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The History of the Future of Nuclear Weapons

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Introduction

It is a paradox that few aspects of international security have been as closely scrutinized, but as incorrectly forecast, as the future nuclear landscape. Since the advent of nuclear weapons in 1945, there have been dozens, if not hundreds of projections by government and independent analysts trying to predict horizontal and vertical proliferation across the world. Various studies examined which countries would acquire nuclear weapons, when this would happen, how many weapons the two superpowers as well as other countries would assemble, and the impact these developments might have on world peace**.** The results have oscillated between gross underestimations and terrifying overestimations. Following the September 11, 2001 attacks, the fear that nuclear weapons might be acquired by so-called "rogues states" or terrorist groups brought added urgency – and increased difficulty – to the task of accurately assessing the future of nuclear weapons.

A survey of past public and private projections provides a timely reminder of the flaws in both the methodologies and theories they employed. Many of these errors were subsequently corrected, but not before, they made lasting impressions on U.S. nuclear (and non-nuclear) policies. This was evident from the time the 'Atoms for Peace' program was first promulgated in 1953 to the 1970 establishment of the Nuclear Non-Proliferation Treaty (NPT), and more recently during the post-Cold War disarmament efforts and debates surrounding U.S. stance towards emerging nuclear threats.

This study offers a brief survey of attempts to predict the future of nuclear weapons since the beginning of the Cold War.[1] The aim of this analysis is not merely to review the record, but to provide an overall sense of how the nuclear future was perceived over the past six decades, and where and why errors were made in prediction, so that contemporary and future predictive efforts have the benefit of a clearer historical

[1] This analysis relies on declassified U.S. government documents and English-language literature on the subject, and thus is limited in its scope. Projections by commentators in several major nuclear states, such as the Soviet Union/Russia and China, are not considered, although some analyses by Australian, British, Canadian, French, German, and Indian experts are taken into consideration.

record. The survey is based on U.S. intelligence estimates as well as the voluminous scholarly work of American and foreign experts on the subject.

Six broad lessons can be gleaned from this history.

First, it reveals consistent misjudgments regarding the extent of nuclear proliferation. Overall, projections were far more pessimistic than actual developments; those emanating from independent experts more so than intelligence estimates. In the early years of the Cold War, the overly pessimistic projections stemmed, in part, from an incorrect emphasis on technology as the driving factor in horizontal proliferation, rather than intent, a misjudgment, which came to light with the advent of a Chinese bomb in 1964. The parallel shift from developed-world proliferation to developing-world proliferation was accompanied by greater alarm regarding the impact of proliferation. It was felt that developing countries were more dangerous and irresponsible nuclear states than developed countries.

Second, while all the countries that did eventually develop nuclear weapons were on the lists of suspect states, the estimations misjudged *when* these countries would go nuclear. The Soviet Union went nuclear much earlier than had been initially predicted, intelligence estimates completely missed China's nuclear progress, and India initially tested much later than U.S. intelligence projections had anticipated and subsequently declared nuclear weapon status in 1998 when virtually no one expected it to do so.

Third, the pace of proliferation has been consistently *slower* than has been anticipated by most experts due to a combination of overwhelming alarmism, the intent of threshold states, and many incentives to abstain from weapons development. In the post-Cold War period, the number of suspected threshold states has gradually decreased and the geographical focus has shifted solely to North-East Asia, South Asia, and the Middle East. There is also much greater concern that a nuclear chain reaction will break out than was the case during the Cold War.

Fourth, the debate concerning the size of future arsenals of the various nuclear powers produced mixed results. While estimates were consistently exaggerated for the

Soviet Union, both intelligence forecasts and expert opinions proved correct in their views that none of the other nuclear states would be able to match the Cold War superpowers in quantitative or qualitative terms. During the Cold War, projections regarding the Soviet Union produced two contradictory effects: it galvanized the arms control agenda while simultaneously providing the American security establishment with a rationale for assembling a much larger arsenal than was necessary for a credible deterrent capability. After the end of the Cold War, new and uncertain threats have transformed the disarmament dialogue into one of arms control, with asymmetric threats such as nuclear terrorism providing the justification for maintaining a nuclear arsenal.

Fifth, the tone of predictive studies was not always consistent with contemporaneous events. Moreover, while U.S. government policy was impacted by intelligence estimates in some cases, in other periods, policy seemed to be at odds with classified projections. Reverse causality – intelligence being tinkered to suit government policy or to fit the liking of the administration in charge – was absent however. Intelligence estimates themselves were impacted by actual developments, as was reflected by the shift in focus to the developing world after the Chinese nuclear test of 1964 and increased pessimism regarding proliferation in the wake of the Indian test a decade later.

Sixth, there is evidence that over the long-term, external assistance was a major factor in proliferation. External actors, especially the superpowers, played the role of dampeners (by providing security guarantees or threatening punitive action), and of collaborators (by providing nuclear material and technology). More recently, this role has been played by second- and even third-tier states, such as Israel, Pakistan, and North Korea.

Table 1: Summary of Forecasts Concerning Major Proliferation Threats 1949-2007

	1949-1964[a]	1965-1991[b]	1991-2003[c]	2004-2007[d]
Potential for horizontal proliferation among developed countries	High	Low	Low	Low
Potential for horizontal proliferation among developing countries	Low	High	High	High
Potential for accelerated vertical proliferation among Cold War superpowers	High	High	-	-
Potential for accelerated vertical proliferation among all other states	Low	Low	Low	Low
Threat of domino effect	Low	High	High	High
Importance of superpower security guarantees to Nth states/involvement in regional crises	High	High	Very high	Very high
Importance of external assistance to Nth states	High	High	High	High
Threat of nuclear terrorism and the role of non-state actors in proliferation	Low	Low	High	Very high
Nuclear war	Low	High	High	High

a= First period of Nth country proliferation during the Cold War

b= Second period of Nth country proliferation during the Cold War

c= Period from the fall of the Soviet Union to the revelation of the global nuclear black market in 2003

d= Period since the revelation of the global nuclear black market

The first section of this paper covers the time period between the dawn of the nuclear age in 1945 and the end of the Cold War in 1991. This was the era of superpower rivalry, but it also witnessed a theoretical evolution. In the first two decades of this period (1945-1965), proliferation was largely seen as technology-driven, with a consequent emphasis on developed nations. Subsequently, during a second phase (1966-91) the proliferation focus shifted to the developing world in the wake of China's nuclear test of 1964. These two phases are analyzed separately. The second section examines the post-Cold War period, which saw the United States reexamining its role as the preeminent nuclear power, as well as renewed worries about Nth power proliferation following nuclear tests by India, Pakistan, and North Korea.[2] There were also more immediate concerns regarding the acquisition of nuclear weapons by non-state actors following the September 11, 2001 terrorist attacks. These two sections are followed by an analysis of the key trends evident in the forecasts from the entire sixty-year period. The conclusion envisages the nuclear world in 2020.

The Cold War

The U.S. intelligence apparatus and independent experts frequently speculated on the future of nuclear weapons throughout the Cold War. While the superpower rivalry remained the key concern during this period, the prospects of weapons proliferation beyond the Cold War rivals was also considered and weighted.

The Superpower Rivalry: The U.S. View of Soviet Capabilities

American intelligence offered its first estimate of the Soviet atomic capability in August 1946, suggesting that Moscow could produce an atomic device between 1950-1953.[3] In 1948, it revised the forecast to suggest an "earliest possible date" of mid-1950,

[2] 'Nth states' or 'Nth powers' are states that are likely to seek and develop nuclear weapons in the near future. The term is hereafter used interchangeably with 'threshold state' and 'suspect state'.
[3] Central Intelligence Group, "Soviet Capabilities for the Development and Production of Certain Types of Weapons and Equipment," ORE 3/1, October 31, 1946, http://www.foia.cia.gov (accessed on December 17, 2007).

although the most probable date was still predicted to be mid-1953.[4] The same projection was retained in an August 1949 report disseminated five days before the actual Soviet atomic test.[5] Following the test, American forecasts about the Soviet Union transitioned into examinations of the relative strengths of the two sides.

Forecasts regarding the nuclear capability of the two superpowers saw a progressive shift of balance in Moscow's favor. During the 1950s, capability-related projections pointed to the probable accelerated modernization of the Soviet nuclear arsenal in an attempt to gain parity with the United States.[6] However, in the early-to-mid 1960s, despite the Berlin and Cuban missile crises, U.S. intelligence anticipated that Moscow would rid itself of any ambition to gain a substantial advantage over Washington.[7] Towards the late 1960s, the sentiment reversed once again, with a 1969 National Intelligence Estimate (NIE) stating that the USSR would seek "rough parity with the U.S." and that "in assessing the strategic balance the Soviets would go beyond numbers to consider operational differences in weapon systems."[8] Such assessments suggested not only the attention Soviet Union was paying to numerical strength but also to the qualitative comparison with American nuclear forces.

