsky, "Workshop Read-Head Paper," p. 6).

[70] Gates, speech at the Carnegie Endowment for International Peace, October 28, 2008. To underscore China's interest in nuclear modernization, Michelle Van Cleave, who served as the National Counterintelligence Executive from 2003 to 2006, recently acknowledged that the Chinese have acquired the designs of all of America's nuclear weapons (60 Minutes transcript, "Caught on Tape: Selling America's Secret," February 25, 2010, p. 1, http://www.cbsnews.com/stories/2010/02/25/60minutes/main6242498.shtml?tag=contentMain;cbsCarousel, accessed March 17, 2010).

America's residual nuclear arsenal. To repeat the central question, how exactly is deterrence, much less dissuasion, supposed to work against prospective competitors or adversaries as diverse as Russia, China, Iran, al Qa'ida, and the Taliban? If al Qa'ida terrorists, for instance, acquired a nuclear weapon, is it at all plausible that the New Triad would deter them from using it?

There is a further complication. The U.S.-Soviet Cold War competition in nuclear arms was essentially a two-player game. The basic strategic choice for both sides was whether to strike first or wait. Once each adversary could absorb a first strike and still inflict devastating nuclear retaliation on the other, self-interest and logic argued that it was far preferable to wait. Today, though, nuclear proliferation is turning the two-player Cold War game into a multi-player game with participants ranging from major states to terrorist organizations. Three-player games lack the determinacy of the two-player Cold War situation in which both sides had robust second-strike retaliatory capabilities. In such circumstances, self-seeking utility maximization or individual rationality clearly argued that neither side should risk shooting first. However, if three countries have nuclear weapons aimed at one another, there is no principle of societal rationality that can resolve whether to shoot first or adopt a waiting strategy and, as Martin Shubik observed in 1982, "none is in sight."[71] It is not that three-player games have no solutions. Rather, the point is that they cannot be "properly analyzed or solved until adequate information is provided about the . . . the possibilities for communication, compensation, commitment, and trust" between adversaries—even if one assumes international security is reducible to mathematical game theory, which it is not.[72]

What game theory suggests, therefore, is that Cold War assumptions and concepts about nuclear deterrence or stability cannot be carried over into the post-9/11 nuclear period without reexamination, if not fundamental rethinking. As Paul Bracken wrote in 2003:

> . . . the facts that the second nuclear age is intrinsically a multiple-player game, that its bomb programs are rooted in nationalism, and that there are tremendous differences in strategic culture all mean that Washington could be facing sequential crises with opponents capable of unpredictable and explosive behavior.[73]

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[71] Martin Shubik, *Game Theory in the Social Sciences: Concepts and Solutions* (Cambridge, MA: MIT Press, 1982), p. 2.

[72] Shubik, *Game Theory in the Social Sciences*, p. 24; also, Paul Bracken, "The Second Nuclear Era: How Much Has Changed, How Much Remains the Same?" unpublished draft November 17, 2002, pp. 7-8, http://www.nautilus.org/gps/scenarios/BrackenSecondNuclearAgeCEIP2002.pdf (accessed March 23, 2010).

[73] Paul Bracken, "The Structure of the Second Nuclear Age," Foreign Policy Research Institute E-Note, based on a paper presented at a November 2002 nonproliferation conference at the Carnegie Endowment for International Peace, published in the Summer 2003 issue of *Orbis*, September

In sum, nuclear deterrence and stability are going to be different and more complex in the current nuclear era than they were during the Cold War.

25, 2003, http://www.fpri.org/enotes/20030925.americawar.bracken.secondnuclearage.html (accessed March 24, 2010).

CHAPTER 3: THE UNRAVELING OF THE COLD WAR CONSENSUS ON NUCLEAR WEAPONS

In 2006, a Defense Science Board (DSB) task force on U.S. nuclear capabilities opened its report with the observation that the Cold War "national consensus on the need for nuclear weapons and the role these weapons played in the security of the United States and its allies . . . no longer exists."[74] Not surprisingly the task force's principal conclusion was that "there is a need for a national consensus on the nature and role of nuclear weapons, as well as a new approach to sustaining a reliable, safe, secure, and credible nuclear stockpile."[75] This chapter examines two questions. First, what were the principal tenets of the consensus on nuclear forces within the U.S. national security establishment during the Cold War? Second, how different are the views of those national leaders, government officials, analysts and academics, think tanks, and others who have rejected at least some elements of that consensus?

In 2008 Kurt Guthe conducted a brief review of presidential directives and statements, memoirs, interviews, official histories, government reports, Congressional hearings and secondary sources on U.S. nuclear policies during the Cold War. He acknowledged at the outset that successive administrations usually have had strong incentives to differentiate their policies from those of their predecessors even when the prior administration has been of the same political party. In the case of nuclear forces, Dwight Eisenhower's administration adopted the "New Look" strategy that gave priority to SAC's bomber force over conventional forces and emphasized "massive retaliation"; the administrations of John Kennedy and Lyndon Johnson promoted, at various times, "counterforce," "flexible response, and "assured destruction"; Richard Nixon's administration called for "strategic sufficiency" but, along with Gerald Ford's administration, explored "flexible nuclear options"; Jimmy Carter's administration adopted a "countervailing strategy" that, among other things, explicitly held at risk Soviet political leaders; and Ronald Reagan's administration emphasized strategic modernization and ballistic missile defense. But although these differences from one administration to the next have tended to garner the most attention and debate, Guthe found the continuities in U.S. nuclear policies, strategies, plans and programs throughout the Cold War more striking than the differences.[76] While his 2008 survey of nuclear policy made no pretense at being exhaustive or comprehensive, he nevertheless

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[74] Dr. John Foster and General (USAF, ret.) Larry Welch (co-chairs), "The Report of the Defense Science Board Task Force on Nuclear Capabilities," Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, December 2006, p. 2.

[75] William Schneider, cover letter forwarding Foster and Welch, "The Report of the Defense Science Board Task Force on Nuclear Capabilities."

[76] Kurt Guthe, "Ten Continuities in U.S. Nuclear Weapons Policy, Strategy, Plans, and Forces," National Institute for Public Policy, Contract No SP0600-04-C-5982, September 2008, p. 1.

identified no less than ten continuities that he saw as constituting the U.S. Cold War consensus on nuclear arms.

With some reordering and rewording, the ten continuities Guthe identified are the following:

1. Nuclear arms are special weapons, not just more powerful versions of high-explosive conventional munitions.

2. Nuclear surety—the safety, security, reliability, and control of U.S. nuclear weapons—is essential.

3. A credible U.S. offensive capability for nuclear retaliation, not defenses, provides the primary protection against nuclear attack.

4. Alternatives to nuclear weapons, wherever possible, are preferred.

5. U.S. nuclear forces must not be inferior to those of another power.

6. A minimum deterrence force posture is inadequate to meet U.S. defense requirements.

7. A triad of heavy bombers, ICBMs and SSBNs is valuable for its resilience, survivability, and flexibility.

8. The roles and missions of U.S. nuclear forces go beyond the deterrence of a U.S.-Soviet nuclear exchange.

9. U.S. nuclear forces support security commitments to reassure and defend key allies.

10. The United States should retain the option to use nuclear weapons first.[77]

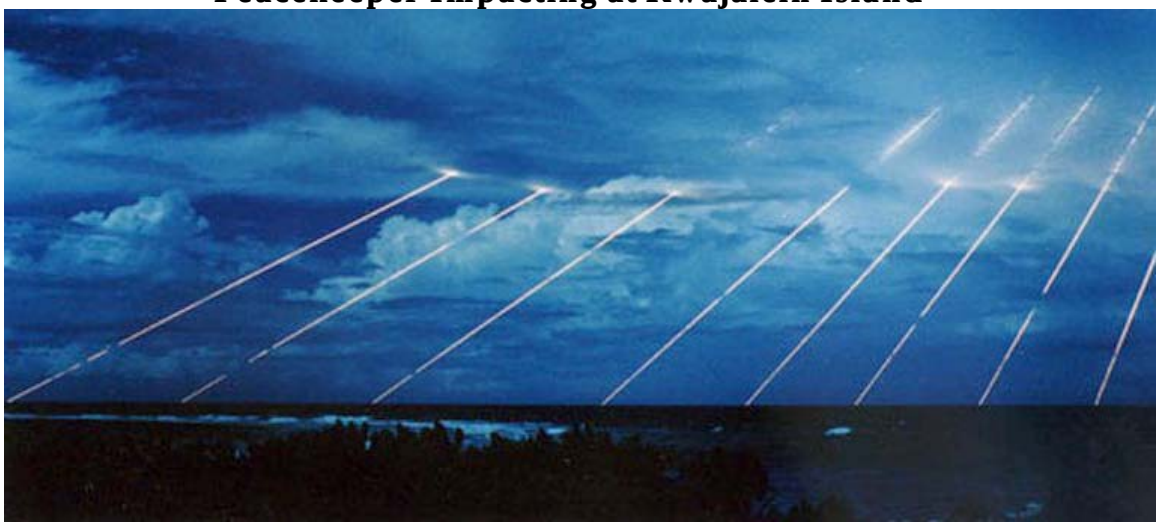
While the intended meanings of these ten continuities are hardly opaque, some additional discussion will serve to clarify them, confirm that most of them have not yet been set aside as of this writing, and recall relevant aspects of U.S. nuclear history.

The view that nuclear weapons are qualitatively different from non-nuclear weapons due to the intensity of their immediate blast and thermal effects together with longer-lasting fallout and radioactive contamination did not take hold in the United States until the 1950s. In fact, U.S. planning for the employment of atomic weapons against the USSR during the brief period of American

[77] Guthe, "Ten Continuities in U.S. Nuclear Weapons Policy, Strategy, Plans, and Forces," p. 2.

monopoly, from July 1945 until August 1949, utilized the concepts and experiences derived from the World War II strategic bombing campaigns against Germany and Japan. Only after Harry Truman made the decision to develop the hydrogen bomb did RAND analysts begin exploring the implications of thermonuclear weapons with yields ranging from one to 25 megatons.[78] And only after it became clear that these weapons could be delivered over intercontinental distances by ballistic missiles against which there was no defense did the U.S. defense establishment begin treating them as ultimate weapons that were qualitatively different from conventional ones. In the end, it was the prospect of plentiful numbers of thermonuclear-tipped ICBMs and SLBMs that propelled both the United States and the Soviet Union into the nuclear missile age.

Figure 6: Mark-21 Reentry Vehicles Launched by an LGM-118 Peacekeeper Impacting at Kwajalein Island[79]



A key step in this direction was the miniaturization of fusion warheads. The thermonuclear device detonated at the Pacific atoll Enewetak on November 1, 1952, weighed some 82 tons. But Edward Teller and John von Neumann soon calculated that, by 1960, the United States would be able to build one-megaton thermonuclear warheads weighing less than a ton.[80] In May 1953, (then Air Force Colonel) Bernard Schriever and his friend Teddy Walkowicz visited von Neumann at Princeton where they received technical confirmation of this forecast. The meeting gave Schriever confidence that it would be possible to marry

[78] Bernard Brodie, Charles Hitch, and Ernst Plesset, "Implications of Large-Yield Nuclear Weapons," RAND, R-237, July 10, 1952, http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB108/ (accessed April 2, 2010).

[79] Each Mark-21 could be independently targeted against a separate aim point within the footprint of the Peacekeeper, which could carry as many as ten Mark-21s.

[80] Neil Sheehan, *A Fiery Peace in a Cold War: Bernard Schriever and the Ultimate Weapon* (New York: Random House, 2009), p. 178.

large-yield thermonuclear warheads with intercontinental ballistic missiles.[81] This prospect, which had already been anticipated at RAND, triggered the development of concepts for nuclear strategy very different from those of World War II strategic bombing campaigns. In the end, the 1950s and early 1960s witnessed the transition from atomic scarcity and American monopoly to the thermonuclear plenty of the missile age for both the United States and the Soviet Union. The USSR tested its first "boosted fission" device, which used fusion to increase yield, and tested its first "true" thermonuclear device in November 1955.[82] This second nuclear "revolution" was far more consequential than the atomic revolution at the end of World War II. Over time, thermonuclear plenty and ballistic missiles led to U.S. and Soviet nuclear arsenals that appeared capable, in at least some scenarios, of annihilating either nation as well as producing catastrophic climatic and environmental damage—possibilities that have energized the desire to abolish nuclear weapons ever since.

From the beginning, nuclear surety has gone hand in glove with the special status of nuclear weapons. Truman, through the Atomic Energy Act of 1946, established "a system that made atomic weapons a separate part of the nation's arsenal under civilian control, with the President of the United States the sole authority over their use."[83] In September 1952, however, Truman authorized the transfer of some nuclear weapons to the Department of Defense "to assure operational flexibility and military readiness."[84] After taking office in 1953, Eisenhower retained Truman's policy that the president would be the final authority over nuclear use.[85] But he also accelerated the transfer of nuclear weapons to military control to increase operational readiness. By the time Eisenhower left office in 1961, less than 10 percent of the stockpile remained under civilian control.[86] After the 1962 Cuban missile crisis, U.S. readiness to employ nuclear weapons at any hour of the day or night was further strengthened by providing the president with a nuclear briefcase containing launch codes that he could use to authorize a nuclear attack while away from fixed command centers such as the White House's situation room. Other means of achieving nuclear surety included building environmental sensing devices into warheads to preclude inadvertent detonations, permissive action links in delivery vehicles so that aircrews could only arm nuclear bombs if they had the proper codes, and the two-man-control system for handing and employing nuclear weapons established in 1962.

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[81] Sheehan, *A Fiery Peace in a Cold War*, pp. 193-194, 217.

[82] Department of Energy, "Nuclear Proliferation (1949-present)," p. 2, at http://www.cfo.doe.gov/me70/manhattan/proliferation.htm (accessed June 27, 2010).

[83] Rosenberg, "The Origins of Overkill," p. 11.

[84] Office of the Deputy Assistant to the Secretary of Defense for Nuclear Matters, "Nuclear Chronology: (1950-1959)," at http://www.acq.osd.mil/ncbdp/nm/nuclearchronology2.html (accessed May 25, 2010).

[85] Rosenberg, "The Origins of Overkill," p. 69.

[86] Rosenberg, "The Origins of Overkill," pp. 27-28, 43.

As mentioned in Chapter 2, the emphasis on offensive forces to deter nuclear attack was enshrined in the 1972 ABM Treaty. In 1983, Ronald Reagan decided to address this dependence by initiating a research program to develop ballistic missile defenses capable of shielding the United States from an all-out attack by Soviet ICBMs and SLBMs. As of fiscal year 2009, the Defense Department had invested over $150 billion in this endeavor.[87] So far, however, the investment has yielded little capability. The roughly two-dozen ground-based interceptors now deployed in Alaska and California are only capable of defending against a very small attack—one or two missiles—launched from places such as North Korea. This modest deployment has almost no capability to defend against a large-scale attack from Russia, for example. Consequently, U.S. nuclear deterrence continues to rest primarily on offensive nuclear forces, just as it did throughout the Cold War. As a practical matter, U.S. abrogation of the ABM treaty and subsequent fielding of a limited capability for national missile defense has not yet departed appreciably from the Cold War consensus of primary reliance on offensive nuclear forces to deter nuclear attack articulated by Guthe's research.

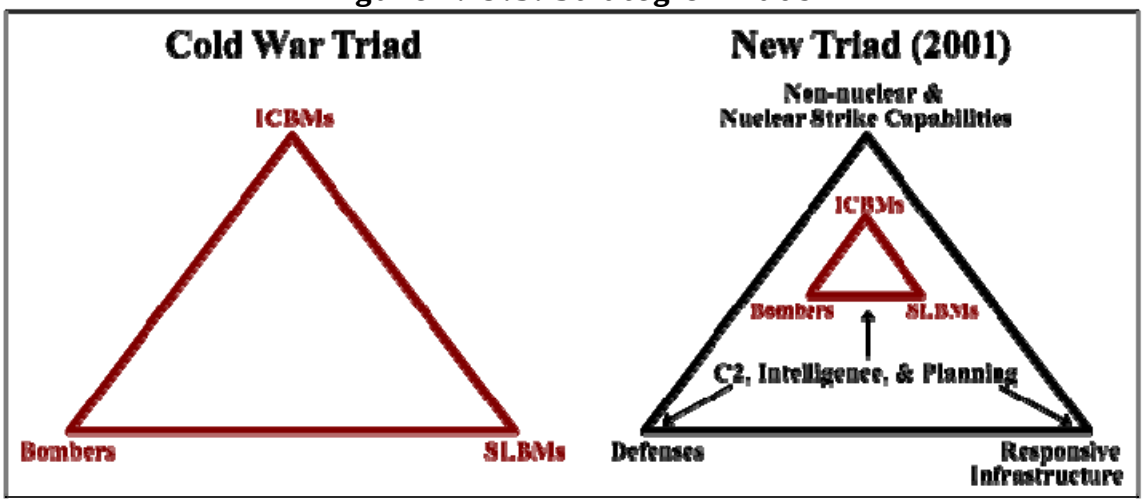
Two other aspects of current U.S. nuclear policies that have not abandoned the precepts of the Cold War consensus on nuclear arms are: maintaining nuclear forces comparable to Russia's and retaining a nuclear triad. Both the 2001 and 2010 Nuclear Posture Reviews insisted that U.S. nuclear forces not be inferior to those of those of the Russian Federation. As Table 2 shows, the U.S. and Russian nuclear stockpiles are, by far, the largest on the planet, all other nuclear powers making up less than 5 percent of the worldwide stockpile of nuclear weapons. Put somewhat differently, the last two Nuclear Posture Reviews also rejected any sort of minimal nuclear deterrent posture. In addition, the 2010 NPR, like its predecessor, explicitly retained a nuclear triad of ICBMs, SLBMs, and heavy bombers. Up to this point, therefore, it is not unreasonable to argue that, for the most part, the Obama administration's nuclear policies embrace the first seven of Guthe's ten Cold War continuities—at least so long as nuclear arsenals continue to exist.

The 2010 NPR's departure from the Cold War consensus on the roles and value of nuclear forces lies in its rejection of the last three of Guthe's continuities (propositions 8, 9 and 10). Beyond the desideratum of initiating concrete steps toward achieving a world without nuclear weapons, the most obvious break with America's nuclear past involves narrowing the range of contingencies that U.S. nuclear forces are intended to deter. U.S. nuclear policy-makers and strategists have long sought alternatives to nuclear use, and rightly so. This inclination dates at least back to 1975 when the final report of the Long Range Research and Development Planning Program concluded that conventional weapons with "near zero miss" were not only feasible, but "could provide the National Command Au-

[87] Steven A. Hildreth, "Ballistic Missile Defense: Historical Review," Congressional Research Service, RS22120, Updated January 28, 2008, p. 1.

thority with a variety of strategic response options as alternatives to massive nuclear destruction."[88] The legitimate desire to reduce U.S. dependence on the threat or use of a massive nuclear response was reaffirmed in both the 2001 and 2010 Nuclear Posture Reviews. The 2001 NPR introduced the New Triad but retained the Cold War nuclear triad within it. Here the underlying notion was that since most of the contingencies for which the United States military prepares to protect its interests (and those of allies) "may not require nuclear strikes," non-nuclear strategic forces—including conventional precision strikes and information operations—could be substituted more widely for a nuclear response.[89] The 2010 review also retained a nuclear triad but, under New START, the U.S. force of ICBMs, SLBMs, and bombers will be smaller—700 deployed launchers (plus another 100 non-deployed)—than the goal of 1,600 in START I.[90]

Figure 7: U.S. Strategic Triads[91]



The 2010 NPR went even further down the path of limiting the role of U.S. strategic-nuclear forces. It declares that the United States "will continue to strengthen conventional capabilities and reduce the role of nuclear weapons in deterring non-nuclear attacks, with the objective of making the deterrence of nuclear attack on the United States or our allies and partners the sole purpose of U.S. nuclear weapons."[92] Arguing that the need to deter chemical and biological weapon (CBW) attacks with nuclear weapons has been diminished by improve-

[88] Dominic A. Paolucci, "Summary Report of the Long Range Research and Development Planning Program," Lulejian and Associates, Falls Church, VA, February 7, 1975, p. 45. Albert Wohlstetter was the primary drafter of this report.

[89] DoD, "Excerpts of Classified Nuclear Posture Review/S," January 8, 2002, p. 2 (which cites page 7 of the classified report).

[90] SORT/Treaty of Moscow in 2002 did not set any new launcher limits but retained those established in 1991 by START I.

[91] J. D. Crouch, "Findings of the Nuclear Posture Review," January 9, 2002, Slide 9.

[92] DoD, "Nuclear Posture Review Report," April 2010, p. 17.

ments in missile defenses and counter-WMD capabilities, the document states that the "United States will not use or threaten to use nuclear weapons against non-nuclear weapons states that are party to the nuclear Non-Proliferation Treaty (NPT) and in compliance with their nuclear non-proliferation obligations."[93] Granted, the 2010 NPR adds the escape clause that the United States might "adjust" this assurance in the face of catastrophic chemical or biological attacks.[94] And while the 2010 review is silent on whether the U.S. still retains the option to preempt with nuclear weapons, the clear intent is to reduce longstanding ambiguity about when and where the U.S. leaders might decide to employ nuclear weapons. Henceforth, only states that are nuclear-armed or not in compliance with the NPT need fear a U.S. nuclear response. Altogether, these policies appear to reject the last three propositions in Guthe's formulation of the bi-partisan U.S. consensus on nuclear forces during the Cold War.

Noting that this consensus had broken down, the 2006 DSB task force on U.S. nuclear capabilities sought to articulate the alternative view that appeared to be gaining acceptance. The five propositions below, which have been slightly updated and stated as clearly as possible, reflect what the task force perceived to be emerging as an alternative position on the value and roles of U.S. nuclear forces.

1. Lower numbers of U.S. nuclear weapons are preferable regardless of the stockpile starting point, with zero as the ultimate goal.

2. U.S. nuclear development and sustainment activities cause other states to seek their own nuclear weapons, thereby spurring nuclear proliferation and the prospect that such weapons could fall into the hands of terrorists.

3. In the post-Cold War world—and even more so after al Qa'ida's attack on September 11, 2001 (9/11)—non-proliferation is more important for U.S. security than nuclear deterrence.

4. Until the world is free of nuclear weapons, nuclear forces should only be used by the United States to deter nuclear threats.

5. Any new nuclear initiatives by the United States—including the design, much less the actual production, of new nuclear warheads—are unnecessary for deterrence, and would undermine the higher priority of non-proliferation.[95]

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[93] DoD, "Nuclear Posture Review Report," April 2010, p. 15.

[94] DoD, "Nuclear Posture Review Report," April 2010, p. 16.

[95] Foster and Welch, "Report of the Defense Science Board Task Force on Nuclear Capabilities: Summary Report," pp. 2-5.

For good or ill, these five tenets appear to reflect the core of the Obama administration's views on nuclear forces as well as those of former U.S. government officials, academics and analysts committed to the attainment of a world free of nuclear weapons. One point that could be added to the 2006 DSB's formulation is the Obama administration's emphasis on "nuclear terrorism and nuclear proliferation" as the most urgent threats to U.S. national security, now and in the foreseeable future.[96] Al Qa'ida and their extremist allies are seeking nuclear weapons and, again, there is little reason to think the new U.S. triad would deter them from using any that might fall into their hands. Since further proliferation of nuclear arms to countries such as Iran would increase the likelihood that terrorist organizations would one day acquire nuclear weapons, there is an obvious linkage between nuclear terrorism and proliferation. Hence the current administration's nuclear priorities and commitment to nuclear abolition in the long run.

Is there a theory or logic underlying the approach to nuclear forces reflected in the five propositions articulated by the 2006 DSB task force? In analyzing the 2010 Nuclear Posture Review in the context of New START and President Obama's April 2009 speech in Prague, Evan Montgomery argued that the administration's various policy positions on nuclear forces reflect a broader strategic calculation about what motivates nations to seek nuclear weapons. The administration's implicit theory is that:

> if the United States diminishes its reliance on nuclear weapons—by reducing the size of its arsenal, restricting the conditions under which it would use these weapons, and forgoing the construction of new warheads—other nations are more likely to de-emphasize their own nuclear capabilities or abandon their nuclear ambitions. Should this happen, the dangers of nuclear proliferation and nuclear terrorism can be reduced substantially, and an important step toward the abolition of nuclear weapons will have been taken.[97]

In other words, a principal reason other nations have pursued or maintained nuclear weapons—if not the main one—has been to counter the U.S. nuclear arsenal, which is precisely that of the second proposition in the 2006 DSB's list of alternative views to the Cold War consensus on nuclear arms.

While this explanation may well have applied to the USSR during the Cold War, in reality most nuclear powers or aspirants have sought or developed nuclear weapons for other reasons. For Britain and France, the primary motivation appears to have been to preserve their positions after World War II as great powers. The bomb gave Britain a front rank in world councils and added political and military strength to the trans-Atlantic alliance that defended Western Europe

[96] DoD, "Nuclear Posture Review Report," April 2010, pp. iv, 2, 3-4.

[97] Evan Braden Montgomery, "The Logic and Limitations of the Nuclear Posture Review," Center for Strategic and Budgetary Assessments, April 2010, p. 1.

during the Cold War.[98] France under Charles de Gaulle made the decision to develop an independent nuclear deterrent for similar reasons. Israel, initially surrounded by six hostile Arab states that had tried in 1948 to destroy the Jewish state, developed its unacknowledged nuclear capabilities for reasons that had nothing to do with countering either U.S. or Soviet nuclear forces. In the aftermath of the Nazi Holocaust in which six million Jews died, David Ben-Gurion, Israel's first prime minister, "was nearly obsessed with developing nuclear weapons as the as the only guarantor against further slaughter."[99] Similarly, India's and Pakistan's development of nuclear weapons was not motivated by the U.S. Or Soviet nuclear arsenals but by their own conflicts and fears of the other. More recently, the North Korean and Iranian nuclear programs appear to be responses to American *conventional* military capabilities, which in 2001 and 2003 were used to bring about regime change—first in Afghanistan and then in Iraq. As for the Russians, their signing of New START not only accords the Russian Federation the prestige of nuclear parity with the United States at lower and more affordable force levels, but even includes constraints on U.S. ballistic missile defenses and non-nuclear prompt global strike capabilities.[100]

The irony of the Obama administration's implicit theory that the U.S. nuclear arsenal is a primary driver behind nuclear proliferation is that, as the United States turns increasingly to conventional capabilities rather than nuclear deterrence, it will emphasize the very capabilities that motivated Iraq, Iran, and North Korea to seek nuclear weapons.[101] As India's former army chief of staff observed after the 1991 Persian Gulf War, the lesson of Desert Storm is: "Don't fight the United States without a nuclear weapon."[102] It appears that Iran's rulers, among others, have heeded this lesson despite the International Atomic Energy Agency, various United Nations Security Council resolutions, the nuclear nonproliferation regime, and Western economic sanctions. True, there are good reasons for the United States to substitute non-nuclear precision strike for nuclear

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[98] Andrew Roberts, *A History of the English-Speaking Peoples since 1900* (New York: Harper Perennial ed. 2008, first published in Great Britain in 2006 by Weidenfeld & Nicolson), pp. 389-390.

[99] Jeffrey Goldberg, "The Point of No Return," *The Atlantic*, September 2010, p. 64.

[100] Article V, Section 3, of New START prohibits both parties from using ICBM and SLBM launchers for the "placement of missile defense interceptors." As for America's ability to develop and deploy conventional prompt global strike capabilities, the latest NPR states that conventionally armed ICBMs or SLBMs "would be accountable" under New START, a point Gates confirmed in May 2010 (DoD, "Nuclear Posture Review Report," April 2010, p. 20; Robert M. Gates, "The Case for the New START Treaty," *The Wall Street Journal*, May 13, 2010, at http://online.wsj.com/article/SB10001424052748703339304575240164048611360.html?mod=WSJ_Opinion_LEFTTopOpinion, accessed May 27, 2010).

[101] Montgomery, "The Logic and Limitations of the Nuclear Posture Review," p. 2.

[102] General Charles A. Horner, "What We Should Have Learned in Desert Storm, But Didn't," *AIR FORCE Magazine*, December 1996, at http://www.airforce-magazine.com/MagazineArchive/Pages/1996/December%201996/1296horner.aspx (accessed May 28, 2010).

weapons whenever and wherever possible. "Nevertheless, the expectation that these steps will slow or reverse nuclear proliferation and diminish the threat of nuclear terrorism is misguided at best, and potentially self-defeating at worst."[103]

[103] Montgomery, "The Logic and Limitations of the Nuclear Posture Review," p. 2.

CHAPTER 4: THE INADEQUACIES OF COLD WAR ASSESSMENTS OF NUCLEAR COMPETITION

Within the U.S. government's executive branch, comprehensive assessments of the prospective implications of U.S. and Soviet nuclear forces on American national security can be traced at least back to 1953. The day before Eisenhower was inaugurated as president on January 19, 1953, President Truman's National Security Council (NSC) created a Special Evaluation Subcommittee "to prepare a summary evaluation of the net capability of the USSR to inflict direct injury on the United States during the period up to July 1, 1955."[104] The subcommittee was chaired by Idwal H. Edwards, a retired U.S. Air Force lieutenant general, and included representatives from the Central Intelligence Agency (CIA), the Joint Chiefs of Staff (JCS), two interdepartmental internal security committees, and the three military services. The study produced by Edwards' interagency working group, NSC 140/1, was submitted to the NSC on May 18, 1953.[105]

On the premise that the Soviets could have 120 atomic weapons with 80-kiloton yields in 1953 and up to 300 in mid-1955,[106] the principal conclusion of NSC 140/1 was that, although a Soviet nuclear attack could kill 9 million Americans and inflict considerable damage on SAC's bomber force and U.S. industrial areas, the United States would still be able to delivery a powerful retaliatory atomic air attack, continue the air offensive with conventional weapons, and successfully prosecute the war.[107] Matthis, who drafted all the chapters of NSC 140/1 save the one Edwards wrote, observed that the scenario the subcommittee was asked to assess—a deliberate Soviet atomic attack on the United States despite the grave risks and uncertainties of such an endeavor—was a "not very likely possibility."[108] In other words, the scenario Edwards' group was directed to examine was very much a worst case.

In the fall of 1954, the NSC initiated a second effort to assess the USSR's net capability to inflict direct injury on the United States with a "bolt-from-the-

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[104] Willard C. Matthias, *America's Strategic Blunders: Intelligence Analysis and National Security Policy, 1936-1991* (University Park, PA: The Pennsylvania State University Press, 2001), p. 111.

[105] Rosenberg, "The Origins of Overkill," p. 32. NSC 140/1, "Summary Evaluation of the Net Capability of the USSR to Inflict Direct Injury on the United States up to July 1, 1955," has still not been declassified.

[106] Matthias, *America's Strategic Blunders*, pp. 113-114

[107] Robert R. Bowie, Memorandum for the Secretary of State, "NSC 140/1 'Summary Evaluation of the Net Capability of the USSR to Inflict Direct Injury on the United States up to July 1, 1955'," Department of State, June 2, 1953, p. 2.