By the early 1970s, estimates began considering the prospect of the Soviet Union seeking nuclear superiority. A 1973 intelligence report suggested that the Soviets may seek "a margin of superiority if they can."[9] The early-to-mid 1980s saw contradictory estimates from within the U.S. intelligence apparatus, with the Defense Intelligence Agency (DIA) maintaining that the Soviets would continue to seek superiority in the nuclear arena, but the Central Intelligence Agency (CIA) downgrading its forecasts to

[4] Central Intelligence Agency, "Status of the U.S.S.R. Atomic Energy Project," MORI 136351, January 1949.
[5] Central Intelligence Agency, "Status of the U.S.S.R. Atomic Energy Project," OSI/SR-10/49/1, August 1949.
[6] Raymond L. Garthoff, "Estimating Soviet Military Intentions and Capabilities" in Gerald K. Haines and Robert E. Leggett, eds., *Watching the Bear: Essays on CIA's Analysis of the Soviet Union* (Central Intelligence Agency, 2001), p.144.
[7] Ibid. The NIEs in 1959 were among the first not to raise concerns about a Soviet intention to attain superiority.
[8] National Intelligence Estimate 11-8-69, "Soviet Strategic Attack Forces," September 9, 1969, p.8.
[9] National Intelligence Estimate 11-8-73, "Soviet Forces for Intercontinental Attack," January 25, 1974, p.4.

project "approximate nuclear parity".[10] During the late-1980s, when economic frailties and internal political turmoil had made any talk of Soviet military supremacy redundant, the CIA's view prevailed in most forecasts.

Predictive studies by independent experts mirrored those of the intelligence community for the first three decades of superpower rivalry. However, their estimates became extremely pessimistic during the 1980s, with most observers foreseeing a relentless arms race and strategic instability. In a highly influential piece in 1981, renowned American scholar Michael Nacht predicted an intensification of U.S.-Soviet nuclear competition, and anticipated a greater number of sophisticated battlefield nuclear warheads with mobile, dispersed, and less detectable delivery systems.[11] However, partly as a consequence of President Reagan's Strategic Defense Initiative (SDI), the greatest danger foreseen by analysts during the 1980s were enhanced ICBM and SLBM capabilities that would prompt both sides to renew their interest in civil and strategic defense systems, a move that was anticipated to lead both sides to pre-delegate launch authority.[12] The more alarmist view of nuclear weapons was also reflected in the analyses of the potential destruction a superpower nuclear war would cause. One such calculation was published by Arthur Westing, who argued that a full-scale nuclear war would witness the use of over 9,000 nuclear weapons with a yield of 7,800 megatons. This would have been 500 times higher than the combined yield from all previous wars.[13]

With the focus increasingly shifting from nuclear deterrence to nuclear war, the few sanguine views were quickly overwhelmed. A view representative of the nuclear optimists was provided by American scholar Michael Mandelbaum, who predicted in 1983 that "the nuclear future will be like the past. It will follow a middle path between

[10] National Intelligence Estimate 11-3/8-79, "Soviet Capabilities for Strategic Nuclear Conflict Through the 1980s," Vol.1, March 17, 1980, pp.3-4.
[11] Michael Nacht, "The Future Unlike the Past: Nuclear Proliferation and American Security Policy," *International Organization*, Vol.35. No.1, Winter 1981, p.203-04.
[12] David C. Gompert, "Strategic Deterioration: Prospects, Dimensions, and Responses in a Fourth Nuclear Regime" in David C. Gompert, Michael Mandelbaum, Richard L. Garwin and John H. Barton, eds., *Nuclear Weapons and World Politics: Alternatives for the Future* (New York: McGraw-Hill Book Company, 1977), pp.260-61.
[13] Arthur H. Westing, "Misspent Energy: Munition Expenditures Past and Future- The World Arsenal of Nuclear Weapons," *Bulletin of Peace Proposals*, Vol.16, No.1, 1985, Stockholm International Peace Research Institute (SIPRI), p.10.

nuclear war and nuclear disarmament. There will continue to be nuclear weapons, but they will not be used at least not by the two most heavily armed countries. The superpowers will continue to deter each other."[14]

The evaluations of American nuclear capabilities had some perplexing characteristics. Estimates of relative capabilities became unfavorable to the U.S. progressively, but intelligence forecasts regarding specific Soviet weapon systems were exaggerated from the very outset.[15] As early as 1950, the National Security Council's NSC-68 report predicted that the Soviets would have as many as 200 nuclear weapons by mid-1954, a forecast that turned out to be a gross overestimation.[16] Moreover, during the mid-1950s, the United States overestimated the sizes of the Soviet submarine force, its nuclear weapons stockpile, its inter-continental ballistic missiles (ICBM) capability, and its heavy bomber force.[17] This trend continued into the 1970s and 1980s. Between 1974 and 1986, the rate of deployment of Soviet strategic forces was regularly overestimated; at least 10 out of the 17 deployable systems were predicted to have been operational zed earlier than they actually were.[18] The only notable underestimations were the forecasts concerning medium range bombers and missiles. For the latter, American estimates remained below the actual level of Soviet forces throughout the Cold War.[19]

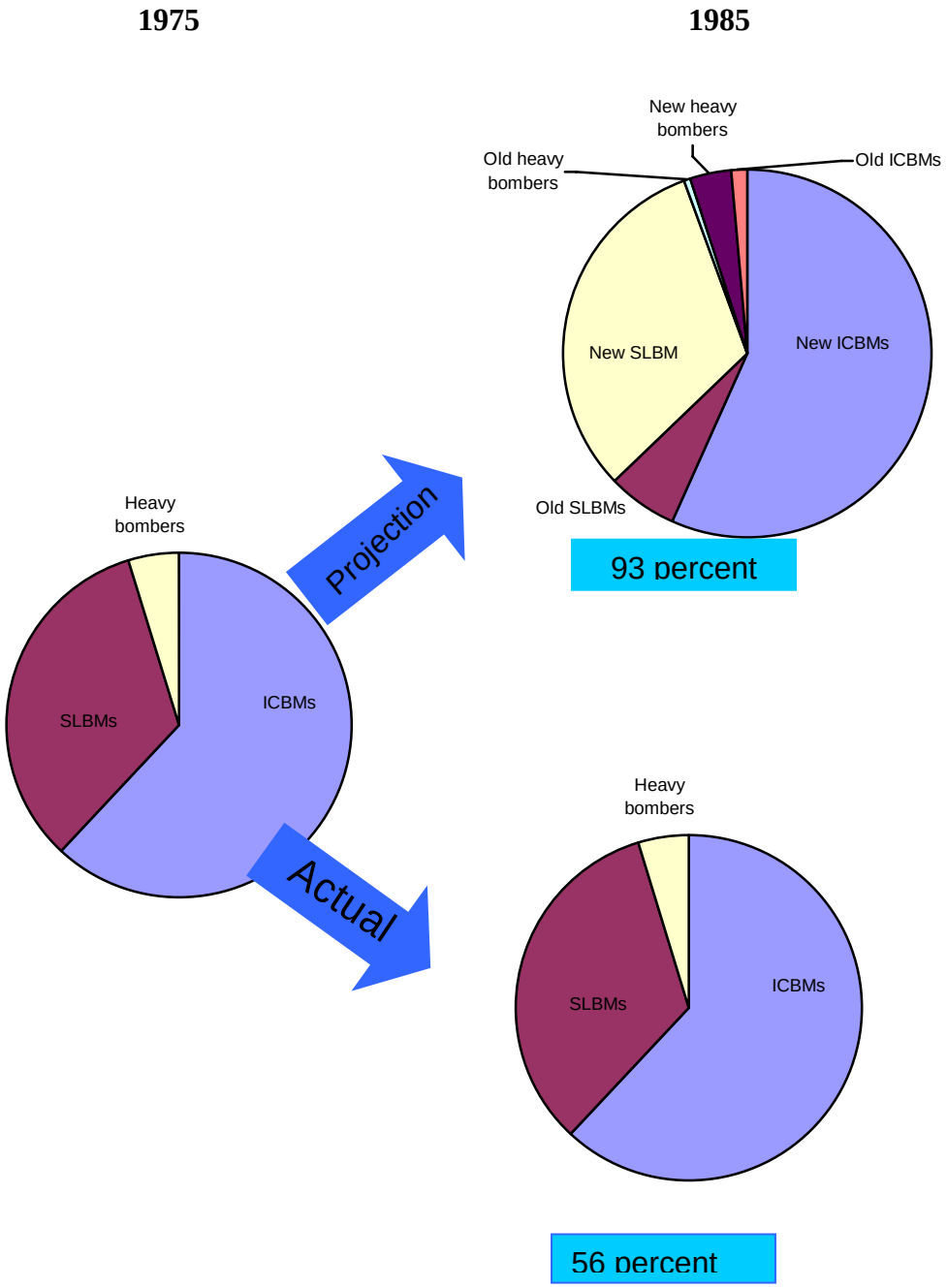
The nuclear system that arguably received the most attention from the mid-1950s onwards was the Soviet ICBM force and its potential for crippling the United States' second strike capability. During the 1950s and early 1960s, NIEs anticipated a several-hundred strong deployed Soviet ICBM force – approximately 700 by mid-1963 according