[108] Matthias, *America's Strategic Blunders*, p. 112. Matthias began his career in intelligence during World War II deciphering "ultra" codes for the Military Intelligence Division of the War Department General Staff. He joined the CIA's Office of the National Estimates when it opened in 1950 and rose to become a member of the Board of National Estimates in 1961. He retired in 1973.

blue" atomic attack. Now called the Net Capabilities Evaluation Subcommittee, retired Army lieutenant general Harold R. Bull was again the CIA committee member, Ray Cline rather than Matthias served as Bull's assistant and, similarly to Matthias' experience, Cline ended up writing "every word" of report.[109] His judgment was that the two "Net Estimates" together with the National Intelligence Estimates of the early 1950s "succeeded in reducing the Soviet military threat to the United States to reasonable proportions," an invaluable but little-remarked analytic accomplishment.[110]

The following February, Eisenhower signed a directive making the Net Evaluation Subcommittee (NESC) a permanent part of the NSC's annual activities. As before, the NESC was to provide "integrated evaluations of the net capabilities of the USSR, in the event of general war, to inflict direct injury upon the continental U.S. and key U.S. installations overseas, and to provide a continual watch for changes which would significantly alter those net capabilities."[111] The NESC continued to provide net evaluations of the impact on the United States of a general nuclear exchange with the USSR until President John Kennedy, on the urging of defense secretary Robert McNamara, disestablished the organization in 1965.[112]

One of the very few NESC documents that has been declassified and released is a report on the problem of using military force in a discriminating manner in order to manage and terminate a general nuclear war with the USSR on terms acceptable to the United States, which presumably would include deterring Soviet anti-population attacks and avoiding the "unconditional destruction" of the USSR as a U.S. war aim.[113] The report considered three main scenarios: (1) a nuclear exchange initiated by a surprise all-out Soviet nuclear attack against the continental United States and Western Europe; (2) a nuclear exchange initiated by a discriminate U.S. preemptive counterforce attack against the USSR based on conclusive intelligence that the Soviet leaders were preparing a surprise all-out nuclear attack; and (3) a conventional conflict in Europe that eventually escalated into a limited U.S.-USSR intercontinental exchange (to which the report also

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[109] Ray S. Cline, *Secrets, Spies, and Scholars: Blueprint of the Essential CIA* (Washington, DC: Acropolis Books, 1976), pp. 141-142; James S. Lay, Jr., "NSC Directive for a Net Capabilities Evaluation Subcommittee," June 23, 1954.

[110] Cline, *Secrets, Spies, and Scholars*, p. 143.

[111] NSC, "Directive on a Net Evaluation Subcommittee," NSC 5511, February 14, 1955; at http://history.state.gov/historicaldocuments/frus1950-55Intel/d207 (accessed May 28, 2010).

[112] McGeorge Bundy, "Discontinuance of the Net Evaluation Subcommittee of the National Security Council," National Security Action Memorandum No. 327, March 18, 1965.

[113] NESC, "The Management and Termination of War with the Soviet Union (TS)," November 15, 1963, pp. i, 1; at http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB31/05-01.htm (accessed June 4, 2010). The terms of reference for this study were developed by an interagency panel under Walt W. Rostow based on the report of an interdepartmental group headed by Thomas C. Schelling (ibid, p. ii). At the time, Rostow was chairman of the State Department's Policy Planning Council.

added a parallel conflict in the Far East involving North Vietnam and China).[114] The first scenario was included as a worst case in which there were the least possibilities of managing the conflict so as to avoid the wholesale destruction of the United States and the Soviet Union. However, the second scenario was based on the United States preempting the first based on unambiguous warning of the intentions of Soviet leaders to execute an all-out surprise nuclear attack on the United States and NATO. And, in the third scenario, the United States and NATO only resorted to theater nuclear use in Eastern Europe when it became clear that the Soviet decision to seize West Germany with conventional forces was about to succeed.[115] Thus, all three scenarios assumed Soviet bolt-from-the-blue aggression, and the first two were predicated on a worst case just as NSC 140/1 had been.

What emerges from these glimpses into the NESC's analyses of U.S-Soviet nuclear war during the 1950s and early 1960s is a decided tendency toward worst-case scenarios. Granted, Eisenhower's 1955 directive institutionalizing the NESC reiterated the original mission of evaluating the net capabilities of the USSR to inflict direct injury upon the United States and its allies in a general nuclear war. In addition, as the Cold War progressed most American strategists and analysts were increasingly hard pressed to imagine circumstances in which the U.S. president might choose to initiate a preventative nuclear attack on the USSR. This possibility was discussed in the early 1950s when Soviet strategic-nuclear forces were limited to LRA regiments equipped with Tu-4 bombers that could only reach the continental United States on one-way missions.[116] But as both sides began rapidly deploying ICBMs and SLBMs at the end of the decade, the notion of a preventative nuclear war against the USSR became far too risky and unappealing to be seriously entertained. In these circumstances, it was natural and understandable for American analysts of the U.S.-Soviet strategic-nuclear competition to embrace a bolt-from-the-blue Soviet nuclear attack on the United States

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[114] NESC, "The Management and Termination of War with the Soviet Union (TS)," pp. 1, 4. 14, 16, 21, 28.

[115] NESC, "The Management and Termination of War with the Soviet Union (TS)," pp. 23-24.

[116] In 1954, for example, the game theorist and head of RAND's mathematics department, John Williams, argued that the existing U.S. strategy vis-à-vis the USSR was bankrupt, and proposed that if the Soviets proved unwilling to place their nuclear armaments under international control, then the United States should "throw the first spear as fast as we can get it out of our hand" (John D. Williams, "Hunting the Tiger (and Other Aspects of the Active Life)," RAND, S-16, March 26, 1954, pp. i, 31-32). In response, Bernard Brodie argued that Williams' solution to the USSR's growing nuclear capabilities not only showed no faith or patience in deterrence, but was "immoral," "unfeasible," and "obviously and demonstrably unacceptable" to president Eisenhower (Bernard Brodie, Memorandum to John Williams, "Reply to you M-5110," M-5185, October 13, 1954, p. 2; and Brodie, Memorandum to John Williams, "A Moratorium on Similes," M-5484, November 1, 1954, pp. 1-2). The Tu-4 was a reverse-engineered version of the U.S. B-29. The first Tupolev Tu-95 Bears with intercontinental range were deployed in 1956. The Tu-95 could carry the Tsar Bomba [Царь-бомба], the largest nuclear weapon ever detonated. The Tsar Bomba dropped from a Tu-95 in 1961 produced a yield of around 50 megatons, which has been estimated to be one quarter of the yield of the 1883 eruption of Krakatoa.

as the dominant scenario. In doing so, however, this worst-case scenario crowded out consideration of more plausible scenarios such as the one that actually occurred in the 1962 Cuban missile crisis. Further exacerbating this narrowing of analytic focus was that as the Soviets achieved rough nuclear parity in the early 1970s, American thinking about nuclear conflict tended to stop with the first nuclear detonations, the presumption being that little or nothing lay beyond the initiation of general nuclear war than the thermonuclear devastation of both the United States and the USSR.

Ironically but understandably, Soviet General Staff analysts largely bought into the same kind of worst-case thinking. Their dominant scenarios during the Cold War generally started with a NATO attack on Eastern Europe or a U.S. nuclear attack on the USSR. In the early 1970s, for example, the Soviet General Staff conducted three major strategic-nuclear exercises that began with a U.S. first strike. [redacted] A pervasive Soviet sense of insecurity, coupled with the ideological preconception that the capitalist West was inherently aggressive, produced a consistent assumption by Soviet strategic planners that NATO or the United States would initiate hostilities.[118] This mindset appears to have been especially ingrained among senior Soviet military leaders even though both common sense regarding the enormous risks of nuclear war and their extraordinary access to Western military secrets argued otherwise. Not only were the dominant nuclear scenarios on both sides of the Iron Curtain throughout the Cold War worst cases, but each side's preferred scenarios were the opposite of the other's.

The problem of worst-case scenarios crowding out plausible ones turns out to be but the tip of the iceberg insofar as the shortcomings of most U.S. analyses of the Cold War strategic-nuclear competition are concerned. In January 1969 Andrew Marshall succeeded James R. Schlesinger as the director of the RAND Corporation's research and studies on strategic-nuclear forces.[119] Marshall had been involved in RAND's work on U.S. and Soviet nuclear forces since the spring of 1950, when he had participated in a major study on how best to target the USSR's economy with a limited number of atomic bombs (200) and the bombing

[redacted]

[118] Malcolm Byrne and Vojtech Mastny, "The Warsaw Pact, Gone with a Whimper," *The New York Times*, May 14, 2005; at http://www.nytimes.com/2005/05/13/opinion/13iht-edbyrne.html?_r=1 (accessed June 5, 2010).

[119] After Nixon won the 1968 presidential election, Schlesinger took a leave of absence to work on Nixon's transition team. In January 1969 he left RAND to be the assistant director of the Bureau of the Budget (now the Office of Management and Budget) with primary responsibility for the defense portfolio.

accuracies of that time. By and large, his work on nuclear forces well into the 1960s had, like that of the NESC and most his RAND colleagues, concentrated on deterrence and the prospective outcomes of a general nuclear exchange. Beyond Marshall's sense by 1969 that there was a lack of overall coherence to RAND's strategic research, what struck him was that the U.S.-USSR nuclear exchange that had been the focus of so much analysis since the early 1950s had not occurred. The United States and the Soviet Union had come perilously close to nuclear war in October 1962 over Nikita Khrushchev's attempt to emplace nuclear missiles in Cuba. But at the end of the day the two countries' leaders had stepped back from the nuclear abyss and deterrence had continued to hold during the rest of the 1960s. In reflecting on these observations, Marshall came to the conclusion that the possession of superior nuclear forces had produced effects and payoffs for the United States that went beyond deterrence. This thought led him to undertake a fundamental rethinking of RAND's approach to U.S.-Soviet competition in strategic-nuclear arms.

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[redacted] [redacted]

[123] The core of the statistical approach suggested by Thomas Bayes (1702-1761) is to provide a mathematical rule explaining how you should change your existing beliefs in light of new evidence ("In Praise of Bayes," *The Economist*, September 28, 2000; online at <http://www.economist.com/science/displayStory.cfm?Story_ID=382968>, last accessed June 2010. While Bayesian statistics remain controversial, their popularity has been growing. "The canonical example is to imagine that a precocious newborn observes his first sunset, and wonders whether the sun will rise again or not. He assigns equal prior probabilities to both possible outcomes, and represents this by placing one white and one black marble into a bag. The following day, when the sun rises, the child places another white marble in the bag. The probability that a marble plucked randomly from the bag will be white (i.e., the child's degree of belief in future sunrises) has thus gone from a half to two-thirds. After sunrise the next day, the child adds another white marble, and the probability (and thus the degree of belief) goes from two-thirds to three-quarters. And so on. Gradually, the initial belief that the sun is just as likely as not to rise each morning is modified to become a near-certainty that the sun will always rise." (ibid.).

[redacted] [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[128] CEP is the radius of a circle about an aim point within which 50 percent of the munitions will impact statistically. At the time of this memorandum, the CEP of the Minuteman III ICBM was thought to be 0.16 nautical miles (972 feet).

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

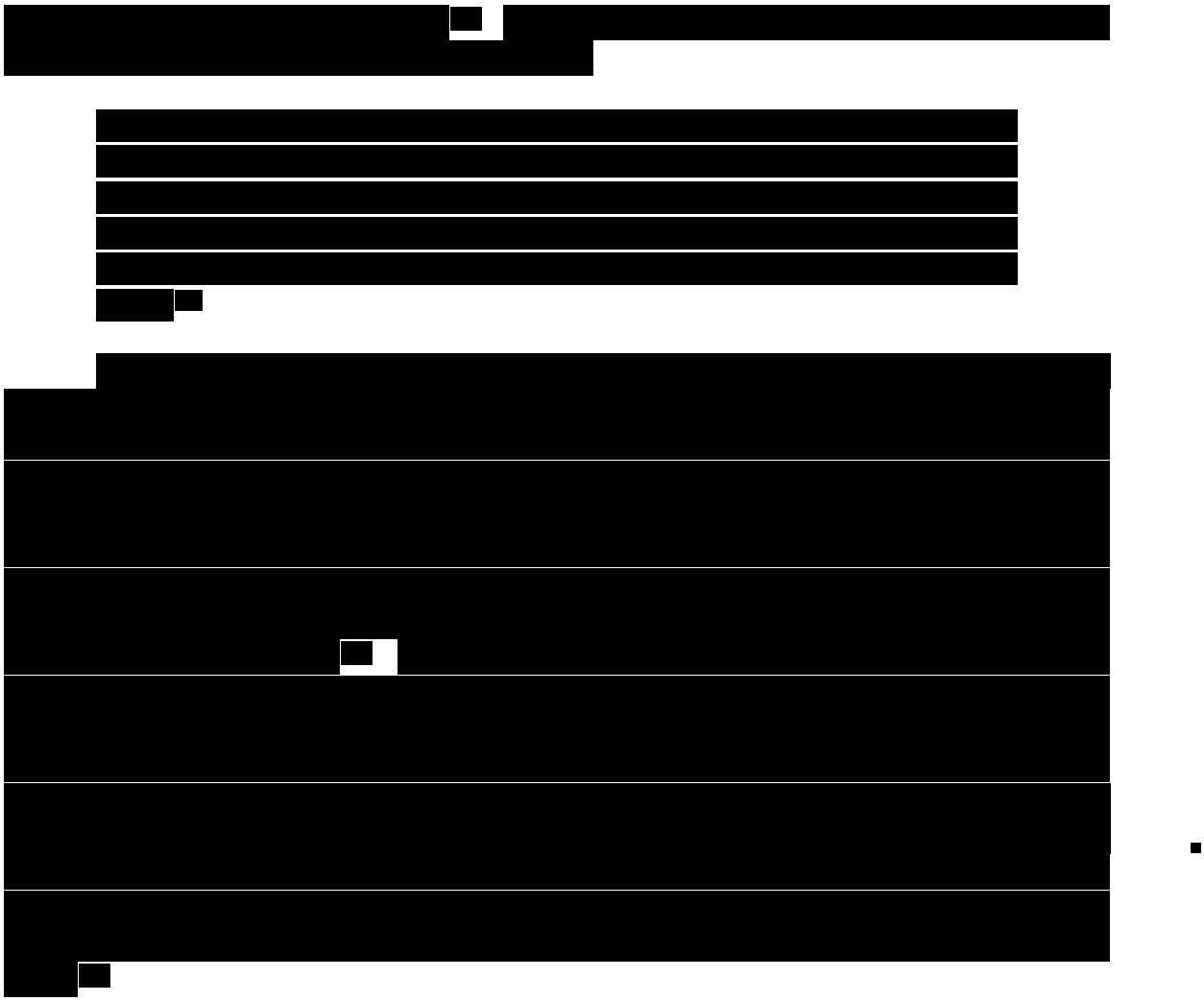
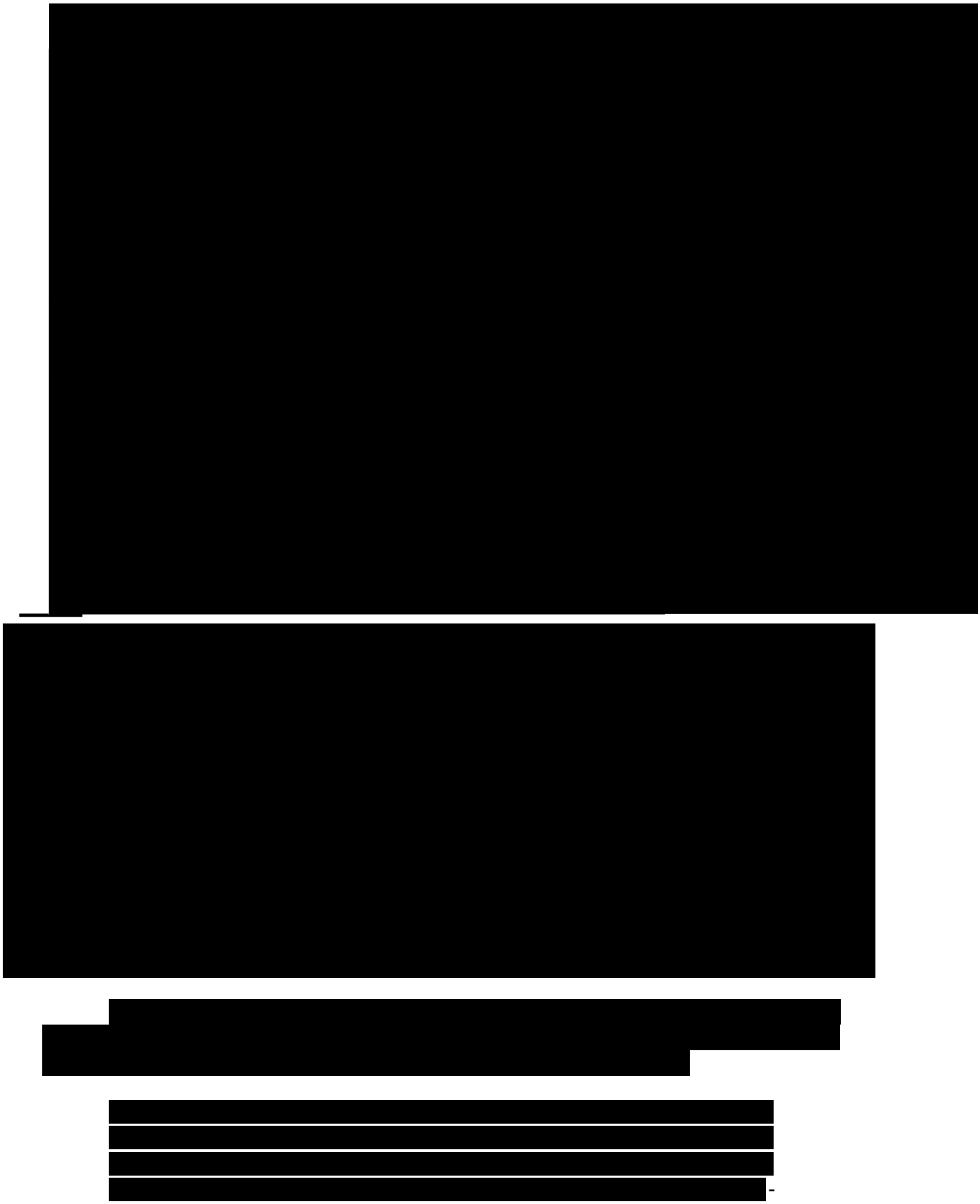


Figure 8: Minuteman Field, 91st Missile Wing, North Dakota[136]

[132] Fritz W. Ermarth, "Contrasts in American and Soviet Strategic Thought," *International Security*, Autumn 1978, p. 147

[133] A. W. Marshall, "A Program to Improve Analytic Methods Related to Strategic Forces," *Policy Sciences*, 15 (1982), p. 48.



[redacted]

In the beginning, the RSAC set out to improve "U.S. strategy analysis by combining the best features of political-military war gaming and analytic modeling" through the application of state-of-the-art artificial intelligence techniques to make "war gaming more efficient, rigorous, and analytic."[139] In the past, well-structured political-military war gaming between knowledgeable human teams had been able to capture some of the richness of events such as the Cuban missile crisis and reflect many of the more subtle differences in goals, doctrines, organizational behavior and operational capabilities largely omitted in analytic models. By developing artificial agents and automating the entire war game, RAND researchers hoped to provide the analytic rigor often missing from political-military interactions between human players. Human teams could still make some or all of the decisions instead of the artificial agents and take into account the non-quantitative aspects of warfare, but automation would provide documentation of what had occurred in any scenario and facilitate rapid replay of variations for sensitivity analyses.

RAND completed the first version of the new tool (RSAS 2.0) in late 1986.[140] [redacted]
Over time, the developmental emphasis gradually shifted from the original aim of improving the analysis of the U.S.-USSR strategic-nuclear competition to model-

[redacted]

[139] Paul K. Davis and Cindy Williams, "Improving the Military Content of Strategy Analysis Using Automated War Games: A Technical Approach and an Agenda for Research," RAND N-1894-DNA, June 1982, p. v.

[140] Paul K. Davis, James A. Winnefeld, Steven C. Bankes, and James P. Kahan, "Analytic War Gaming with the RAND Strategy Assessment System (RSAS)," RAND Research Brief RB-7801, September 1987, p. 1.

[141] For a more upbeat contemporary assessment of the RSAS, see Thomas B. Allen, "Sam and Ivan: Bottom Line in Wargames," *Jane's Defence Weekly*, February 6, 1988, pp. 217-218.

ing conventional theater campaigns in Central Europe and later Korea. As Paul Davis and Bruce Bennett wrote in 1984, two years into the RSAC development:

> Although the initial focus was on strategic [nuclear] forces, it became obvious that we also had to handle major conventional conflicts as well, since the use of strategic forces seemed most likely to escalate from theater conflict. Furthermore, most analysts felt that the outcomes of theater conflicts were critical to the outcome of the war even after the employment of strategic forces.[142]

[redacted]

[redacted]

[142] Bruce W. Bennett and Paul K. Davis, "The Role of Automated War Gaming in Strategic Analysis," RAND P-7053, December 1984, p. 2.

[143] Andrew W. Marshall, "1985-1988," taped interview transcribed by Kurt Guthe, December 16, 1994, pp. 8-30 & 8-31.

[144] [redacted], see Thomas B. Allen, "Run Silent, Run Deep," *Smithsonian*, March 1978, pp. 50-58, 60-61. For an account of the erosion of U.S. advantages in acoustic detection and acoustic quieting during the 1980s, see Owen R. Cote, *The Third Battle: Innovation in the U.S. Navy's Silent Cold War Struggle with Soviet Submarines*, Newport Paper 16 (Newport, RI: Naval War College, 2003), pp. 69-78.

[145] Admiral James D. Watkins, "The Maritime Strategy," U.S. Naval Institute, January 1986, p. 11. For insight into the thinking and intelligence behind the Navy's Maritime Strategy, see John B. Hattendorf, *The Evolution of the U.S. Navy's Maritime Strategy*, Newport Paper 19 (Newport, RI: Naval War College, 2004), pp. 23-36.

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CHAPTER 5: A FRAMEWORK FOR ASSESSING NUCLEAR COMPETITION IN THE 21ST CENTURY

This chapter advances a series of interrelated assumptions about the existence, roles, and value of nuclear arms through 2050 that, taken together, offer a realistic framework for thinking about nuclear competition in the first half of the 21st century. [redacted] the new framework is presented as a series of explicit beliefs or hypotheses about the future course of competition in nuclear arms. Drawing out some of the framework's more salient implications will be mostly deferred to Chapter 6.

Assumption 1: The probability is very low—perhaps vanishingly small—that nuclear arms will have been abolished by 2050.

How probable is it that a world without nuclear weapons could be achieved within a decade or two, or is this desideratum likely to take considerably longer—half a century or more rather than ten or twenty years? The answer to this question makes an enormous difference regarding how one thinks about nuclear arms between now and mid-century. In April 2009, when President Obama announced his administration's commitment to seeking the "peace and security of a world without nuclear weapons," the 47-year-old president immediately went on to concede that this "goal will not be reached quickly—perhaps not in my lifetime."[150] In May 2009, former defense secretary William Perry agreed with Obama's caution about how soon nuclear disarmament might become a reality. In his preface to the final report of the Congressional Commission on the strategic posture of the United States, Perry wrote that if the vision of a world without nuclear arms is thought of as the "top of the mountain," then it is clear "that it cannot be seen at this time."[151] At best, he wrote, we can presently see no further up the mountain than to a "base camp." Indeed, reaching this "base camp" would be a worthy accomplishment in its own right. It would offer a more stable nuclear regime than today's because the world's nuclear forces would have been rendered safer, more secure, and better able to serve the perceived needs for nuclear deterrence. Nevertheless, the reason Perry cited for not being able to see beyond the notional base camp stemmed from the fact that the international community consists of the 198 sovereign states belonging to the United Nations (UN) plus Taiwan and the Vatican, which are not UN members. "All of the commission members," Perry explained, "believed that reaching the ultimate goal of global nuclear elimination would require a fundamental change in geopolitics."[152] As the commission's final report went on to explain, "The conditions that might

[150] "Remarks by President Barack Obama," The White House, April 5, 2009.

[151] Perry and Schlesinger, *America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States*, p. xi.

[152] Perry and Schlesinger, *America's Strategic Posture*, p. xi.

make possible the global elimination of nuclear weapons are not present today and their creation would require a fundamental transformation of the world political order."[153] Thus, since the members of the Perry-Schlesinger commission, which represented the full range of responsible views on nuclear issues, could not reach agreement on the feasibility or wisdom of achieving this transformation in the long term, they focused their report on discussing steps aimed at achieving the greater safety and security of Perry's "base camp."[154]

What might be required to get from Perry's "base camp" to "the top of the mountain"? George Perkovich's and James Acton's 2008 Adelphi paper, *Abolishing Nuclear Weapons*, is perhaps the most serious and realistic attempt to answer this question. In their analysis, the first impediment would be for states "to build political confidence, reduce the number and salience of nuclear weapons, and stabilize political and military relations to the point where nuclear weapons did not appear indispensable for preventing war among major powers."[155] But doing so would be no easy matter. Among other things, Perkovich and Acton suggested that the conventional military capabilities of the United States would need to be sufficiently curtailed or constrained so that Russia and China in particular would no longer worry about unilateral or small-coalition U.S. military interventions, including U.S. capabilities such as missile defenses that could affect their core interests.[156] Presumably in Russia's case, the same restraints would need to be accepted by NATO. More broadly, "conflicts centering on Taiwan, Kashmir, Palestine and (perhaps) the Russian periphery" would have to be "resolved, or at least durably stabilized."[157] Especially in a post-9/11 world in which the amount of death and destruction a handful of dedicated terrorists can inflict on "soft" targets appears to be growing steadily, settling these prospective sources of conflict once and for all would appear to be a tall order.

The next impediment to achieving a world without nuclear weapons concerns the verification of reductions and, eventually, the elimination of the world's nuclear arms. Since verification schemes cannot be perfect, Perkovich and Acton argued that, aside from technical details and the degree of verification various nations might require at different points in time, the aim of verification is com-

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[153] Perry and Schlesinger, *America's Strategic Posture*, p. xvi.

[154] "The Congress charged the Commission to look to the long term in formulating its recommendations about the U.S. strategic posture. As we have debated our findings and recommendations, it has become clear that we have very different visions of what might be possible in the long term. Fundamentally, this reflects our differences over whether the conditions can ever be created that might enable the elimination of nuclear weapons." (Perry and Schlesinger, *America's Strategic Posture*, p. xix). The other commission members were: Harry Cartland, John Foster, John Glenn, Morton Halperin, Lee Hamilton, Fred Iklé, Keith Payne, Bruce Tarter, Ellen Williams, and James Woolsey.

[155] Perkovich and Action, *Abolishing Nuclear Weapons*, Adelphi Paper No. 396, p. 83.

[156] Perkovich and Action, *Abolishing Nuclear Weapons*, pp. 25, 27.

[157] Perkovich and Action, *Abolishing Nuclear Weapons*, pp. 27-28.

pliance, and compliance requires strong enforcement.[158] Even if near-perfect means of verifying that the world's nuclear weapons had been destroyed, a state—or sub-state group—could still decide later to break the prohibition against nuclear arms by re-acquiring them. Doing so might be especially tempting in the event of a protracted conventional conflict involving any of the former nuclear states. Indeed, in a future in which nuclear weapons had been abolished, the United States, Russia, China, and a number of other countries might well "have hair-trigger mobilization plans to rebuild nuclear weapons and mobilize or commandeer delivery systems" in the event of a prolonged conventional conflict.[159]

President Obama touched on the imperative for effective enforcement of a future ban on nuclear arms in his 2009 speech in Prague:

> . . . we go forward with no illusions. Some countries will break the rules. That's why we need a structure in place that ensures when any nation does, they will face consequences. . . . Rules must be binding. Violations must be punished. Words must mean something.[160]

But effective enforcement entails significant difficulties. First, as Perkovich and Acton conceded, there is great ambiguity and prospective disagreement over any decision to enforce compliance, especially with military force.[161] Here one need look no further than to the history of United Nations economic sanctions to constrain Iran's nuclear program. The resolve of the international community and the UN Security Council have, too often, fallen short, if not been feckless. The only UN military action since the United Nation's founding occurred in response to North Korea's 1950 attack on South Korea, and the decision to put together a military force under UN auspices to repel the North Korean invasion only came about because the USSR, absent in protest over the Republic of China on Taiwan rather than the People's Republic of China (PRC) occupying a permanent seat on the Security Council, could not exercise a veto over Resolution 83.[162]

Second, who or what would do the enforcing and with what means? Perkovich and Acton stopped just short of recommending a world government armed with credible military forces, although they came very close. They stated that it is difficult to envision an alternative to the UN Security Council as the body to be tasked with enforcement, but they admitted that the Security Council would only succeed as an enforcer if agreement existed between the United States, the Russian Federation, and the People's Republic of China as to the need and means

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[158] Perkovich and Action, *Abolishing Nuclear Weapons*, p. 44.

[159] Schelling, A World without Nuclear Weapons?" *Daedalus*, Fall 2009, p. 127.

[160] "Remarks by President Barack Obama," The White House, April 5, 2009.

[161] Perkovich and Action, *Abolishing Nuclear Weapons*, p. 85.

[162] See UN Security Council, "Resolution 83 (1950) of 27 June 1950"; at http://www.unhcr.org/refworld/docid/3b00f20a2c.html (accessed May 25, 2010).

necessary to enforce compliance.[163] Their preference regarding the means of enforcement is economic sanctions, whether automatic or not. But economic sanctions failed in the case of Saddam Hussein's Iraq before and after 1991, and have yet to change minds in Pyongyang or Tehran. Ultimately, however, they argued that "military action could be taken to end non-compliant activities and/or to destroy threatening capabilities, or, *in extremis*, to remove a threatening government."[164]

As Elbridge Colby pointed out in his critique of *Abolishing Nuclear Weapons*, it is currently most difficult to envision this sort of decisive collective military action occurring under the auspices of the UN Security Council, even assuming substantial agreement among the major powers on the need to do something. For example, if the goal were to seize and destroy all the prohibited nuclear weapons, how much certainty would the Security Council require that this could be done without provoking nuclear use by the violator?[165] Colby objected that Perkovich's and Acton's hope that the permanent members of the Security Council (or perhaps a separate body of the eight declared nuclear powers) could cooperate "in a manner timely and robust enough to deter or eliminate threats" by states or non-state entities attempting to violate the nuclear-weapons prohibition would entail "a revolutionary shift in global governance," if not the "creation of a sovereign-like entity to manage international security relations."[166] Perkovich and Acton rejected this interpretation, arguing that "global government is irrelevant: the real challenge is for the three big nuclear weapon competitors to reorder their security relations in ways that could end their reliance on nuclear weapons, and then to build on their convergence to induce the other nuclear-armed states to follow suit."[167] They then added that "we do not predict that the many states whose cooperation would be necessary to make nuclear abolition feasible will actually take the necessary steps"; instead Acton and Perkovich said that they merely urge the world's sovereign states to do so in order to achieve a world free of nuclear weapons.[168]

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[163] Perkovich and Action, *Abolishing Nuclear Weapons*, pp. 88-89.for

[164] Perkovich and Action, *Abolishing Nuclear Weapons*, p. 94.

[165] RAND research in the early 1990s into the challenges the United States would face in projecting conventional military power against even a small state with a limited nuclear arsenal suggested that president would demand very high levels of assurance that enemy nuclear use could be deterred or prevented. See Marc Dean Millot, Roger Molander, and Peter A. Wilson, "*The Day After . . .*" *Study: Nuclear Proliferation in the Post-Cold War World*, Vol. I, *Summary Report* (Santa Monica, CA: RAND MR-266-AF, 1993). Here it is sobering to recall that Leon Panetta, the Director of Central Intelligence, admitted in May 2009 that the U.S. intelligence community does not know where all Pakistan's nuclear weapons are located.