[14] Michael Mandelbaum, *The Nuclear Future* (Ithaca and London: Cornell University Press, 1983), p.121.
[15] It is important to note that there were significant discrepancies in the forecasts of various U.S. agencies. The CIA's Directorate of Intelligence Estimates often provided numbers substantially different – usually lower – than those being suggested in the NIEs at the same point in time. There were also frequent cases of dissent with regard to the uptake of forecasts, including some from influential quarters within the Department of Defense and the State Department, among others. Any elaborate discussion of these internal dynamics however is beyond the scope of this paper.
For an account of the internal inconsistencies in U.S. estimates, see Garthoff, "Estimating Soviet Military Intentions and Capabilities," pp.140-41, 152-54.
[16] Ibid., p.138.
[17] Ibid., pp.139-41.
[18] Central Intelligence Agency, "Intelligence Forecasts of Soviet Intercontinental Attack Forces: An Evaluation of the Record," Directorate of Intelligence, April 1989, p. iv.
[19] Garthoff, "Estimating Soviet Military Intentions and Capabilities," p.148.

to the 1960 NIE.[20] A 1957 NIE predicted a deployed ICBM force of up to 500 by mid-1961, when the actual figure was only four.[21] The air force estimated 1,450 launchers between 1966 and 1971. In reality, the Soviet ICBM force had leveled off at 209 launchers between 1963 and 1965 and remained so until the end of the 1960s.[22] Moreover, during the 1960s, just when talk of an American advantage in relative capabilities was overshadowed by concern about the Soviet objective to attain parity, the potential use of Soviet ICBMs as preemptive tools came to the forefront.[23] Similarly, it was feared that more Soviet ICBMs would increase the targeting points for complete decimation of the Soviet missile force to between 300 and 575 by mid-1970, virtually assuring a Soviet second-strike capability.[24]

[20] National Intelligence Estimate 11-8-60, "Soviet Capabilities for Long-Range Attack Through Mid-1965," August 1, 1960, p.2.
[21] National Intelligence Estimate 11-10-57, "The Soviet ICBM Program," December 1957, cited in Garthoff, "Estimating Soviet Military Intentions and Capabilities," p.141.
[22] Garthoff, "Estimating Soviet Military Intentions and Capabilities," p.141.
[23] National Intelligence Estimate 11-8-64, "Soviet Capabilities for Strategic Attack," October 1964, p.4.
[24] Ibid.

Diagram 1: Soviet Force Modernization: Forecasts versus Reality, 1975-1985



Source: Gerald K. Haines and Robert E. Leggett, *CIA's Analysis of the Soviet Union, 1947-1991: A Documentary Collection* (Washington, D.C: Central Intelligence Agency, 2001), p.292.

Another major miscalculation in intelligence estimates was with regard to the Soviet ballistic missile defense (BMD) program. As many as 7,000 Soviet anti-ballistic missile (ABM) launchers were estimated in the late-1960s.[25] Earlier in 1965, the USSR was predicted to have defenses in 20-30 areas covering a quarter of its population with an anti-missile defense over Moscow operational zed by 1975.[26] In reality, Soviet air defenses remained extremely limited and only the Moscow system, which comprised of approximately 100 launchers, survived the 1974 superpower protocol banning all but a single ABM deployment area.[27]

Diffusion of the Bomb: The Developed World in Focus (1949-1964)

The overwhelming focus on the Soviet Union notwithstanding, the Nth country problem remained an important concern for the U.S. government from the 1950s onwards. Forecasts regarding Nth country proliferation can be neatly divided into two periods, the first from 1949 to 1964,[28] when the Chinese conducted their first nuclear test, and the second from 1965 until the Soviet collapse in 1991. Whereas commentaries in the earlier period were marked by concern about horizontal proliferation among the industrialized countries, the latter period saw the focus shift to the developing world.[29]

[25] These estimates became redundant after the ABM Treaty in SALT in 1972. Garthoff, "Estimating Soviet Military Intentions and Capabilities," p.150.
[26] National Intelligence Estimate 11-3-65, "Soviet Strategic Air and Missile Defenses," November 1965, p.2.
[27] Garthoff, "Estimating Soviet Military Intentions and Capabilities," p.150. U.S. intelligence estimates however managed to predict a Soviet anti-satellite capability correctly. In 1965, a NIE forecasted an operational capability within "the next few years"; The Soviet Union had indeed managed to induct its IS system in its inventory by 1972. National Intelligence Estimate 11-3-65, "Soviet Strategic Air and Missile Defenses," p.3.
[28] While some notable strategists did comment on Nth country proliferation prior to 1949 as well, these were largely general statements that envisioned the potential of a spread of nuclear weapons in the distant future. Perhaps the most perceptive of these voices was that of Bernard Brodie, the American strategists who hinted at the possibility of proliferation and its impact on the super power rivalry as early as 1946. In one of the seminal books on the subject, *The Absolute Weapon* he stated: "not only might their regular rivals on the same level [U.S. and U.S.S.R] be equipped……but possibly some of the nations lower down in the power scale might get hold of atomic weapons and alter the whole relationship of great and small states." Bernard Brodie, ed., *The Absolute Weapon* (New York: Harcourt, Brace and Company, 1946), p.5.
[29] The terms 'developed' and 'industrialized' are hereafter used interchangeably.

Overall, the forecasts during the first period remained pessimistic. An overwhelming majority of classified and academic studies suggested that horizontal proliferation was inevitable. The extreme pessimists seldom drew a distinction between a country's capability to develop a nuclear weapon and the desire or need to do so. Denis Healey, a British scholar who later became the country's Defense Minister, summed up this pessimist outlook: "so far no country has resisted the temptation to make its own atomic weapons once it has acquired the physical ability to do so".[30]

U.S. intelligence reports tracked the Nth power problem in detail regularly after 1957. The 1957 NIE suggested that Canada, France, and Sweden could produce nuclear weapons within a decade using completely indigenous resources. Canada however was thought to have the least inclination of the three to do so. West Germany and a combined European effort were mentioned as second-tier possibilities, where a weapons production capability could be developed towards the end of the 10-year horizon. Finally, Japan was tipped to initiate a weapons program within the next decade but pursue it at a leisurely pace.[31]

Other than Japan, all countries mentioned in the 1957 Estimate were repeated in a 1960 CIA forecast, shortly after France conducted its first nuclear test. This outlook provided a specific time horizon by which these countries could cross the nuclear threshold: Sweden (7-8 years), West Germany (6-8 years), and a joint European effort (3-6 years).[32] However, unlike the estimate three years before, the forecast concluded that no country would go nuclear in the short term. The list of second-tier Nth powers was expanded to include Italy, Norway, Switzerland, Netherlands, Canada, Australia, and Belgium. Again, while these countries were expected to have the capability to go nuclear, none was perceived as being interested in doing so.[33] The larger pool of Nth powers would have been a consequence of technological advancement in these countries, while

[30] Denis Healey, "Race Against the H-Bomb - Fabian tract 322," March 1960, p.3.
[31] National Intelligence Estimate 100-6-57, "Nuclear Weapons Production in Fourth Countries: Likelihood and Consequences," June 18, 1957, pp. 3-6.
[32] National Intelligence Estimate 100-4-60, "Likelihood and Consequences of the Development of Nuclear Capabilities by Additional Countries," September 20, 1960, p. 2.
[33] Ibid., p.6.

their lack of ambition could be attributed to the continuing trust in U.S. security guarantees under NATO.

Increased pessimism set in by 1963 when U.S. Secretary of Defense Robert McNamara communicated to President John F. Kennedy that at least eight new nuclear powers may emerge within a decade's time, and perhaps many more thereafter due to of a decline in the cost of nuclear weapons production "by a factor of 2 to 5."[34] The eight countries mentioned by McNamara were China, Sweden, India, Australia, Japan, South Africa, Germany and Israel. McNamara's memorandum was the first instance of a U.S. classified report listing developing countries as threshold states. The message was brought home to the American public during President Kennedy's oft-quoted press conference just a month later in which he predicted – somewhat liberally – that the world could see 15 to 25 new nuclear states by the 1970s.[35] While McNamara's memorandum highlighted the relative motivations of the named suspects, Kennedy's statement never hinted at such a distinction and thus heightened fears of accelerated proliferation among independent experts.[36] McNamara's forecast was repeated in a fresh intelligence estimate in the latter part of 1963.[37]

The greatest fluctuation in official forecasts during this period however was with regard to China. In the 1957 NIE, China was mentioned along with Japan in the lowest-tier of Nth states.[38] It was listed as a candidate for initiating a nuclear weapons program in over a decade's time but one that was unlikely to advance quickly due to technological