[166] Perkovich and Action, *Abolishing Nuclear Weapons*, p. 84; Elbridge Colby, *St Antony's International Review*, February 2009, p. 115.

[167] James M. Acton and George Perkovich, "A Response to Elbridge Colby," *St Antony's International Review*, February 2009, p. 123.

[168] Acton and Perkovich, "A Response to Elbridge Colby," p. 123.

Acton and Perkovich may have a point in shying away from a world government as a necessary requirement for the abolishment of nuclear arms. As Fred Iklé recently commented, in March 1946 a committee under Dean Acheson and David Lilienthal forwarded a report to President Truman that proposed an international organization of scientists to develop atomic energy for peaceful purposes and exercise proprietary authority over the facilities, materials, and processes required for making atomic weapons.[169] Truman then designated Bernard Baruch to lead negotiations at the UN over the Acheson-Lilienthal proposal. In the end, however, Soviet opposition prevented the transformation of the international order that might have brought atomic power under international control.[170] In the fall of 2009 Iklé, who was a member of the Perry-Schlesinger congressional commission, echoed Colby's deep skepticism about the feasibility of abolishing nuclear weapons without establishing an "international organization so powerful that it can implement, supervise, protect, and enforce the dispensation of zero nuclear weapons." Iklé judged the establishment of such an organization to "be far more difficult than was the creation of the United Nations at the end of World War II."[171] At a minimum, doing so would entail investing the international body with the political authority to make early enforcement decisions even if the evidence of cheating was uncertain. But it is most difficult to reconcile the establishment of such an authority with the present world order of sovereign states that grew out of the peace treaties of Westphalia in 1648.

Iklé's article elicited strong criticisms from both former U.S. Ambassador Max Kampelman as well as Barry Blechman, co-founder of the Henry L. Stimson Center, which has been publishing a series of studies advocating nuclear abolition.[172] Blechman, like Perkovich and Acton, has been insistent that a world government would not be necessary to achieve a world free of nuclear weapons but comes very close to this position:

> . . . a central characteristic of a disarmament treaty would be the degree to which nations would have to cooperate with one another and with the treaty organization to ensure that the treaty was verified and enforced. . . . Most importantly, by signing and ratifying the treaty, all participating nations would agree that significant violations of the treaty could be cor-

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[169] Department of Energy, "Negotiating International Control (December 1945-1946"; at http://www.cfo.doe.gov/me70/manhattan/international_control.htm (accessed June 26, 2010).

[170] Fred C. Iklé, "Nuclear Abolition, A Reverie," *The National Interest*, September/October 2009; at http://www.nationalinterest.org/Article.aspx?id=22014 (accessed June 27, 2010).

[171] Iklé, "Nuclear Abolition, A Reverie."

[172] For the exchanges between Kapelman, Blechman and Iklé over the feasibility of nuclear abolition, see "Is Zero Nukes Impossible?" *The National Interest* online, October 5, 2009; at http://www.nationalinterest.org/Article.aspx?id=22436 (accessed June 28, 2010). Regarding Stimson Center reports advocating nuclear disarmament see Barry M. Blechman and Alexander K. Bollfrass (eds.), *Elements of a Nuclear Disarmament Treaty: Unblocking the Road to Zero* (Washington, DC: Henry L. Stimson Center, February 2010).

> rected through the collective use of military power by the other signatories, and that no one state could veto such military action.[173]

On the very next page, though, Blechman went on to concede that getting the nations of the world to take the steps he deems necessary to abolish nuclear weapons "would likely take three or four decades."[174] This concession, which itself is probably optimistic, reinforces the framework assumption that nuclear weapons are most unlikely to have been abolished by 2050. Together with the ambiguity of nuclear abolitionists over whether states would have to give up a significant degree of their current sovereignty before they could begin abolishing nuclear weapons goes far to explain why the Perry-Schlesinger commission members could not agree upon the prospects for achieving the fundamental transformation of geopolitics necessary to eliminate nuclear arms.

The inability to reach agreement on the critical issue of national sovereignty does not appear to stem from any lack of vision. Those committed to nuclear abolition argue that the nations of the world *cannot be trusted* in the long term to avoid nuclear use in their own self-interests (as they have done for the past six decades).[175] Yet, they simultaneously insist, the nations of the world *can be trusted* to realize that it is in their self-interests to give up enough sovereignty to bring about a world free of nuclear weapons. The evident contradiction between these two positions further reinforces the assumption nuclear arms will still be with us in 2050.

Assumption 2: Proliferation is likely to continue; by 2050 the chances are good that more states will have nuclear weapons than the United States, Russia, Great Britain, France, China, Israel, India, Pakistan, and North Korea.

At a March 1963 press conference, President Kennedy was asked about the chances for a nuclear test ban agreement. Negotiations with the Soviets in Geneva had recently stalled. Kennedy responded that while his hopes for an agreement had dimmed somewhat, he intended to keep working toward a test ban because he was "haunted by the feeling that by 1970s, unless we are successful, there may be ten nuclear powers instead of four, and by 1975 fifteen or twenty."[176] Kennedy's administration was, of course, partially successful. A treaty

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[173] Barry M. Blechman, "Why We Need to Eliminate Nuclear Weapons—and How to Do It," Blechman and Bollfrass, *Elements of a Nuclear Disarmament Treaty: Unblocking the Road to Zero*, p. 10.

[174] Blechman, "Why We Need to Eliminate Nuclear Weapons—and How to Do It," p. 11.

[175] Roberts has taken a more conservative view on the need to transform geopolitics in order to achieve a world without nuclear arms. "It has not been necessary to combine all nations together in order to prevent ourselves from perishing; all that was needed was to build a bomb" (*A History of the English-Speaking Peoples since 1900*, p. 390).

[176] President John F. Kennedy, "News Conference 52," Washington, DC, March 21, 1963; at http://www.jfklibrary.org/Historical+Resources/Archives/Reference+Desk/Press+Conferences/003POFO5Pressconference52_03211963.html (accessed June 27, 2010).

banning nuclear weapon tests in the earth's atmosphere, under water, and in outer space enter into force in October 1963, and most countries have signed and ratified the agreement (although the People's Republic of China remains a notable exception). In retrospect, Kennedy's 1963 worry that the number of nuclear states might double or quadruple in the 1970s was overly pessimistic. As of 2010, the number of states with nuclear weapons is still less than ten (including Israel's undeclared arsenal).

Why has the number of nuclear states remained so much lower than Kennedy feared? Part of the reason undoubtedly lies in the high costs and marginal benefits for most countries of possessing and maintaining a nuclear force that, even today, would be dwarfed by the U.S. and Russian arsenals. Certainly for the majority of Western nations during the Cold War, the extension of the U.S. "nuclear umbrella" offered a nearly cost-free solution to deterring the Soviets. Furthermore, the nuclear Non-Proliferation Treaty that entered into force in March 1970 undoubtedly helped. After all, there have been some non-proliferation successes. In the 1970s, South Korea, Taiwan, Brazil and Argentina were convinced to abandon their nuclear weapons programs. In 1991, South Africa acceded to the NPT and became the only known state to have indigenously produced nuclear weapons and verifiably dismantled them. Next, in 2004, Moammar Gadhafi allowed the United States to airlift out of Libya components of the country's nuclear weapons program, thereby abandoning his quest to acquire nuclear weapons via the black-market network that included Pakistani nuclear scientist Abdul Qadeer Khan. Iraq's nuclear program, first set back by Israel's successful raid in June 1981 on the Osirak reactor at al Tuwaitha, was eventually halted by a combination of U.S. military action and international inspections during and after the 1991 Gulf War. And, in September 2007, the Israeli Air Force successfully attacked a Syrian nuclear reactor, which reportedly was being built with North Korean assistance.[177]

Yet, while nuclear proliferation has not progressed at either the pace or to the extent that many feared in the early 1960s, there have been notable setbacks. In 1998 both India and Pakistan conducted eleven underground nuclear weapons tests, and both countries had ballistic missile programs underway. In India's case, the country's leaders are believed to have come to view nuclear weapons as a cost-effective way to be recognized as the dominant power in the region, to counter China's growing nuclear and conventional military capabilities, and to deter Pakistani aggression. The Pakistani nuclear program appears to have been driven by concerns over Indian military capabilities after being defeated in the conflict with India over Kashmir in 1965. As Pakistan's president, Zulfikar Ali

[177] "Oh What a Tangled Web They Weave," *The Economist*, May 3, 2008, p. 69.

Bhutto, said at the time: "If India builds the Bomb, we will eat grass or leaves, even go hungry. But we will get one of our own."[178]

Another notable proliferation setback has been North Korea. When the Cold War ended, Pyongyang lost its Soviet sponsor (albeit a sponsor Kim Il Sung had never fully trusted after the USSR withdrew its missiles from Cuba in 1962). Since then, the international community has been unable to stop North Korea's efforts to develop nuclear weapons using measures short of military force. The six-party talks (involving China, Russia, the United States, Japan, and both Koreas), the United Nations, the Security Council, and the International Atomic Energy Agency (IAEA) have all failed to prevent North Korea from acquiring the fissile material to set off two small nuclear detonations. As Art Brown, who retired as head of CIA's East Asia desk in 2005, explained, "From Kim Jong Il's view, the moment that he gives up the nuclear weapons, he becomes the Congo without the diamonds. And nobody will ever talk with him again, and he knows that."[179]

Nor is post-Cold War nuclear proliferation likely to end with North Korea. The next country most observers expect to go nuclear is Iran. Why might Iran's rulers want nuclear weapons? Plausible Iranian objectives include:

- Hedging against or precluding U.S. coercion or, worse, regime change imposed by conventional military force;

- Establishing Shi'a Iran as the dominant power or hegmon in the region and bolstering the regime's claim to leadership in Islam's struggle against the United States and Israel;

- Protecting Iran's freedom to pursue ambiguous forms of aggression and coercion, including the overt support of terrorist organizations such Hezbollah, Hamas or anti-American Shi'a elements in Iraq[180]; and

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[178] "Who Has the Bomb," *TIME Magazine*, June 3, 1985; at http://www.time.com/time/printout/0,8816,957761,00.html (accessed June 28, 2010). Zulfikar Ali Bhutto decided to develop a nuclear capability nearly a decade before India exploded its first "peaceful" nuclear device in 1974 in its so-called Smiling Buddha test.

[179] "Six-Party Standstill," *The Economist*, December 17th, 2008; at http://www.economist.com/node/12799531/print (accessed June 29, 2010).

[180] By the fall of 2007, there "was no doubt" that the Quds Force of Iranian Revolutionary Guards was training and equipping Iraqi military factions to kill Americans, including the provision of explosively-formed penetrators—Bing West, *The Strongest Tribe* (New York: Random House Trade Paperback, 2009), p. 323; also pp. 329, 350, 355.

- Advancing such millenarian goals as the reestablishment of an Islamic caliphate in the Middle East.

The first of these objectives is tied to American military power—but to U.S. conventional power-projection capabilities rather than the America's nuclear arsenal. The second putative objective is about enhancing Iranian international prestige and influence, and the third focuses on increasing Iran's freedom of action to pursue aggressive foreign policy goals using ambiguous means that avoid direct confrontation with the military forces of the "Great Satan" (the United States). Offhand, there is no obvious reason why the 2010 Nuclear Posture Review, New START, or further reductions in the U.S. nuclear arsenal would incentivize Iran's leaders to abandon the pursuit of nuclear weapons in order to secure these objectives.

The hope in the United States and other Western nations for over a decade has been that the objections of the international community, coupled with economic sanctions, could persuade Iran's rulers to abandon, in a verifiable way, any ambitions to acquire nuclear weapons. As of 2010, U.S. and Western efforts to realize this hope have not born any fruit. Overall Iranian behavior has been to prevaricate by seemingly acceding to various restrictions on its nuclear activities and then reneging while insisting that Iran's uranium-enrichment efforts are for peaceful purposes and growing ever more defiant of international pressures to curtail its nuclear program. 2007 was especially discouraging for U.S. efforts to prevent Iran from accumulating enough highly enriched uranium to build an atomic bomb. In February the IAEA reported that Iran had ignored a UN Security Council ultimatum to freeze its uranium enrichment program, instead expanding that effort by adding hundreds of centrifuges while Iranian president Mahmoud Ahmadinejad declared that the "train of the Iran nation is without brakes."[181] Then, in November, the U.S. intelligence community released a national intelligence estimate (NIE) that opened with the "high confidence" judgment that, in the fall of 2003, Tehran had "halted its nuclear weapons program."[182] This judgment was footnoted with the clarification that this meant Iran had halted nuclear weapon design and weaponization work and covert uranium conversion-related and uranium enrichment-related work, but excluded civil work related to uranium conversion and enrichment for peaceful purposes. Thus, what momentum may have been building since February for the UN Security Council to impose tougher sanctions on Iran dissipated overnight in the wake of the 2007 NIE.

Collectively, the United Nations has remained ambivalent about reigning in Iran's nuclear ambitions ever since. Russia and China, both of which have veto

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[181] "Ahmadinejad Compares Iranian Nuclear Program to Runaway Train," *USA Today*, February 25, 2007, at http://www.usatoday.com/news/world/2007-02-25-iran_x.htm (accessed June 30, 2010).

[182] National Intelligence Council. "Iran: Nuclear Intentions and Capabilities," November 2007, opening sentence of the "Key Judgments" section.

power as permanent members of the Security Council, have consistently watered down U.S. attempts to impose anything approaching severe or crippling economic sanctions on the Islamic Republic over its nuclear activities. Security Council (SC) Resolution 1929 in June 2010 illustrates this lack of consensus within the Security Council. SC Resolution 1929 merely *calls upon* all states to restrict providing financial services or other assets or resources to Iran "should they have information that provides reasonable grounds to believe that such services, assets or resources could contribute to Iran's proliferation-sensitive nuclear activities, or the development of nuclear weapon delivery systems."[183] The Iranian representative at the Security Council meeting that passed Resolution 1929 declared that Iran would never bow to these sorts of hostile actions and pressures and remained determined to exercise its right to nuclear technology for peaceful purposes.

To date, diplomatic engagement, IAEA inspections, and limp economic sanctions have done little, if anything, to restrain, much less halt, Iran's nuclear weapons program. Since it is focused on uranium rather than plutonium, it is not critically dependent on reactors such as those the Israeli successfully attacked in 1981 and 2007. Given the degree to which elements of the large-scale Iranian program have been dispersed throughout the country, hidden in underground facilities, and concealed from Western intelligence agencies, military options appear limited. At best, a few airstrikes would be unlikely to do more than delay or retard Iranian progress.[184] A more sustained series of American attacks would undoubtedly be more effective, but would also "probably lead to real warfare in the Persian Gulf, disrupting oil supplies and producing global responses" by Iran or its terrorist allies.[185] It appears, therefore, that the United States may well be on a path that will acquiesce to Iran's acquisition of low-yield atomic weapons together with the ballistic missiles able to reach countries throughout the Middle East, including Israel. In February 2009, CIA Director-designate Leon Panetta said that, based on the information he has seen, "there is no question" that the Iranians are seeking nuclear weapons.[186] In late June 2010, Panetta added on

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[183] UN Security Council, "Resolution 1929 (2010) of 9 June 2010," paragraph 21; at http://www.un.org/News/Press/docs/2010/sc9948.doc.htm (accessed July 1, 2010).

[184] The Obama administration's policy is that tougher sanctions combined with engagement has, in the words of Dennis Ross, "a chance" of persuading the Iranian government to abandon its efforts "to develop a breakout nuclear capability (often understood to be the capacity to assemble more than one missile0ready nuclear device within about three months of deciding to do so)" (Goldberg, "The Point of No Return," pp. 58, 67).

[185] Eliot A. Cohen, "There Are Only Two Choices Left on Iran," *The Wall Street Journal*, September 27, 2009; at http://online.wsj.com/article/SB10001424052970204518504574420641457091318.html?mod=googlenews_wsj (accessed July 2, 2010).

[186] "Obama Administration Expresses Certainly of Iranian Nuclear Bomb Intent," the Nuclear Threat Initiative's Global Security Newswire, February 12, 2009, at http://gsn.nti.org/siteservices/print_friendly.php?ID=nw_20090212_6525 (accessed July 10, 2010).

ABC's Sunday television news show that he did not think the latest UN economic sanctions would ultimately deter the Iranians from eventually enriching enough uranium for at least a couple atomic bombs.[187] And although the Obama administration has insisted that it has not taken off the table the option of using military force to prevent Iran from going nuclear, there is considerable skepticism that President Obama would risk starting a third war in the Middle East while engaged in two others.[188]

Figure 9: Chinese DF-3 (CSS-2) IRBM

Would the emergence of an Iranian nuclear capability, whether declared or not, trigger a cascade of nuclear proliferation in the volatile Middle East? In light of how far off President Kennedy's 1973 forecast turned out to be, one hesitates to offer a firm prediction. However, the emergence of a Persian Shi'ite bomb would surely motivate the Saudis to consider the need for an Arab Sunni bomb, and the Turks might begin wondering if they needed to go nuclear as well. Moreover, the Saudis currently possess (reportedly 36-60) DF-3 (CSS-2) intermediate-range ballistic missiles (IRBMs), which they got from China in 1987; these IRBMs are operational at two locations in Saudi Arabia and have a range of around 2,800 kilometers.[189] The DF-3s China exported to Saudi Arabia are believed to have conventional warheads and a CEP no better than 1,000 meters (0.54 nm) and possibly as great as 4,000 meters.[190] The CSS-3 was originally de-

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[187] "Panetta's Bomb: Now the CIA Tells Us Iran Is Going Nuclear, and Sanctions Won't Work," *The Wall Street Journal*, June 29, 2010, at http://online.wsj.com/article/SB10001424052748703964104575335242943136462.html (accessed July 10, 2010).

[188] Goldberg, "The Point of No Return," pp. 65-68.

[189] Sean O'Conner, "Saudi Arabia's Ballistic Missile Force," February 10, 2009, at http://geimint.blogspot.com/2009/02/saudi-arabias-ballistic-missile-force.html (accessed July 10, 2010); also See "DF-3A/CSS-2," http://www.globalsecurity.org/wmd/world/china/df-3a.htm (accessed July 12, 2010).

[190] See "DF-3A/CSS-2 IRBM: Specifications," Global Security, at http://www.globalsecurity.org/wmd/world/china/df-3a-specs.htm (accessed July 12, 2010).

signed to deliver nuclear warheads with yields up to 3 MT. The higher estimates of the DF-3's CEP suggest that the missile may not be all that effective with a conventional warhead against a point target. Whatever the Saudis may have had in mind when they acquired the Chinese missiles, they could enable Saudi Arabia to go nuclear very quickly—particularly if the Saudis were able to obtain warheads from Pakistan or China.

Should the Saudis respond to an Iranian atomic bomb by going nuclear themselves, what other countries might follow in the Saudis' footsteps is uncertain—a matter of conjecture at best. Nevertheless, it now seems probable that, within the next decade, there will be some additions to the "nuclear club." These emerging nuclear states will have small numbers of weapons and delivery systems compared to the United States, the Russian Federation, or the People's Republic of China. If their first weapons are indigenously developed, they will probably be atomic weapons with yields equivalent to a few tens of kilotons of TNT. The most important point when considering these arsenals, however, is that their purposes and utility will be unique to the security concerns of each individual state. As the cases of India, Pakistan, and Iran illustrate, the fears and incentives that drove their nuclear program were not a consequence of American or Russian nuclear capabilities. Assessments of the nuclear forces of these or other new nuclear states will have to take into account the specific aims, motivations and security concerns of each nuclear state. The Cold War was dominated by a single U.S.-Soviet nuclear balance. The early 21st century, by comparison, seems destined to involve a number of largely separate and distinct nuclear competitions, and each participant in these separate competitions will have its own objectives, perceptions, capabilities, metrics, and dominant scenarios.

Assumption 3: So long as nuclear forces exist, they will affect the perceptions and calculations of the leaders of most, if not all, nations about their power relationships with other states.

"Prestige," Andrew Roberts has rightly reminded us, "is a tangible benefit in the calculus of international relations, its loss is a concomitant danger."[191] The idea that prestige is one of the drivers underlying competition and conflict between polities is, of course, an ancient one. Michael Howard recalled at the end of the 20th century that Thucydides, in his account of the Peloponnesian War, identified three causes of this protracted conflict among the Greek city states: prestige (alias honor or credibility); self interest (or gain), which he felt to be most important in limited wars; and fear, which tends to make wars total.[192] Howard went on to observe that prestige "has played a part in twentieth-century warfare quite as great as it did in earlier ages"; today, as in 431 to 404 B.C., the Thucydidean coordinates—interest, fear and honor—determine the aims for

[191] Roberts, *A History of the English-Speaking Peoples since 1900*, p. 12.

[192] Michael Howard, "When Are Wars Decisive?" *Survival*, Spring 1999, p. 127.

which wars are fought.[193] While it is admirable to attempt to reduce U.S. dependence on nuclear forces, there is a point beyond which those forces will continue to affect the perceptions of friends and foes alike regarding American power. This observation seems especially relevant to continuing U.S. efforts to preserve extended deterrence—the threat to retaliate against an adversary with nuclear weapons on behalf of a third party. Maintaining the credibility of the American "nuclear umbrella" in the eyes of close partners and allies as well as potential aggressors would seem to suggest a point beyond which U.S. dependence on nuclear weapons cannot be reduced so long as nuclear forces exist.

This conclusion was amply borne out by the historical research Herbert Goldhamer did in the late 1970s on the role of perceptions and beliefs in military affairs. Three of Goldhamer's main conclusions were:

- First, "that military-political behavior is often a function of images of the enemy and of self," and that "these images often deviate from reality."
- Second, "that political and military leaders will surely try to extract political and military gains by shaping and exploiting enemy opinion of their forces."
- Third, "that awareness of the importance of opinion, of manipulation and deception, leads to the recognition that the size and structure of one's forces and weapons need not always be based on the operational effectiveness of forces and weapons, where their operational effectiveness is defined in terms of the military capabilities . . . [ostensibly] assigned to them.[194]

Assumption 4: A world without nuclear arms may not be safer and more secure than a world in which a few of the more responsible states possess small nuclear arsenals compared to those the United States and the Soviet Union amassed during the Cold War.

It is widely assumed by advocates of complete nuclear disarmament that the elimination of nuclear weapons would make the world safer and more secure than it has been since 1945. But would it? One objection to this view is that the elimination of nuclear arms would open the door to conventional warfare between major powers, including conflicts as destructive and protracted as World War II. Worth remembering is that estimates of the death toll from the Second World War range from 50 million (the commonly accepted figure) to as much as

[193] Howard, "When Are Wars Decisive?" pp. 127, 128.

[194] Herbert Goldhamer, edited by Joan Goldhamer, "Reality and Belief in Military Affairs: A First Draft (June 1977)," RAND R-2448-NA, February 1979, pp. 5, 6, 8.

perhaps 70 million.[195] A point skeptics of nuclear abolition have made is that ever since 1945, the prospect of escalation to large-scale nuclear use has deterred direct conflict between the major powers. The British historian Andrew Roberts has explicitly credited the atomic bombings of Hiroshima and Nagasaki with "bringing about the relatively peaceful world of the past six decades."[196]

Figure 9: The Atomic Bombing of Hiroshima

A further difficulty, which has already been mentioned, is that a future world without nuclear weapons need not remain so. In that supposedly safer and more secure world, belligerents would have strong incentives to reconstitute their nuclear capabilities during any protracted crisis or conventional conflict. As Schelling has observed, each crisis would be a nuclear crisis, and "any war could become a nuclear war."[197] Schlesinger has made much the same point: "If, by some miracle, we were able to eliminate nuclear weapons, what we would have is a number of countries sitting around with breakout capabilities or rumors of breakout capabilities—for intimidation purposes" and, eventually, there would probably be a number of small clandestine stockpiles" that would make the United States more vulnerable than it is today in a world with nuclear weapons.[198] Regarding the ultimate wisdom of eliminating nuclear arms, Schelling appears to be right to have objected in the fall of 2009 that a solid, well-thought-through

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[195] Including the six million Jews murdered by the Nazis, the global total killed during World War II "probably reached 60 million"—Gerhard L. Weinberg, *A World at Arms: A Global History of World War II* (Cambridge: Cambridge University Press, 1994), p. 894.

[196] Roberts, *A History of the English-Speaking Peoples since 1900*, p. 378.

[197] Schelling, "A World without Nuclear Weapons?" *Daedalus*, Fall 2009, p. 127.

[198] Melanie Kirkpatrick, "Why We Don't Want a Nuclear-Free World," *The Wall Street Journal*, July 11, 2009; at http://online.wsj.com/article/SB124726489588925407.html (accessed June 27, 2010).

case that the world would then be safer and more secure has yet to be made.[199] It is impossible to disagree with Harold Brown and John Deutch's sentiment that the strongest possible measures should be taken to inhibit the acquisition of and roll back the possession of nuclear arms. However, they went on to insist,

> even the even the aspirational goal, of eliminating all nuclear weapons is counterproductive. It will not advance substantive progress on nonproliferation; and it risks compromising the value that nuclear weapons continue to contribute, through deterrence, to U.S. security and international stability.[200]

Assumption 5: While the threat of a large-scale nuclear exchange rendering the northern hemisphere—or the entire globe—uninhabitable has not completely vanished, it has become improbable and is likely to grow even more so if the U.S., Russian and Chinese arsenals are further reduced and modernized.

By the 1960s, apocalyptic visions of the long-term consequences of an all-out nuclear exchange between the United States and the Soviet Union had become embedded in the minds of defense specialists and the general public alike, especially in the West. A good example can be seen in the plot of Nevil Shute's 1957 end-of-the-world novel *On the Beach*. Set in the (then) near-future of 1963, approximately one year after a general nuclear war, the conflict has so polluted the northern hemisphere with nuclear fallout that all animal life has died out, leaving only Australia, New Zealand, South Africa and the southern parts of South American still habitable. But, as global atmospheric currents spread the radiation deeper and deeper into the southern hemisphere, even the survivors in these southernmost locations are faced with eventually succumbing to radiation poisoning. The novel describes how individuals who had find refuge in Melbourne, including the crew of the last American nuclear submarine, cope with their unavoidable fates.

Nuclear fallout and accompanying radiation were not the only mechanisms cited to raise the specter of a global nuclear Armageddon. In 1983, five scientists raised the possibility that the absorption of sunlight in smoke and dust clouds following a nuclear exchange of 5,000 megatons could produce land temperatures as low as -23°C within three weeks and subfreezing temperatures that would persist for several months, thereby turning summer into winter.[201] By then, U.S. and Soviet nuclear forces were quite capable generating a 10,000-MT exchange, and the scientists calculated that exchanges as low as 100 MT could

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[199] Schelling, "A World without Nuclear Weapons?" p. 125.

[200] Harold Brown and John Deutch, "The Nuclear Disarmament Fantasy," *The Wall Street Journal*, November 19, 2007, p. A19.

[201] R. P. Truco, O. B. Toon, T. P. Ackerman, J. B. Pollack, and Carl Sagan, "Nuclear Winter: Global Consequences of Multiple Nuclear Explosions," *Science*, Vol. 222, No. 4630, December 23, 1983, p. 1286.

trigger "severe aftereffects"—cold, dark, and radioactivity—if urban areas were heavily targeted.[202]

In 2010, Owen Brian Toon (who, along with Carl Sagan, was one of the authors of the 1983 "nuclear winter" article) and Alan Robock argued that an India-Pakistan nuclear exchange of only one hundred Hiroshima-size bombs dropped on the highest-density population centers "could block enough sunlight within 49 days that the earth's skies "would look overcast perpetually, everywhere," producing agricultural collapse and mass starvation.[203] While Robock and Toon based their conclusions on improved climate models compared to those available in the early 1980s, the editors of *Scientific American* commented that "observations of volcanic eruptions, forest fire smoke and other phenomena provide confidence that the models are correct."[204] In other words, an India-Pakistan counter-value exchange totaling as little as 1.3 megatons could produce a global climatic catastrophe in addition to the loss of life and devastation caused by immediate nuclear weapons effects.

How plausible are these most recent predictions of planet-wide "nuclear winter" from even a very small nuclear exchange? The answer hinges on how much confidence one has in the predictive capabilities of the climate models. On the one hand, the doubling of computational power every two years or so since the early 1980s, together with software advances, have enabled climate scientists to improve the complexity and sophistication of their atmospheric models. Events such as the June 1991 eruption of Pinatubo in the Philippines have also provided data that were not available in 1983. On the other hand, models are inherently abstractions from reality, meaning that they leave out many features of the very processes they aspire to represent. Currently, even the most sophisticated climate models do not do a very good job of representing factors such as evaporation (water vapor constituting some 95 percent of the greenhouse gases in the atmosphere), rainfall, the emissions of methane by ruminants (methane being twenty-five times more potent as a greenhouse gas than carbon dioxide emitted by cars), and clouds.[205] In the case of water vapor, Lowell Wood's hope is that "we'll have good numbers . . . by 2020 or thereabouts."[206] Wood and his Innovation Ventures colleagues, including Nathan Myhrvold, therefore stress the limited predictive power of current climate models. Steven Levitt and Stephen

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[202] Truco, et al., "Nuclear Winter," pp. 1283, 1290.

[203] Alan Robock and Owen Brian Toon, "Local Nuclear War, Global Suffering," *Scientific American*, January 2010, pp. 74, 76-77.

[204] Robock and Toon, "Local Nuclear War, Global Suffering," p. 74.

[205] Steven D. Levitt and Stephen J. Dubner, *Super Freakonomics* (New York: HarperCollins, 2009), pp. 167, 168, 182.

[206] Levitt and Dubner, *Super Freakonomics*, p. 182. A former close colleague of Edward Teller, Wood is an astrophysicist at the Lawrence Livermore National Laboratory. Among other accomplishments, his research contributed to the international effort to achieve controlled thermonuclear fusion through the use of lasers.

Dubner have added that climate scientists are more like economists than physicists in that they cannot conduct experiments; the best they can do is to try "to tease out relationships from existing data without the ability to, say, invoke a ten-year ban on cars (or cows)."[207] The physicist Freeman Dyson has also questioned the predictive value of contemporary climate models. The models, which Dyson has studied,

> solve the equations of fluid dynamics, and they do a very good job of describing the fluid motions of the atmosphere and the oceans. They do a very poor job of describing the clouds, the dust, the chemistry and the biology of fields and farms and forests. They do not begin to describe the real world that we live in. The real world is muddy and messy and full of things that we do not yet understand.[208]

In light of the evident limitations of climate models, how credible is Robock and Toon's model-based prediction that the detonation of some 100 Hiroshima-size atomic weapons in an India-Pakistan exchange targeting urban centers would produce global climatic effects such as the collapse of agriculture? While there is little hard evidence to contradict their prediction, the total yield from the exchange would be only 1.3 megatons. Yet the Soviet "Tsar bomba" detonated in 1961 had at least a 50-megaton yield (and probably 57 MT). Granted, the detonation took place over the remote Arctic island of Novaya Zemlya, not over urban centers. Still, the fact remains that this enormous detonation, which destroyed even brick buildings at distances of 55 kilometers, did not produce nuclear winter or even global climatic changes.[209] Given the spectacular failure of the financial community's sophisticated risk-assessment and risk-management models to anticipate the 2007 global financial meltdown triggered by the collapse of inflated U.S. housing prices, Robock and Toon's prediction appears best taken with a large grain salt.[210] The possibility of an all-out nuclear exchange between

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[207] Levitt and Dubner, *Super Freakonomics*, p. 168.

[208] Freeman Dyson, "Heretical Thoughts about Science and Society," Edge Foundation website, August 8, 2007, at http://www.edge.org/3rd_culture/dysonf07/dysonf07_index.html (accessed July 13, 2010).