[34] Robert McNamara stated this in a memorandum to President Kennedy entitled "The Diffusion of Nuclear Weapons with and without a Test Ban Agreement," February 12, 1963, available at Digital National Security Archive, no. NP00941.
[35] The press conference was reported in *The New York Times* on March 23, 1963. Press Conference, March 21, 1963, *Public Papers of the Presidents of the United States: John F. Kennedy, 1963* (Washington, D.C.: U.S. Government Printing Office, 1964), p.280.
[36] McNamara put France and China's motivations at 'high', Israel and United Arab Republic's at 'moderate to high', and West Germany's at 'moderate'. All others were considered to either have 'low' or 'unclear' motivations.
[37] National Intelligence Estimate 4-63, "Likelihood and Consequences of a Proliferation of Nuclear Weapons Systems," June 28, 1963.
[38] National Intelligence Estimate 100-6-57, "Nuclear Weapons Production in Fourth Countries," p.4. This group included Belgium, India, Italy, Czechoslovakia, East Germany, Poland, Switzerland, Norway, and the Netherlands. However, all these powers were seen as theoretically able to attain a weapons capability within a decade, but not likely to do so. Israel and Australia (along with China) were considered to be even further away and believed to have required major foreign assistance even to acquire a single weapon in 10 years time.

constraints. The intelligence community believed that the USSR had only just begun to provide tangible assistance to China.[39] The 1960 NIE suggested that China was receiving Soviet aid and that it could detonate a nuclear device between 1962 and 1964.[40] In a 1960 presidential debate, John F. Kennedy did make a passing remark regarding China's potential to become a nuclear power along with 10-20 other nations.[41] In 1962, a NIE suggested that a Chinese nuclear test would be delayed by "as much as several years beyond 1963" owing to the slowdown of Soviet aid to China as well as the technical difficulties Beijing was believed to be facing at the time.[42] McNamara's 1963 estimate merely lumped China with the other seven countries that were likely to cross the threshold. However, it did suggest a high desire in China to acquire the weapon.[43] Notwithstanding, it was only the 1963 Special NIE that raised serious concerns, acknowledging that China had "a much more ambitious advanced weapons program than we had earlier thought possible".[44] The Estimate hinted at the possibility of a Chinese test within the year. Moreover, all intelligence forecasts had predicted that China would use a plutonium device for a nuclear test. Its uranium capability was believed to be lagging considerably.[45] In reality, to the surprise of the U.S. intelligence community, Beijing's 1964 test used highly-enriched uranium (HEU).[46]

The mood among the independent expert community was somewhat more pessimistic than in the classified intelligence reports of the 1954-1964 periods. The most systematic work on the future course of nuclear proliferation was conducted by the

[39] National Intelligence Estimate 100-6-57, "Nuclear Weapons Production in Fourth Countries," p.6.
[40] National Intelligence Estimate 100-4-60, "Likelihood and Consequences of the Development of Nuclear Capabilities by Additional Countries," pp.1-2.
[41] Kennedy made this remark in the third Presidential debate with Richard Nixon held on October 13, 1960. The text of the debate is available at http://www.debates.org/pages/trans60c.html (accessed on January 17, 2008).
[42] National Intelligence Estimate 13-2-62, "Chinese Communist Advanced Weapons Capabilities," April 25, 1962, pp.11-12.
[43] McNamara "The Diffusion of Nuclear Weapons with and without a Test Ban Agreement", cited in Peter R. Lavoy, "Predicting Nuclear Proliferation: A Declassified Documentary Record," *Strategic Insights*, Vol. III, Issue 1, January 2004, p.2, http://www.fas.org/man/eprint/lavoy.pdf (accessed on February 1, 2008).
[44] Special National Intelligence Estimate 13-2-63, "Chinese Communist Advanced Weapons Capabilities," July 24, 1963, quoted in Lavoy, "Predicting Nuclear Proliferation," p.2.
[45] In 1963, the CIA had predicted that HEU would be ready for use in 1966 at the earliest but 1968 or 1969 was suggested to be a more probable time frame. Special National Intelligence Estimate 13-2-63, "Chinese Communist Advanced Weapons Capabilities," pp.4-6.
[46] Torrey C. Froscher, "Anticipating Nuclear Proliferation: Insights from the Past," *Nonproliferation Review*, Vol.13, No.3, November 2006.

National Planning Association (NPA) in 1960. This gravely pessimistic study used a number of indices of technological and industrial capability to determine the likelihood of the acquisition of explosive devices by Nth countries.[47] They concluded that 12 countries – all but two being industrialized nations – could potentially produce 2-4 plutonium weapons in 5 years.[48] These countries were Belgium, Canada, China, Czechoslovakia, France, East Germany, West Germany, Japan, Sweden, India, Italy, and Switzerland. A second tier of countries was comprised of Australia, Austria, Denmark, Finland, Hungary, Poland, Netherlands, Poland and Yugoslavia, where economic resources and political will were present but technical manpower was lacking. Finally, Argentina, Brazil, Mexico, Norway, Spain and South Africa were considered to have the technical capacity for nuclear weapons but lack the economic resources to invest in a nuclear program. In a 1961 update, the NPA included delivery systems in their assessment framework. The updated report suggested that while no Nth country would be able to close the gap with the superpowers, all of them could possess rudimentary air delivery capabilities.[49] Therefore, a nuclear capability would automatically be operational zed upon the successful production of the bomb.

Relative optimists British scholars Leonard Beaton and John Maddox, while agreeing with the premise that a large number of countries were in a position to go nuclear, argued that Nth powers could be deterred by creating the right incentives. They pointed to the examples of India, Sweden, Israel, and Canada as weapon-capable states that had chosen not to take the nuclear route, a trend they predicted would persist.[50]

[47] W. Davidon, M. Kalkstein, and C. Hohenemser, *The Nth Country Problem and Arms Control* (Washington, D.C.: National Planning Association, 1960).
[48] Ibid., quoted in Christopher Hohenemser, "The Nth Country Problem Today" in Seymour Melman, ed., *Disarmament: Its Politics and Economics* (Boston: The American Academy of Arts and Sciences, 1962), p.239.
[49] Hohenemser, "The Nth Country Problem Today" pp.256-57, 260-62 and 272.
[50] Leonard Beaton and John Maddox, *The Spread of Nuclear Weapons* (New York: Frederick A. Praeger, 1962), pp.185-186.

Table 2: Beaton and Maddox's estimations of Nth states in 1962

	Capability to build bomb	**Mood in 1962**	**General Position**
Canada	1957	Non-nuclear	Hostile to national force
India	1963-65	Non-nuclear	Creating a nuclear option but sentiment hostile to nuclear force
China	1963-65	Nuclear	Unclear
Germany	1965	Nuclear	Seeking allied arrangement
Italy	1966	Non-nuclear	Allied arrangements only
Japan	1966	Non-nuclear	Hostile to nuclear weapons
Sweden	1969	Non-nuclear	Hostile to national force but in dispute
Israel	1968-71	Non-nuclear	Creating option
Switzerland	1970	Non-nuclear	Hostile to national force but in dispute
Australia	1971	Non-nuclear	Uncertain

Source: **Beaton and John Maddox, *The Spread of Nuclear Weapons*, p.189.**

Diffusion of the Bomb: The Developing World in Focus (1965-1991)

With China having conducted its first nuclear test in 1964, the focus of the proliferation debate shifted abruptly to the developing world in the mid-1960s. Unlike the period before 1964, the intelligence community seemed to be just as pessimistic about prospects for future proliferation as independent experts during this phase.

The 1966 NIE removed all developed countries from the list of first-tier suspect states. Instead, it suggested that only one country – India – was in a position to cross the threshold over the next several years, an estimate which proved to be correct.[51] The three other countries singled out in the 1966 Estimate were all developing nations: Pakistan, South Africa, and Egypt. All three were deemed to be some time away from acquiring a weapon and unable to do so without external assistance.[52]

The trend of focusing on developing countries continued throughout the next decade and was reinforced by India's "peaceful nuclear explosion" in 1974. A year later, the CIA predicted that ten other Nth powers had the potential and incentives to develop nuclear explosives.[53] These included Taiwan, South Korea, Pakistan, Argentina, Brazil, Libya, South Africa, Iran, Egypt, and Spain. Reflecting the pessimistic outlook prevalent at the time, it suggested that the future is "likely to be characterized not only by an increased number but also an increased diversity of nuclear actors. These will include nuclear superpowers, regional nuclear powers, nuclear abstainers, closet nuclear powers, nuclear explosives powers, and possibly, nuclear terrorists".[54] The pessimism was so extreme that the most realistic policy option suggested was merely to attempt to "delay and space out successive nuclear debuts".[55] At the same time, the report suggested that a sophisticated offensive or defensive delivery system would remain out of reach of all Nth powers for well over a decade. At most, Nth states were likely to attain rudimentary

[51] National Intelligence Estimate 4-66, "The Likelihood of Further Nuclear Proliferation," January 1966, cited in Lavoy, "Predicting Nuclear Proliferation," p.3.
[52] Ibid.
[53] Central Intelligence Agency, "Managing Nuclear Proliferation: The Politics of Limited Choice," Research Study, OPR 408, December 1975, p.9.
[54] Ibid., p.3.
[55] Ibid., p.34.

delivery capabilities. The superpowers would therefore be immune from any direct threat from Nth powers.[56]

By the 1980s, the developed world was seen to be in a stable equilibrium. On the developing country front however, the question of 'when' rather than 'if' countries were likely to go nuclear had become important. The list of suspect states however changed little from the previous decade.

Expert analyses converged with the intelligence community on the fact that proliferation was inevitable. Pessimists weighed in heavily on the debate. In fact, even some optimists seemed to have changed their mind. In the wake of the Chinese test, Leonard Beaton, who had produced the earlier-mentioned optimistic analysis with John Maddox just four years earlier, now posited what was perhaps the most pessimistic scenario throughout the Cold War.[57] While he mentioned the potential for arms control agreements to reverse his predicted course, Beaton suggested that eight new states could potentially join the nuclear club between 1975 and 1985. By 1995, the number of potential nuclear states would expand to 32 including a few industrialized countries.[58] Without explicitly saying so, Beaton was condoning the domino effect thesis for developing countries. Proponents of this view argued that the pace of proliferation in the developing world would be far quicker than among industrialized countries since diffusion would take place in action-reaction chains. The entire breadth of possible chains was summarized by Lewis Dunn and William Overholt in 1977: (i) India, Pakistan, Iran, Saudi Arabia, Iraq, Egypt, Syria, Libya, Israel, and even Brazil and Argentina; (ii) Taiwan, South Korea, and Japan; (iii) Libya, Egypt, Iraq, Syria, Israel, Saudi Arabia, Iran, and subsequently India and Pakistan; (iv) Argentina, Brazil, Chile, and

[56] The report concluded that most new nuclear weapons states would only remain at the nuclear explosives stage and only "a decreasing proportion of the Nth states will cross the successive thresholds beyond nuclear explosives, to weapons deliverable by aircraft, and then to nuclear-tipped missiles." Central Intelligence Agency, "Managing Nuclear Proliferation: The Politics of Limited Choice," Research Study, OPR 408, December 1975, pp. 3, 9, 28, 34.

[57] Beaton's analysis was the only one that included developed countries as potential Nth states during this stage. See Leonard Beaton, *Must the Bomb Spread?* (Middlesex: Penguin, 1966).

[58] Ibid., pp. 81-82. The states predicted to go nuclear between 1975 and 1985 were Canada, Germany, Sweden, Switzerland, Italy, United Arab Republic, Pakistan, and South Africa. The states predicted to join them by 1995 were the Netherlands, Greece, Belgium, Spain, Turkey, Poland, Czechoslovakia, East Germany, Australia, Yugoslavia, Indonesia, Mexico, Brazil, Austria, Finland, and Argentina.

subsequently, Venezuela; (v) Japan, Philippines, Indonesia, Australia, West Germany, Italy, and Spain.[59]

Just as was the case with the intelligence community, another major impetus to pessimistic arguments was provided by India's 1974 test. In 1977, Canadian scholar Ashok Kapur reflected the post-test sentiment by forecasting a continued trend towards proliferation, one that could accelerate in the 1980s owing to the potential deterioration of the global strategic environment. He pointed to Israel, India, Japan, Australia, South Africa, Brazil, South Korea, Taiwan, and Argentina as countries widely perceived as potential nuclear states.[60] Japan was singled out by a number of commentators as a certain entrant into the nuclear club barring a reinvigorated security guarantee from the United States. A somewhat softened Soviet stance towards a Japanese capability, given lingering Sino-Russian tensions, was predicted to pull Tokyo towards the nuclear threshold.[61]

The 1980s saw a shift towards regional (as opposed to state-by-state) projections. Again, implicit in the very idea of analyzing threshold regions rather than states was the recognition of the domino effect. By the early 1980s, projections were pointing to the high likelihood of Middle Eastern, South Asian, and South African weaponization.[62] Rather interestingly however, a comforting picture was now being presented regarding Latin America. Most analysts argued that Brazil and Argentina were likely to refrain from pursuing the weapons option.[63] Even more surprising was the reversal to relative optimism regarding North East Asia. The change in sentiment regarding Japan was remarkable as it moved from being tipped as an almost certain entrant into the nuclear

[59] Lewis A. Dunn and William H. Overholt, "The Next Phase in Nuclear Proliferation Research" in William H. Overholt, ed., *Asia's Nuclear Future* (Boulder: Westview Press, 1977), p.5.
[60] Ashok Kapur, "Nth Powers of the Future," *Annals of the American Academy of Political and Social Science*, Vol. 430, March, 1977, pp.84, 88-94.
[61] Saburo Kato, "Japan: Quest for Strategic Compatibility" in Robert M. Lawrence and Joel Larus, eds., *Nuclear Proliferation Phase II* (Lawrence: The University Press of Kansas, 1974), pp. 203-206.
[62] Lewis A. Dunn, *Controlling the Bomb: Nuclear Proliferation in the 1980s* (New Haven: Yale University Press, 1982), pp.44-56.
[63] While the possibility of these two countries revisiting the nuclear option was not completely ruled out, their shift away from actively pursuing nuclear status was widely acknowledged. See for example, Dunn, *Controlling the Bomb,* pp.59-60.

club to one that was likely to forgo nuclear weapons.[64] This was despite the fact that the superpower arms race was expected to keep Washington's attention away from the need to strengthen its security umbrellas.

Despite the inherently pessimistic outlook throughout the Cold War, virtually no one foresaw the possibility of any Nth power being able to match superpower might.[65] Neither of the two European nuclear weapon powers was expected to try and play 'catch up' with the United States and USSR. This also held true for the developing world. The inability of developing countries to match the superpowers was essentially attributed to their resource constraints. Christopher Hohenemser, an American physicist, had pointed to the prohibitive costs of developing long range delivery systems as early as 1962.[66] There was one notable exception: China. Michael Mandelbaum argued that if Beijing's relations with the superpowers continued to deteriorate, China could potentially have "several hundred intercontinental ballistic missiles and a submarine fleet of modest size and technical capability" by the end of the 1980s and a force as large as the superpowers by 2000.[67]

The Superpowers and Nth Country Proliferation

Estimates of Nth country proliferation were tightly linked to the roles of the United States and the USSR given their ability to provide robust security guarantees to allies and non-aligned countries. These security guarantees were considered crucial to reducing Nth power proliferation. During the 1950s and 1960s, there was an

[64] Ibid., pp. 64-66. While presenting plausible scenarios under which Japan may reconsider its options, Dunn acknowledges that the likelihood of such a development was low.
[65] Hedley Bull was among the few analysts who opposed this widespread sentiment at the time. Bull argued that Nth power proliferation would not allow the two superpowers to maintain their centrality indefinitely. The technological spread made 'catch up' merely a question of investing resources. He pointed to the growing dissatisfaction among the Nth powers about the hierarchical structure and presented weakening superpower control over the NPT as proof of their declining leverage. Hedley Bull, "Future Conditions of Strategic Deterrence" in Christoph Bertram, ed., The Future of Strategic Deterrence (London: International Institute for Strategic Studies 1980), pp. 20-21.
[66] Hohenemser, "The Nth Country Problem Today," pp. 255-260.
[67] Michael Mandelbaum, "International Stability and Nuclear Order: The First Nuclear Regime" in David C. Gompert, Michael Mandelbaum, Richard L. Garwin and John H. Barton, eds., *Nuclear Weapons and World Politics: Alternatives for the Future* (New York: McGraw-Hill Book Company, 1977), p.63.

overwhelming consensus that European nuclearization could be delayed, if not forestalled completely, by extending U.S. nuclear weapons to Europe in bilateral or common pool arrangements.[68] The 1960 NIE argued that European countries suspected to have the capabilities, and an interest in producing nuclear weapons, would resist the temptation as long as U.S. security guarantees remained credible. Most European countries (especially West Germany) – as well as Canada, Australia, and Japan – were believed to prefer U.S. cooperation to independent weapons programs.[69] It was also anticipated that the Soviet Union, driven by its interest in maintaining a nuclear monopoly in Eastern Europe, would continue extending strong security guarantees to its communist bloc allies. It was not until the 1980s, when Soviet economic weakness gradually brought into question the credibility of its security umbrella, that countries like Yugoslavia began regularly showing up on lists of threshold states.[70]

During the 1970s and the early-1980s, when fears of Soviet supremacy in the nuclear arena were high, the U.S. was expected to be inhibited in its ability to extend credible guarantees to its allies. It was believed that Nth powers would consider the U.S. to be overstretched and thus lose confidence in Washington's pledges to come to their defense. Moreover, some argued that American preoccupation with an increasingly belligerent USSR would divert the United States' attention from Nth country proliferation, thus providing Nth powers with a window of opportunity to initiate independent programs.[71] The northeast Asian countries – Japan, South Korea, and Taiwan – were considered to be the principal candidates to go nuclear.[72] Even beyond northeast Asia, in 1974, Australian political scientist T. B. Millar highlighted the