[209] "*Big Ivan*, the Tsar Bomba ("King of Bombs")," Carey Sublette, Nuclear Weapons Archive, September 3, 2007, at http://nuclearweaponarchive.org/Russia/TsarBomba.html (Accessed July 13, 2010).

[210] Regarding the financial-risk models, Edmund Phelps has maintained that they were never well founded. "There was a mystique to the idea that market participants knew the price to put on this or that risk. But it is impossible to imagine that such a complex system could be understood in such detail and with such amazing correctness . . . the requirements for information . . . have gone beyond our abilities to gather it." ("In Plato's Cave," A Special Report on the Future of Finance, *The Economist*, January 24, 2009, p. 14). For an account of the damage wrought by David X. Li's Gaussian copula formula, see Felix Salmon, "The Secret Formula that Destroyed Wall Street," *Wired*, March 2009, pp. 74-79, 112, at http://www.wired.com/techbiz/it/magazine/17-03/wp_quant?currentPage=all (accessed July 13, 2010). For an earlier episode of financial models developed by Nobel Prize economists failing in the case of Long Term Capital Management in 1998, see Michael Lewis, "How the Eggheads Cracked," *The New York Times Magazine*, January

the United States and Russia is now exceedingly remote. The two countries' nuclear arsenals are far smaller than they were at the height of the Cold War, and will likely be reduced even further. It would appear, then, that the Perry-Schlesinger commission on the strategic posture of the United States was right to conclude in 2009 that the "threat of a nuclear Armageddon has largely disappeared."

24, 1999, pp. 24, 26-31, 42, 67-68, 71, 77; also "When Markets Turn," A Special Report on the Future of Finance, p. 12.

CHAPTER 6: IMPLICATIONS FOR THINKING ABOUT NUCLEAR COMPETITIONS IN THE 21ST CENTURY

In September 2008, the secretaries of energy and defense, Samuel Bodman and Robert Gates, endeavored to remind everyone concerned with nuclear affairs that nuclear weapons continue to play unique roles in supporting U.S. national security. Despite the Cold War's end and the 2001 NPR's adoption of a new triad of conventional and nuclear offensive strike systems, active and passive defenses and a strong nuclear infrastructure, they argued that U.S. nuclear forces serve to:

> 1) deter acts of aggression involving nuclear weapons or other weapons of mass destruction; 2) help deter, in concert with general-purpose forces, major conventional attacks; and 3) support deterrence by holding at risk key targets that cannot be threatened effectively by non-nuclear weapons. Because of their immense destructive power, nuclear weapons . . . deter in a way that simply cannot be duplicated by other weapons.[211]

Two years later, of course, Bodman and Gates' formulation had been further constrained. Once again, the 2010 NPR asserted that U.S. dependence on nuclear weapons to deter conventional, biological, or chemical attacks had "declined significantly" and promulgated a policy that the United States would not use nuclear weapons against non-nuclear weapon states in compliance with the nuclear Non-Proliferation Treaty.[212]

Nevertheless, for threats of nuclear retaliation or punishment to work at all, they must be credible in the minds of U.S. adversaries. In his April 2009 speech committing the United States to seek a world without nuclear weapons, President Obama stated that so long as nuclear weapons continued to exist, the United States would need to "maintain a safe, secure and effective [nuclear] arsenal to deter any adversary and guarantee that defense to our allies."[213] Currently, the United States has explicitly extended its nuclear umbrella to around 30 countries (25 NATO members and other allies such as Japan and the Republic of Korea). In addition, members of the Obama administration, including the president and his secretary of state, have at least considered the possibility of extending the U.S. nuclear guarantee to Arab allies and Israel in the event that Iran acquires nuclear weapons. Such prospective extensions of the American "nuclear umbrella" appear to increase, rather than decrease, U.S. dependence on nuclear forces—or at least place even greater weight than before on the credibility of the U.S. nuclear deterrent.

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[211] Samuel W. Bodman and Robert M. Gates, "National Security and Nuclear Weapons in the 21st Century," Departments of Energy and Defense, September 2008, p. 3.

[212] DoD, "Nuclear Posture Review Report," April 2010, pp. viii, 15.

[213] "Remarks by President Barack Obama," April 5, 2009.

However, it is difficult to see how the U.S. nuclear arsenal can provide a credible deterrent for several more decades, if not longer, without some modernization of both launchers and warheads. The credibility of the U.S. deterrent seems especially doubtful in the case of extending the U.S. nuclear umbrella to various third-party allies and partners. After all, the United States is the only one of the original five nuclear powers that has formally declared that it will not develop any new nuclear warheads, and that service-life extension programs for existing warheads will "only use nuclear components based on previously tested designs, and will not support any new military missions or provide for new military capabilities."[214] These policies contrast sharply with Russian investments in a new generation of low-yield nuclear weapons to attack hard or deeply buried targets, minimize collateral damage, and neutralize enemy C3 or other electronics by generating electro-magnetic pulses.

Turning to delivery and launch vehicles, the Obama administration's only concrete step toward modernization has been to announce that the F-35 will be capable of delivering nuclear as well as conventional weapons.[215] In April 2009, Secretary Gates zeroed funding for a new air-breathing long-range strike system to follow the B-2A on the grounds that the need, requirement and technology were not yet understood (despite at least a decade of prior studies).[216] This decision reduced the air-breathing leg of the U.S. nuclear triad to 20 B-2s and some 77 B-52Hs, the B-1Bs having been withdrawn from the nuclear mission for which they were originally built. Not all of these bombers are operationally available on a day-to-day basis. Currently the United States generally has no more than 16 B-2As and 44 B-52Hs available for nuclear missions. Only the low-observable B-2s are capable of penetrating defended airspace. The B-52Hs rely on standoff cruise missiles for nuclear missions. But with the Air Force's announcement in 2007 that it planned to retire the low-observable AGM-129 Advanced Cruise Missile, the B-52 is left with the older AGM-86B Air Launched Cruise Missile (ALCM), of which 1,715 were produced, the last in October 1986. Moreover, as of 2001 a reasonable estimate is that at least 400 "surplus" ALCMs have been converted to conventional variants (Conventional Air Launched Cruise Missiles or CALCMs). This estimate is based on the fact that around 360 CALCMs had been expended in combat operations through 2003.[217] In light of these developments,

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[214] DoD, "Nuclear Posture Review Report," April 2010, p. xiv.

[215] DoD, "Nuclear Posture Review Report," April 2010, p. 27. It is reported that some 200 of B-61 gravity nuclear bombs remain in Europe at perhaps six sites (Franklin Miller, George Robertson and Kori Schake, "Germany Opens Pandora's Box," Centre for European Reform, briefing note, February 2010, p. 1, at http://www.cer.org.uk/pdf/bn_pandora_final_8feb10.pdf, accessed August 9, 2010).

[216] Robert M. Gates, "Budget Press Briefing," Department of Defense, at http://www.defense.gov/speeches/speech.aspx?speechid=1341 (accessed July 22, 2010).

[217] Boeing, "Demonstrates Precision-Strike Accuracy in CALCM," May 8, 2001, at http://www.boeing.com/news/releases/2001/q2/news_release_010508n.htm (accessed July 22, 2010).

one can appreciate why some have observed that the U.S. nuclear deterrent is moving toward "a de facto Dyad" of ICBMs and SLBMs, and argued that doing so actually appears wise in terms of likely development and acquisition costs for fielding a new air-breathing long-range strike system between now and 2050.[218]

The argument in favor of a de facto dyad augmented by 20 B-2s is supported by the historical reliability of U.S. ICBMs and SLBMs as well as recent and ongoing investments to modernize both the Minuteman and Trident II D-5. In the case of Minuteman, the rocket motors, guidance package, and other elements of the missile and its infrastructure have been updated over the last decade.[219] The most recent successful flight test of a Minuteman III, assembled from parts taken from the three Minuteman wings, took place on June 14, 2010, with all three unarmed reentry vehicles hitting their targets in the Kwajelin Missile Range. In October 2009, a submerged SSBN, the USS *West Virginia*, successfully launched two unarmed Trident II D-5s down range, marking the 128th and 129th successful test firing of the missile since 1989. In addition to various D-5 improvement programs aimed at keeping this missile in service through 2042, initial deliveries of the first batch of 115 life-extension D-5 SLBMs is expected in 2011. On the whole, then, U.S. ICBMs and SLBMs, in contrast to the heavy bomber leg of the nuclear triad, appear to be in relatively good shape for the next couple decades.

Warheads, however, are another matter. A case can be made that the longstanding U.S. policy not to develop new warheads with lower yields, less collateral damage, and more precise effects will, in the long run, undermine the credibility of the U.S. nuclear deterrent. The rationale parallels James Schlesinger's argument for developing limited nuclear options during the second Nixon administration. As Schlesinger explained in his annual report to Congress in March 1974, the Eisenhower administration's reliance on mutual assured destruction left the president, in the event of a nuclear attack, with a choice between surrendering or "ordering the mass destruction" of the Soviet population, knowing that it would be "followed by the mass slaughter of Americans."[220] Meanwhile, the

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[218] Dana J. Johnson, Christopher J. Bowie, and Robert P. Haffa, "Triad, Dyad, Monad?" Mitchell Institute for Airpower Studies, Paper 5, December 2009, p. 7. This paper recommends that the United States opt for an ICBM/SLBM dyad that retains the 20 B-2s as a niche capability for nuclear strikes (ibid., pp. 27-28).

[219] "TRW To Upgrade Stage Four Engines on Minuteman 3," *Space Daily*, February 4, 2000, at http://www.spacedaily.com/news/icbm-00a.html (accessed July 22, 2010); and "Northrop Grumman and USAF Complete Guidance Upgrade Installations on Minuteman III ICBMs," *Space Daily*, March 12, 2008, at http://www.spacedaily.com/reports/Northrop_GrummanAnd_USAF_Complete_Guidance_Upgrade_Installations_On_Minuteman_III_ICBMs_999.htm (accessed July 22, 2010).

[220] James R. Schlesinger, "Defense Department Annual Report," March 4, 1974, pp. 3, 35. The portions of this report on strategic (nuclear) forces are available online at http://www.airforce-magazine.com/MagazineArchive/Documents/2006/February%202006/0206keeperfull.pdf (accessed July 24, 2010).

build-up of more accurate Soviet ICBMs with multiple independently-targetable reentry vehicles (MIRVs) was beginning to give the Soviets a counterforce option against the U.S. ICBM fields. On the grounds that it was "impermissible" from an American viewpoint for the Soviets to possess such options while the United States did not, Schlesinger argued that it was necessary to reinforce deterrence by providing the president "with a wider set of much more selective targeting options," thereby removing any temptation Soviet leaders might have to consider a limited counterforce nuclear attack against the United States. His aim was to reduce to an even lower point the probability of a nuclear clash with the USSR by improving U.S. deterrence across a broad spectrum of contingencies.

At the time, the main objection to limited nuclear options from dovish critics was that they made the unthinkable—nuclear war—more thinkable.[221] Since the controversy over so-called "neutron bombs" with enhanced radiation effects in the late 1970s, much the same objection has been made to any U.S. development of new warheads with lower yields, less collateral damage, or more precise effects. The motivation has been to make the gap between conventional and nuclear employment as great as possible. But with the Russians and possibly others developing such weapons, logic suggests that the credibility of the U.S. nuclear deterrent will be eroded over time by a continuing American refusal to do likewise. Granted, developing more new warheads with more tailored effects may well lower the threshold for limited nuclear use. But advances in precision conventional weapons have been making conventional strikes approach ever more closely the effectiveness of nuclear weapons—at least since the 1991 Persian Gulf War. Consequently, insofar as limited nuclear options are now judged, in retrospect, to have strengthened the credibility of the U.S. nuclear deterrent in the 1970s, developing more "usable" nuclear warheads should do the much same in the early 21st century.

This conclusion highlights the deep inconsistency between eschewing sensible nuclear modernization in pursuit of a future world without nuclear weapons while, at the same time, trying to maintain a credible nuclear deterrent between now and then. If abolishment of the world's nuclear arsenals appeared likely with ten or even twenty years, then the stricture against new warheads might be defensible. But if abolishing nuclear arms is likely to take half a century or more, then these policy choices are surely fraught with considerable risk. The policy prohibition against any U.S. development of new, more usable warheads leaves the United States in the position of ceasing to compete in an area in which several of the world's nuclear powers are moving ahead. While this choice can be viewed as setting a good example for others to follow with regard to eventual nuclear disarmament, it also undermines the credibility of the U.S. nuclear deterrent in the meantime.

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[221] "Schlesinger's Limited Nuclear Options," *AIR FORCE Magazine*, February 2006, p. 8.

To this point, the analysis has employed core concepts about nuclear weapons dating from the 1950s and 1960s—deterrence (including its extension to allies and friends), stability (both in crisis and in war), sufficiency, etc.—with little attempt to revise or update them for the post-9/11 beyond highlighting some of the differences between the Cold War and now. As stated at the outset, however, the principal aim of this report is to provide a more realistic framework for assessing the role that nuclear arms are likely to play in international affairs through the middle of the 21st century. The previous chapter set out a framework for thinking about nuclear competitions through mid-century formulated as a series of assumptions about the role and likely place of nuclear weapons in the evolving international security environment. What remains to be done is to spell out in more detail the implications of this framework for actually doing a net assessment of nuclear competitions in the current period.

The foremost implication is that, in contrast to the Cold War, *the world's nuclear relationships are no longer dominated by a single rivalry between two superpowers whose combined nuclear forces are so enormous that they overshadow all other nuclear forces and competitions*. This observation is not intended to denigrate the independent nuclear forces that the British fielded in the early 1950s or the French in the early 1960s. The existence of separate British and French nuclear weapons and delivery systems undoubtedly added to the risk and uncertainty Soviet leaders would have confronted in considering either a conventional attack on NATO or, especially after the 1962 Cuban missile crisis, any initiatives that could escalate into an all-out nuclear exchange with the United States. Rather, the point is that the reductions in the U.S. and Soviet arsenals since 1992, together with those likely to occur in the future, have been large enough to disaggregate nuclear relationships into a series of separate competitions:

- U.S.-Russia;
- U.S.-China;
- Russia-China;
- India-Pakistan;
- India-China;
- the United States and the Republic of Korea versus North Korea;

and, looking ahead to some all-too-likely possibilities,

- Iran versus Israel and the United States;
- terrorist organizations such as al Qai'da versus the United States and its Western allies;

and, possibly,

- Sunni Saudi Arabia and Syria versus Shi'a Iran.

The critical point from a net assessment perspective is that *each of these existing and prospective nuclear competitions will need to be evaluated in its own terms*. The meaning of concepts such as nuclear deterrence and stability will vary across the range of cases depending on the specific objectives of individual competitors and the roles and value their leaders perceive their nuclear capabilities to have relative to rivals. In addition, the appropriate metrics and analytic methods for assessing each of these individual competitions are likely to vary widely, and each competition will need to be evaluated against a robust range of plausible scenarios (as opposed to one or two worst cases). Needless to say, this disaggregation of nuclear affairs from a single, overriding U.S.-Soviet nuclear competition into a series of disparate competitions enormously complicates any comprehensive assessment of nuclear forces and deterrence in the years and decades ahead.

It is not difficult to illustrate the many complications arising from this proliferation of nuclear competitions. To start with the U.S.-Russia nuclear relationship, the likelihood of an all-out Russian nuclear attack on the United States is, once again, extremely remote (although probably not zero). Nonetheless, the Russians have been adamant about retaining a capability to annihilate the United States with nuclear weapons. Evidence can be seen in their longstanding opposition to national missile defenses. This opposition dates from President Reagan's 1983 Strategic Defense Initiative. Although much has changed in Russia's nuclear relationship with the United States since the Cold War ended, Russian leaders remain opposed to American deployments of even limited missile defenses. This position has been apparent both in Russian opposition to deployments of ground-based radars and interceptors in Eastern Europe as well as in Russian use of New START to constrain U.S. freedom to convert ICBM silos to missile-defense launchers. Starting in September 2009, the Obama administration shifted the emphasis of the U.S. missile defense program to the Phased Adaptive Approach focused on defending European allies from medium-range ballistic missiles. Instead of pressing ahead with further deployments of long-range Ground-Based Interceptors (GBIs) for defending the United States against small numbers of ICBMs from North Korea, the administration decided to emphasize Aegis combatants, advanced versions of the Standard Missile (SM)-3, and the Army-Navy transportable AN/TPY-2 X-band radar to defend European countries against short- and medium-range ballistic missiles from Iran.[222] Reflective of this change in emphasis, in July 2010 the United States and Poland signed an

[222] The White House, "Fact Sheet on U.S. Missile Defense Policy: A 'Phased, Adaptive Approach' for Missile Defense in Europe," September 17, 2009, at http://www.whitehouse.gov/the_press_office/FACT-SHEET-US-Missile-Defense-Policy-A-Phased-Adaptive-Approach-for-Missile-Defense-in-Europe/ (accessed August 4, 2010). The intelligence underlying this shift in the focus of U.S. ballistic missile efforts was that Iran's development of ICBMs appeared to be proceeding more slowly than previously thought whereas Iran's progress on developing medium- and short-range ballistic missiles seemed to be maturing faster than expected.

agreement to field an SM-3 missile-defense site based on the new approach in Poland in the 2018 timeframe.[223]

Figure 11: Successful SM-3 Intercept of a Medium-Range Ballistic Missile Target Launched from Vandenberg AFB, June 22, 2007

The Russian Federation's continuing insistence on being able to hold the United States at risk with nuclear weapons appears to be based on the desire of Russia's leaders to maintain the country's international prestige as a great power together with their perception of the Russian military's conventional inferiority vis-à-vis NATO. At the end World War II, the USSR's status as a great power was based largely on the size of the Red Army and its occupation of Eastern Europe.[224] During World War II the Soviet Union mobilized over 34 million for its military forces compared to America's nearly 15 million, the British Commonwealth's 5 million, Germany's nearly 13 million, and Japan's more than 7 million.[225] While the Red Army did demobilize somewhat immediately after World War II, the USSR's status was acknowledged by a permanent seat on the United Nations Security Council, and Soviet forces remained in East Germany, Poland, Hungary and Czechoslovakia until the Cold War's end. Granted, in the early days of the Cold War the size of the Soviet Army was exaggerated in the West. In

[223] Roxana Tiron, "U.S., Poland Sign Amended Missile Defense Pact despite Russian Objections," *The Hill*, July 3, 2010, at http://thehill.com/homenews/administration/107111-us-poland-sign-amended-missile-defense-pact-despite-russian-objections (accessed August 3, 2010).

[224] In April 1945, the Soviets had built up four massive fronts containing nearly 4 million men, 9,800 tanks and over 40,000 artillery pieces and heavy mortars for the final offensive into East Prussia, Hungry, and Slovakia—Williamson Murray and Allan R. Millett, *A War To Be Won: Fighting the Second World War* (Cambridge, MA, & London: Belnap Press of Harvard University Press, 2000), pp. 472-475.

[225] Andrew Roberts, *The Storm of War: A New History of the Second World War* (London: Allen Lane, 2009), pp. 556, 604; Roberts, *A History of the English-Speaking Peoples since 1900*, p. 256.

1948, it was widely believed that the Soviet army numbered 4 to 5 million men, whereas the actual figure probably did not exceed 3 million.[226] But as late as the mid-1980s, Soviet ground forces numbered around 1.9 million personnel, and had 30 divisions and nearly 28,000 tanks deployed in Eastern Europe.[227] These Western misperceptions of the Soviet army strength notwithstanding, the Soviets did not ignore nuclear weapons either during or after World War II. Low-priority Soviet research on the atomic bomb started in the autumn of 1942, and, in August 1945, the USSR's State Defense Committee formally enacted Joseph Stalin's decision to make development of nuclear weapons the first priority of the Soviet state.[228] By the time the USSR achieved rough nuclear parity with the United States in the early 1970s, Soviet nuclear forces had become widely perceived as being as central to the USSR's status as a great power as its conventional military capabilities had been in 1945.

The break-up of the Soviet Union itself along with the country's economic collapse inevitably produced a parallel collapse in Russia's conventional capabilities. The last elements of the Group of Soviet Forces in Germany withdrew in August 1994. By then, some 57 former Soviet divisions had been turned over to Belarus and Ukraine. Coupled with the loss of the industrial capacities in the newly independent states, Russia's gross domestic product did not beginning recovering significantly until the late 1990s. Given NATO's subsequent enlargement, which began with German reunification, it is easy to see why the Russian military has turned toward greater reliance on theater nuclear weapons to compensate for Russia's conventional inferiority relative to NATO in the west and China in the east. Coupled with the desire to preserve its status as a great power manifested under Vladimir Putin, it therefore seems unlikely that the Russian Federation will be inclined to give up its nuclear arms anytime soon. As Dima Adamsky recently concluded: "The Russian strategic community perceives its nuclear arsenal as a symbol of superpower status, an instrument of foreign policy, and an ultimate security guarantor."[229]

What do these observations and developments imply for the ability of the United States to deter Russian nuclear use? Again, the chances of the Russian Federation initiating an all-out nuclear attack on the United States are remote.

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[226] Walter Isaacson and Evan Thomas, *The Wise Men: Six Friends and the World They Made* (New York: Simon & Schuster Paperbacks, 1986), p. 503. Paul Nitze, the primary author of National Security Council (NSC)-68 in 1950, later acknowledged that a third of the 175 Soviet divisions cited in NSC-68 were "cadres" of ill-equipped militia (ibid.).

[227] Caspar Weinberger, *Soviet Military Power 1985* (Washington, DC: U.S. Government Printing Office, April 1985), pp. 62, 66.

[228] Richard Rhodes, *Dark Sun: The Making of the Hydrogen Bomb* (New York: Simon & Schuster, 1995), pp. 66, 181-182.

[229] Adamsky, "Workshop Read-Head Paper," August 16, 2010, p. 1. "Since Russia lacks soft power to promote its strategic goals, it uses its nuclear tool and energy supply to influence global and regional politics" (ibid.).

But beyond that extreme case, the U.S. deterrent relationship with Russia today bears little resemblance what it was during the 1980s. The Russian Federation's campaign against Georgia in 2008 suggests clear limits to the U.S. ability to extend its nuclear umbrella to at least some portions of Russia's near abroad. Similarly, the prospects of U.S. nuclear forces deterring a Russian decision to resort to nuclear weapons to end a conventional conflict against NATO that began turning out badly for Moscow appear dim. Although internal Russian debate over a "regional nuclear deterrence" doctrine to compensate for conventional weakness has yet to achieve overall coherence at the national level, exercises during the last decade have included Long Range Aviation nuclear strikes on the continental United States (CONUS), apparently in the belief that these strikes would end the war rather than provoke nuclear escalation.[230] The underlying Russian calculation seems to be that U.S. leaders would judge it to be in their best interests to halt the war even after limited nuclear attacks on CONUS rather than escalate and risk a massive nuclear exchange. These reductions in the reach of U.S. deterrence of nuclear use by Russia seem particularly worrisome in the event of a Russian-NATO conventional clash over the Baltic States or Poland.[231] Again, nuclear deterrence and stability between the United States and Russia are not at all what they were during the Cold War.

Similar implications emerge in the case of the nuclear relationship between the United States and China. Cold War notions of nuclear deterrence between the United States and the Soviet Union were largely based on the symmetric vulnerability of both sides' societies and nuclear forces. China's 2nd Artillery Corps is a missile force whose weapons are almost entirely underground and, as result, highly survivable. Granted, it is possible to conceive of a U.S. counterforce campaign against the 2nd Artillery Corps using nuclear weapons to seal the various exits to launch positions associated with 5,000 kilometers of tunnels, many of them under mountains. But the vulnerability of China's nuclear forces even to attacks with large nuclear warheads is quite different from that of U.S. bomber bases, SSBNs in port, and Minuteman fields in North Dakota and Montana. Moreover, as mentioned in the first chapter, it is no longer as clear as has long been believed in the West that the PRC's leaders have opted for a minimal deterrent posture. The possibility is growing that China possesses several times more warheads than the commonly held figure of around 300. This possibility raises the disturbing prospect of a future in which the U.S. intelligence community suddenly discovers that the PRC's stockpile of nuclear warheads is comparable in size to those of the United States and Russia. If the PRC's nuclear forces also remain outside U.S.-Russian arms control agreements, then there will be little leverage for preventing China from continuing to expand its nuclear arsenal. While the implications of these possibilities for both conventional and nuclear deterrence of China have yet to be thought through, it appears probable that persisting

[230] Adamsky, "Workshop Read-Head Paper," p. 4.

[231] Poland, Latvia, Estonia, and Lithuania are all NATO member countries. Belarus and Ukraine are NATO partner countries, as is Georgia.

with Cold War understandings of deterrence in the case of China could be deeply misleading, if not dangerous. After all, China, in contrast to the United States and Russia, is not currently constrained from fielding ground-launched cruise and ballistic missiles with ranges of 500-5,500 kilometers. Indeed, the short-range (300 kilometers) DF-11 (CSS-7) is the only one of the 2nd Artillery Corps ballistic missiles that fall outside the INF range ban. Thus, the future of the U.S-China and Russia-China nuclear competitions may not be as minimalist and benign as Western analysts have long assumed.[232]

The prospect of a nuclear-armed Iran suggests further departures from Cold War notions of nuclear deterrence and stability. During the Cold War, the Kent-Thaler concept of first-strike stability was predicated on the inability of the United States or the USSR to preclude a devastating retaliatory response from the other by attempting a disarming counterforce first strike. Offhand, it is far from obvious how this notion might apply to Iran or the United States. At least until the Iranians field ICBMs, the country cannot pose a direct retaliatory threat to the continental United States, and by that time sufficient missile defenses may be in place to cope with a small number of Iranian warheads. On the side of the coin, Iran is likely to be vulnerable to a disarming counterforce strike by the United States or, in the event of Iranian use of a nuclear weapon against Israel or other U.S. Persian Gulf allies, a severe countervalue attack against Persian population centers. During the 2008 U.S. presidential campaign, Hillary Clinton, now Secretary of State, vowed to obliterate Iran should the country use a nuclear weapon against Israel.[233] While this threat may constitute a case in which extended deterrence could avert an Iranian attack with an atomic weapon on Israel, it is hardly likely to deter Iranian funding of terrorist activities. Again, the United States has not responded militarily at any level to Iranian support of Iraqi insurgents even though the weapons the Iranian Revolutionary Guards supplied and the terrorists they trained have been killing American soldiers. So the escalatory potential inherent in extending nuclear deterrence to NATO allies that seems to have restrained Soviet adventurism in Europe during the Cold War would not obviously restrain a nuclear-armed Iran from provocations short of nuclear threats or actual nuclear use in the Middle East or elsewhere.

What about deterring nuclear threats or nuclear use by the Islamic Republic of Iran? Henry Kissinger recently told Robert Kaplan that, from an American viewpoint, deterrence of Iran by the United States would be different from deterrence between the United States and USSR during the Cold War.[234] One would

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[232] See Hans M. Kristen, Robert S. Norris, and Matthew G. McKinzie, *China's Nuclear Forces and U.S. Nuclear* War Planning, Federation of American Scientists and the Natural Resources Defense Council, November 2006; also Jeffery G. Lewis, *The Minimum Means of Reprisal: China's Search for Security in the Nuclear Age* (Cambridge, MA: MIT Press, 2007).

[233] Associated Press International, "Clinton's Iran Threat Looks to Post-Bush Policy," May 5, 2008, at http://afp.google.com/article/ALeqM5hjy4zRiRXiyDgG0IVtWzzeTQhHgA (accessed August 6, 2010).

[234] Robert D. Kaplan, "Living with a Nuclear Iran," *The Atlantic*, September 2010, p. 72.

have to consider, Kissinger suggested, Iran versus Israel, Iran versus the Sunni Arabs, Iran versus its own dissidents, and Islam versus the West. These various relationships constitute a way of thinking about the nuclear deterrence of Iran by the United States. They draw attention to the principal factors or dynamics that any realistic assessment of the United States' ability to deter Iranian nuclear adventurism would have to take into account. Deciding how to think about a given military competition has almost always been the most difficult part of doing a good net assessment (as opposed to a poor one). Of course, identifying the main dynamics to pay attention to in the case of deterring Iran is only a first step toward an adequate assessment of an Iran with either nuclear weapons or a breakout capability to acquire them quickly. Beyond these individual dynamics is the additional analytic problem of deciding how they interact with one another to yield an overall assessment.

As a final example of the complications generated by the Cold War U.S.-Soviet nuclear competition being supplanted by a series of "lesser" but more complex nuclear competitions, the 2010 Nuclear Posture Review argued that "today's most immediate and extreme danger is nuclear terrorism" by al Qai'da and its extremist allies, not the threat of global nuclear war; and since the acquisition of nuclear weapons by additional countries—especially those at odds with the United States and its allies—would weaken the nuclear non-proliferation regime and increase the chances of terrorists acquiring a nuclear weapon, nuclear proliferation is today's "other pressing threat."[235] If Kilcullen is right, the primary aim al Qai'da or its allies would have in detonating a nuclear device on American soil would be to provoke a massive overreaction in order to alienate U.S. allies, and inflict "far greater loss, cost and damage (physical, political, and economic) than the terrorists themselves could ever directly impose."[236] As suggested earlier, U.S. nuclear forces appear to have little, if any, leverage to deter such an attack. Instead, the most efficacious course lies, as the Obama administration has recognized, in strengthening the nuclear non-proliferation regime, to include stronger international controls over nuclear materials. Yet, as sensible as this approach may be, it leaves unanswered exactly what nuclear forces and capabilities the United States may need in coming decades to maintain nuclear deterrence and stability.[237] If countries turn increasingly to nuclear power for generating electricity, then controlling fissile materials is likely to grow ever more difficult over time. Furthermore, the inclination in the 2010 NPR to assume that the smaller the U.S. and Russian arsenals become, the safer and more secure the world will be from nuclear conflict ignores the prospective range of contingencies that U.S. nuclear launchers and warheads will need to deter for the foreseeable future. The requirements of deterrence and stability across the full gamut of current and prospective nuclear competitions should determine the nuclear forces and capa-

[235] DoD, "Nuclear Posture Review Report," April 2010, p. iv.

[236] Kilcullen, *The Accidental Guerilla*, p. 274.

[237] DoD, "Nuclear Posture Review Report," April 2010, p. iii.

bilities—including the numbers of launchers and warheads—the United States will need through at least 2050. Instead, U.S. nuclear forces and capabilities are being set by arms-control agreements with the Russian Federation that largely ignore other nuclear competitions, nuclear powers, and nuclear aspirants. Doing so seems especially dangerous because several of these "lesser" competitions—particularly India-Pakistan, China-Russia, and Iran-Israel—could potentially draw in the United States as a third party, thereby adding n-player complexities that were largely ignored during the Cold War.

These emerging complications suggest a final challenge for assessing nuclear competitions in the 21st century. While each of the current and prospective nuclear competitions needs to be assessed on its own terms, *it will ultimately be necessary to integrate across the entire set of existing and emerging nuclear competitions* in order to assess the role of world's nuclear forces and capabilities in the 21st century as a whole, much less to provide a diagnostic baseline for thinking about U.S. nuclear requirements through mid-century. Analytically, the most significant change in nuclear affairs since the late 1980s has been the gradual shift from the single, overriding U.S.-Soviet nuclear rivalry into a series of six to potentially as many as nine "lesser" competitions. But even after each of these competitions has been assessed individually, the final step in any adequate strategic-nuclear assessment will be to integrate the ramifications of the various nuclear competitions into a coherent global picture. Unfortunately, Cold War analyses of nuclear strategy and competition provide few guidelines as to how this might be done.