[68] See for example, Hedley Bull, *The Control of the Arms Race: Disarmament and Arms Control in the Missile Age* (New York: Fredrick A. Praeger Publishers, 1961), pp. 153-154.
[69] National Intelligence Estimate 100-4-60, "Likelihood and Consequences of the Development of Nuclear Capabilities by Additional Countries," pp.1-2, 7-9. Fears were raised in the late 1950s to early 1960s when U.S. officials hinted at their reluctance to defend allies with nuclear weapons. In 1959, U.S. Under Secretary of Defense Christian Herter stated that a decision for nuclear war was inconceivable "unless the facts showed clearly we are in danger of all-out devastation ourselves" (quoted in Beaton and Maddox, *The Spread of Nuclear Weapons*, p.199). In the same vein, two years later, President Kennedy, stated: "our objective now is to increase our ability to confine our response to non-nuclear weapons." (President Kennedy's message to Congress on Defense Budget, March 28, 1961).
[70] Dunn, *Controlling the Bomb*, pp.61-63.
[71] Nacht, "The Future Unlike the Past," pp. 204, 209-10.
[72] William H. Overholt, "Nuclear Proliferation in Eastern Asia" in William H. Overholt, ed., *Asia's Nuclear Future* (Boulder: Westview Press, 1977), pp. 139-157.

importance of U.S. obligations with regard to Australia's security under the Australia, New Zealand, and United States (ANZUS) treaty.[73]

An obvious paradox in this dialogue was created by another relevant contention. Throughout the last two decades of the Cold War, forecasts suggested that superpower involvement in Nth country crises would raise the likelihood of a direct U.S.-USSR confrontation that could quickly escalate to the nuclear level.[74] While this issue was debated even in the early years of the Cold War, before the pessimism associated with the superpower arms race set in during the 1970s, a significant number of strategic experts argued that superpower involvement would prevent crises from expanding into a general war. Later on, however, forecasts predicted that the pace of regional conflicts was likely to be swift, thus increasing the possibility of a crisis spiraling out of control and escalating to a general war. Some even argued that the superpowers would be under threat of direct attack, most likely inadvertent or conducted on advancing superpower forces as a last resort.[75]

The Effects of Proliferation

Projections about the impact of proliferation on global peace underwent a marked change between the pre-1964 and post-1964 periods.[76] Initially, the acquisition of weapons by industrialized countries was not perceived as substantially destabilizing. Virtually no analytical study pointed to an increased probability of crises or a general war featuring nuclear weapons induced by developed country proliferation. For instance, despite its concerns regarding West German nuclearization, the Soviet Union was anticipated to stay short of initiating a military attack. Instead, the only impact of

[73] T.B. Millar, "Australia: Recent Ratification" in Robert M. Lawrence and Joel Larus, eds., *Nuclear Proliferation Phase II* (Lawrence: The University Press of Kansas, 1974), pp.83-84. The ANZUS treaty came into force in 1952 and was essentially a collective security arrangement whereby an attack of any of the three member countries was to be considered an attack upon all of them. The U.S. abrogated its ANZUS commitments in 1985.
[74] Dunn, *Controlling the Bomb*, pp.85-87.
[75] Ibid., pp.81-85.
[76] In this section, the use of the terms optimism and pessimism conforms to their conventional uses in proliferation literature. Proliferation 'optimists' are those who view proliferation as stability-inducing while proliferation 'pessimists' argue that the spread of nuclear weapons would lead to instability. The terminology was first used by Peter Feaver, "Proliferation Optimism and Theories of Nuclear Operations," in Zachary S. Davis and Benjamin Frankel, eds., *The Proliferation Puzzle: Why Nuclear Weapons Spread (and What Results), Security Studies (special issue)*, Vol.2, No.3/4 (Spring/Summer 1993), pp.159-191.

European proliferation was expected to be political. U.S. intelligence estimates repeatedly warned that Moscow would attempt to intensify any intra-NATO drifts that might appear due to the emergence of new nuclear powers in Europe.[77]

The sentiment was far more pessimistic with regard to the developing world, but not without notable exceptions. Michael Mandelbaum, earlier mentioned as someone who remained relatively comfortable about the ability of the superpowers to deter each other, was less optimistic regarding the capacity of developing countries to do so. He stressed that developing country proliferation would increase the likelihood of the use of nuclear weapons in conflicts.[78] Ted Greenwood, an American academic who later advised the U.S. Department of Defense, pointed to the active border disputes of Nth states such as South Africa, Israel, and Taiwan to suggest an increased likelihood of nuclear war.[79] Mentions of the possibility of weapons falling into the hands of irresponsible powers – the 'mad ruler' scenario – were frequent. As French scholar, Thierry de Montbrial pointed out: "there are many politically unstable countries whose leaders are not predictable…and would not hesitate to use an atomic weapon, if they had one."[80] Hinting at the same concern, the renowned French sociologist Raymond Aron argued that acquisition of nuclear weapons by developing countries could even result in a superpower conflict in the Cold War context due to a deliberate or inadvertent action of a 'small state'.[81]

Moreover, in contrast to the relative stability within the borders of developed countries, Dunn and Overholt pointed to frequent military coups in countries like Argentina, Chile, Brazil, Greece, Indonesia, Iraq, Libya, Nigeria, Pakistan, South Korea, Syria, Turkey, Venezuela, and Zaire to emphasize the possibility of militaristic leaders

[77] See for example, National Intelligence Estimate 100-6-57, "Nuclear Weapons Production in Fourth Countries," pp. 9-10.
[78] Michael Mandelbaum, "International Stability and Nuclear Order," p.72.
[79] Ted Greenwood, "Nuclear Weapons and National Purposes" in Ted Greenwood, Harold A. Feiveson, and Theodore B. Taylor, eds., *Nuclear Proliferation: Motivations, Capabilities, and Strategies for Control* (New York: McGraw-Hill, 1977), p.28.
[80] Thierry de Montbrial, "Perceptions of the Strategic Balance and Third-World Conflicts" in Christoph Bertram, ed., *The Future of Strategic Deterrence* (London: International Institute for Strategic Studies 1980), p.94.
[81] Raymond Aaron, *Peace and War*, translation by Richard Howard and Annette Baker Fox (Garden City: Doubleday and Company, 1966), p.639.

wresting power and utilizing nuclear weapons as a means of coercing adversaries.[82] A number of commentators anticipated that Nth powers would seek to create a first strike capability to preempt traditional rivals. Counterforce targeting strategies were considered likely, but also inherently destabilizing, especially for contiguous countries where warning times were diminished. Technical deficiencies in ensuring robust command and control and the security of the arsenal were taken for granted and used to further heighten fears of accidental or unauthorized use.[83]

Finally, although peripheral, pessimists also raised the possibility of nuclear terrorism. While projections on this count did not tie the danger exclusively to developing country proliferation, the mere fact that such concerns only began to surface after attention had shifted to developing countries suggests a correlation between the two.[84] Overall, the threat of nuclear terrorism was downplayed. The CIA's first systematic analysis on the issue in 1975 presented a mixed picture. It argued that while the growing ease with which nuclear materials and technology was likely to be available in the future would benefit terrorist groups, technical barriers to the acquisition would remain high. Moreover, the Agency contended that any organization able to acquire a nuclear capability would have to be highly organized and have an institutionalized set up. These were considered to be organizations that were wary of backlashes in public opinion, and were thus only likely to use nuclear weapons as bargaining chips.[85] Views in scholarly work were similar. In a RAND Corporation analysis, Brian Jenkins argued that while future possibilities for nuclear terrorism may increase, the threat ought not to be exaggerated as extreme nuclear actions remained unlikely.[86] American Nobel laureate Thomas Schelling took much the same line by presenting the threat of terrorism as

[82] Dunn and Overholt, "The Next Phase in Nuclear Proliferation Research," p.5. Also see Dunn, *Controlling the Bomb,* pp.91-92.
[83] For a pessimistic take on this count and an overview of the kind of problems developing countries are likely to face in managing their nuclear arsenal, see Dunn, *Controlling the Bomb,* pp.69-78.
[84] The U.S. government only began to research the area of nuclear terrorism in 1973. Brian M. Jenkins, "Will Terrorists Go Nuclear?" Seminar on Arms Control and Foreign Policy, *RAND Corporation*, Paper No.64, 1975, p.1.
[85] Central Intelligence Agency, "Managing Nuclear Proliferation," pp.29-38.
[86] Jenkins, "Will Terrorists Go Nuclear?", p.8.

futuristic.[87] However, Schelling was the only commentator to have contemplated the possibility of deliberate leakage of nuclear material from a government or even a sub-national actor to terrorist groups. He pointed to the potential of nuclear material being misused by militaries in charge of the programs or deposed heads of state.[88]

In contrast to the widely prevalent pessimistic viewpoint, the relative optimists, while supporting the need to curb proliferation, anticipated few lasting implications of developing country proliferation on strategic stability. The 1975 CIA study argued that proliferation related instability would be most destabilizing in the transitional stage when number of countries would attempt to cross the nuclear threshold one after another.[89] However, it envisioned the long-term political consequences of the expansion of the nuclear club as relatively more stable. Others suggested that while instability may occur among antagonistic Nth countries, the overall global order would not be affected.[90] Moreover, optimists contended that a larger nuclear club would decrease the prestige and political leverage attached to nuclear weapons, in turn acting as a self-deterrent for potential threshold states.[91] There were even those who predicted marginally beneficial results in terms of successful deterrence and regional balance of power.

The Future of Arms Control and Disarmament

The arms control and disarmament dialogue was perhaps the only aspect of proliferation that followed a linear progression. Starting from a rather optimistic mood in the 1950s, the outlook towards disarmament became increasingly somber. Any realistic prospects for disarmament were practically written off by the 1980s. Moreover, the

[87] See Thomas C. Schelling, "Thinking About Nuclear Terrorism," *International Security*, Vol.6, No.4 (Spring 1982), pp. 61-77. While Schelling received a Nobel prize in economics, he wrote extensively on nuclear weapons and bargaining in crises as well.
[88] Schelling illustrates his concern about Heads of States siphoning off nuclear material or technology by using a hypothetical example involving the Shah of Iran fleeing with soft or hard components of the nuclear program. The scenario was highly far-fetched. Ibid., pp. 62-66.
[89] Central Intelligence Agency, "Managing Nuclear Proliferation," p.21.
[90] de Montbrial, "Perceptions of the Strategic Balance and Third-World Conflicts," p.95.
[91] This was a theme that had continued to feature intermittently from the 1960s onwards. Beaton and Maddox were among the first to argue along these lines. Beaton and Maddox, *The Spread of Nuclear Weapons*, pp. 198-199.

disarmament dialogue was also the only aspect where intelligence forecasts and independent views mirrored each other for the most part.

Apart from one exceptional report from the U.S. Department of State as early as 1946, the early years of the Cold War were marked by a sentiment that portrayed the arms control agenda as attainable.[92] The 1957 NIE suggested that even a first-step global disarmament agreement could temporarily deter Nth power proliferation. Over the long run however, the Estimate argued, success would be dependent upon the continued reduction in superpower stockpiles and progress towards effective controls.[93] The 1960 NIE which forecasted a strong possibility of Nth power proliferation also suggested that the spread of nuclear weapons and its associated dangers may "increase the pressures throughout the world for a test ban, disarmament, and nuclear free zones".[94]

Despite the Kennedy administration's emphasis on arms control in the early 1960s and the signing of the Partial Test Ban Treaty (PTBT) in 1963, forecasts during the 1960s were more cautious.[95] The 1966 intelligence estimate projected that competition between the superpowers would bring them to a point where they "may not be prepared to give nonproliferation priority over other policy objectives".[96] However, the Estimate still remained optimistic about the potential for international safeguards to detect any clandestine activity concerning the use of peaceful programs for military purposes.[97] It was only after India's 1974 test – which coincided with the decline of the 'world nuclear disarmament movement'[98] – that pessimism set in on this count.[99] By the late-1970s,

[92] The report we refer to shed pessimism regarding the potential for international policing measures to protect rivalries and mutual suspicions among states regarding their possession of nuclear weapons. It stated, "rivalries are inevitable and fears are engendered that place so great a pressure upon a system of international enforcement by police methods that no degree of ingenuity or technical competence could possibly hope to cope with them." U.S. Department of State, "A Report on the International Control of Atomic Energy," Publication No. 2498, Washington, D.C., March 16, 1946.
[93] NIE 100-6-57, "Nuclear Weapons Production in Fourth Countries," p. 7-8.
[94] National Intelligence Estimate 100-4-60, "Likelihood and Consequences of the Development of Nuclear Capabilities by Additional Countries," pp.2-3.
[95] The PTBT banned nuclear tests in the atmosphere, outer space and under water.
[96] National Intelligence Estimate 4-66, "The Likelihood of Further Nuclear Proliferation," p. 7.
[97] National Intelligence Estimate 4-66, "The Likelihood of Further Nuclear Proliferation", cited in Lavoy, "Predicting Nuclear Proliferation," p.5.
[98] For a history of the world nuclear disarmament movement, see Lawrence S. Wittner, *Resisting the Bomb: A History of the World Nuclear Disarmament Movement 1954-1970* (Stanford: Stanford University Press, 1997).
[99] Lavoy, "Predicting Nuclear Proliferation," p. 4.

U.S. President Eisenhower's 'Atoms for Peace' vision of the 1950s had waned, and civilian nuclear energy was increasingly being looked upon as a convenient means to attain a nuclear weapons capability.[100] Referring to the more widespread acquisition of civilian nuclear energy at the time, a 1975 CIA study stated: "nuclear exporters' efforts to introduce mutual restraints which would make their products less susceptible to being used as a short-cut to nuclear explosions have been paltry. LDC [Least Developed Countries] consumers have successfully…opposed any regulatory efforts by suppliers".[101] Indeed, by the 1980s, safeguard measures were considered largely ineffective.[102]

An important addition to this debate was the emphasis independent commentaries laid on the improbability of successful arms control under a discriminatory global regime. As early as 1961, the influential Australian scholar Hedley Bull raised concerns about the growing divide between the 'have's' and 'have not's', arguing that Nth powers were unlikely to accept any arms control arrangement that seemed to perpetuate this divide.[103] By the mid-1960s, the realization that disarmament negotiations had little chance of success in the absence of sincere non-proliferation efforts by the two superpowers had become commonplace. In the 1970s, the growing power disparity between the global North and South and the reluctance of the superpowers to check their own nuclear expansions was predicted to make the arms control agenda irrelevant. Commentators were increasingly pointing to the looming danger of explosive proliferation barring an active superpower role in disarmament.[104] During the early-1980s, even though the superpowers' arms control efforts remained active in principle, forecasts suggested that

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The only exception to this trend was a

[100] Eisenhower promoted the idea of diverting nuclear technology for peaceful uses to support economic development. The text of his 'Atoms for Peace' speech on peaceful uses of atomic energy before the U.N. General Assembly on December 8, 1953 is available at http://www.atomicarchive.com/Docs/Deterrence/Atomsforpeace.shtml (accessed on January 4, 2008).

[101] Central Intelligence Agency, "Managing Nuclear Proliferation," pp. 11-12.

[102] Lavoy, "Predicting Nuclear Proliferation," p. 5.

[103] Bull, *The Control*, p. 155.

[104] Frederick C. Thayer, "Proliferation and the Future: Destruction or Transformation?" *Annals of the American Academy of Political and Social Science*, Vol. 430, March 1977, pp. 145-146.

the South would use superpower competition as an excuse to point to the hypocrisy of the nuclear weapon states (NWS) with regard to their pledge to disarm. [105]

Finally, the 1980s added yet another, counter-productive dimension to the debate. Influential voices now argued that arms control was undermining efforts for strategic stability between the United States and the USSR.[106] Hawks were concerned that arms control treaties would lead to complacency and, consequently, that there would be a lack of attention to legitimate defense needs on the part of the United States. For example, Nacht contended that a loss of strategic parity in the face of growing Soviet capabilities would undermine stability.[107] Some even went so far as to suggest that one could only expect the USSR to discuss a ban on warhead production, or negotiate an agreement on the level of deployment of intermediate-range and other strategic nuclear weapons, if rough parity prevailed between the two sides. Even those like Mandelbaum who believed that "modest negotiated agreements between the two superpowers will be part of the nuclear future" only based this estimate on the presupposition that both sides would maintain credible deterrents by responding to each other's force modernizations.[108] In essence, the discussion had decisively shifted from disarmament to risk reduction. The National Academy of Science's Committee on International Security and Arms Control (CISAC) summed up the sentiment at the time: "it is difficult to foresee the total elimination of nuclear weapons from this earth without drastic changes in the international order…[M]utual deterrence will be a fact of life for the foreseeable future but that a great deal can be done to decrease both the burdens and dangers of nuclear armament and nuclear war".[109] By itself, this shows how irrelevant the original

[105] Nacht, "The Future Unlike the Past," p. 205.
[106] Ibid., p. 212. Perhaps it was this sentiment that led the Reagan administration to discontinue negotiations on a Comprehensive Test Ban Treaty, refuse a Soviet Proposal on arms cuts, initiate SDI, witness a breakdown of START negotiations, and reject a nuclear testing moratorium. It was only after 1986 that the momentum reversed and the two sides began to conclude arms control agreements once again. For details of U.S.-U.S.S.R. relations during the 1980s, see "United States Relations with Russia: The Cold War," Office of the Historian, *U.S. Department of State*, http://www.state.gov/r/pa/ho/pubs/fs/85895.htm#reductions_refused (accessed on June 2, 2008).
[107] Nacht, "The Future Unlike the Past," p. 204.
[108] Mandelbaum predicted the perpetuation of the superpower arms race into the 21st century. Mandelbaum, *The Nuclear Future*, pp. 41, 74.
[109] Committee on International Security and Arms Control, National Academy of Sciences, *Reykjavik and Beyond: Deep Reductions in Strategic Nuclear Arsenals and Future Direction of Arms Control* (Washington, D.C.: National Academy of Sciences, 1988), p. 3.

disarmament agenda had become, premised as it had been on the eventual elimination of nuclear forces.

The Post-Cold War Era[110]

With the end of the Cold War, the outlook on the nuclear future shifted dramatically. The five nuclear weapons states (NWS) and Nth power proliferation continued to be important, but the role of the United States, and the nature of the arms control and disarmament movement altered radically. The principal objective of U.S. nuclear weapons shifted from deterring the Soviet Union to new, uncertain threats emanating from the developing world. Arms control and disarmament also began to be seen largely in light of the threats emanating from the developing world, both from states as well as from non-state actors.

Discussion on nuclear weapons was most divisive in the years immediately following the collapse of the Soviet Union. Future projections reflected a sense of extreme uncertainty. While some predicted the declining relevance of nuclear weapons, others argued that nuclear forces would become even more important. Still others saw an accentuation of the North-South dichotomy. They argued that while the salience of nuclear weapons was likely to decline in terms of their role in determining the global hierarchy of states among developed countries, their impact in the developing world would be highly destabilizing and would make nuclear war more likely.[111]

The United States

The bulk of the literature during the early 1990s focused on the role of U.S. nuclear forces in the post-Cold War era. Immediately after the Cold War, Russia was predicted to remain a strong power, albeit one that would not seek a confrontational stance against the

[110] Since most classified U.S. estimates for the post-Cold War period have not been released, the discussion in this section is based primarily on independent expert commentaries.
[111] John Van Oudenaren, "Nuclear Weapons in the 1990s and Beyond" in Patrick J. Garrity and Steven A. Maaranen, eds., *Nuclear Weapons in the Changing World: Perspectives from Europe, Asia, and North America* (New York: Plenum Press, 1992), p.34, 51.

United States. Richard Wagner, a U.S. nuclear expert with a long career in government, suggested that Russia was expected to remain the "major driver of U.S. defense budgets, postures, and programs, at least over the next several years".[112] Others, however, saw a greater danger of an unauthorized strike on the United States as well as potential for nuclear proliferation to other actors induced by Russia's weakened command and control structure.[113]

That said, within a year of the Soviet collapse, the Russian threat was downplayed and there were predictions that concerns about Moscow would continue to decline.[114] Moscow was believed to be comfortable with vying for respect in a unipolar order without challenging the United States. Russia's primary objective from the mid-1990s onwards was perceived to be to secure arms control arrangements that would allow it to retain a substantial edge over the medium nuclear powers despite its declining nuclear weapons inventory.[115] Russia is expected to have fewer than 2,000 strategic weapons by 2015.[116]

Apart from Russia, U.S. relations with the Nth powers remained at the forefront of nuclear literature. Throughout the post-Cold War period, American experts argued that the United States could not afford to disarm due to the uncertainty of future threats. Despite small, relatively rudimentary arsenals, Nth powers were expected to increasingly complicate deterrence policy for a number of reasons: the multiplicity of potential

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[112] Richard L. Wagner Jr., "Future Nuclear Weapon Roles and Postures in the Context of an Overall Security Strategy of Dissuasion," paper presented at the Lawrence Livermore National Laboratory workshop on The Role of Nuclear Weapons in the Year 2000, October 22-24, 1990, p.2. Some argue even today that Russia's high-alert nuclear forces constitute the biggest threat to the United States. However, there is much less focus on Russia in recent U.S. proliferation literature. See Greg Giles, Candice Cohen, Christy Razzano and Sara Whitaker, "Future Global Nuclear Threats," report prepared for the Advanced Systems and Concepts Office, *Defense Threat Reduction Agency*, June 4, 2001, p. 10.

[113] Committee on International Security and Arms Control, National Academy of Sciences, *The Future of U.S. Nuclear Weapons Policy* (Washington, D.C.: National Academy Press, 1997), p.18.

[114] Committee on International Security and Arms Control, National Academy of Sciences, *The Future of the U.S.-Soviet Nuclear Relationship* (Washington, D.C.: National Academy Press, 1991), pp. 1-2.

[115] Oudenaren, "Nuclear Weapons in the 1990s and Beyond," p. 43.

[116] National Intelligence Council, "Annual Report to Congress on the Safety and Security of Russian Nuclear Facilities and Military Forces," February 22, 2002. Text of the report is available at http://www.cia.gov/nic/pubs/other_products/icarussiansecurity.htm. At an all-time high in 1985, Soviet stockpiled warheads neared 45,000. At the end of the Cold War, the figure for in tact warheads stood just below 30,000. Joseph Cirincione, *Bomb Scare: The History and Future of Nuclear Weapons* (New York: Columbia University Press, 2007), p. 43.

aggressors, the absence of any clear 'rules of the game', and the potential ramifications of a nuclear threat.[117] Maintaining a nuclear capability was thus considered essential from the United States' vantage point. Defending the U.S. nuclear capability, American scholars Patrick Garrity and Steven Maaranen argued in 1992 that the "most important role [of nuclear weapons] will be to offer reassurance, a hedge against unexpected and dangerous developments".[118] Even those like CISAC who advocated eventual disarmament acknowledged that Washington's nuclear arsenal was desirable, and perhaps even stabilizing.[119]

However, commentators by and large forecasted a much smaller American nuclear arsenal in the absence of a Soviet threat, albeit one that would be stronger than that required to maintain a minimum deterrent level. In fact, towards the end of the 1990s, forecasts suggested that the U.S. would opt for smaller, more accurate micro-nuclear weapons to cater to the 'new' kind of threats emanating from the developing world,[120] even as predictions suggested that the U.S. would comply with strategic warhead reduction commitments under the Strategic Arms Reduction Treaty (START).[121] This view continued to gain prominence until it was officially backed by the George W. Bush administration.

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[117] Glenn Buchan, Glenn Buchan, David M. Matonick, Calvin Shipbaugh, and Richard Mesic, *Future Roles of U.S. Nuclear Forces: Implications for U.S. Strategy*, RAND, Project Air Force, 2003, pp. xv-xix.

[118] Patrick J. Garrity and Steven A. Maaranen, "Introduction" in Patrick J. Garrity and Steven A. Maaranen, eds., *Nuclear Weapons in the Changing World: Perspectives from Europe, Asia, and North America* (New York: Plenum Press, 1992), p. 14.

[119] Committee on International Security and Arms Control, National Academy of Sciences, *The Future of U.S. Nuclear Weapons Policy*, p.4.

[120] Jim Walsh, "The Future Role of United States' Nuclear Weapons," report on a conference held at the Massachusetts Institute of Technology, February 2-3, 1994, working paper 94-2, p. 1.

[121] START is an agreement between U.S. and U.S.S.R/Russia to scale down their nuclear weapons stockpiles to stipulated levels under fixed timeframes. There are two START arrangements. The first was signed in 1991 and the second in 1993. However, the enforcements of both were delayed considerably. In the wake of Washington's 2002 announcement of abrogation of the Anti-Ballistic Missile Treaty, Russia has stated that it will not adhere to START II. In fact, the Treaty was officially bypassed by a new agreement between the two sides, the Strategic Offensive Reductions Treaty (SORT) or The Moscow Treaty, in 2002. For details of the stipulations under these treaties including the text of the agreements, visit the *Arms Control Association's* website at http://www.armscontrol.org/treaties/. Nonetheless, the Bush administration is expected to continue with its warhead reduction plan which would ultimately bring down the number of weapons to approximately 5,000 warheads from about 24,000 during the 1980s. The National Resources Defense Council estimates that the U.S. will have 5,470 warheads by 2012. However, according to the Department of Energy (DOE), dismantlement of retired warheads would not be completed until 2023. For a breakdown of the projected U.S. warhead inventory in 2012, see National Resources Defense Council, "The U.S. Nuclear Stockpile, Today and Tomorrow," *Bulletin of Atomic Scientists*,

The other major aspect of the United States' nuclear posture was BMD capability. In the late 1990s, Senate majority leader Trent Lott argued that "effective missile defenses, not unenforceable arms control treaties will break the offensive arms race in Asia and provide incentives to address security concerns without a nuclear response".[122] Post-2000, the idea of pursuing a more robust missile defense posture also received official sanction from Washington. There is now a debate between those who argue that the United States is likely to settle for basic defenses coupled with strong conventional pre-emptive capabilities to tackle developing country threats, and those who foresee the United States opting for a full-fledged BMD system.

The Middle Powers

As during the Cold War, the debate on the future of the two European nuclear powers remained peripheral to the broader nuclear debate. While no one suspected an aggressive upgradation program from either France or Britain, both were seen as likely to continue modest improvements after having reduced their arsenals immediately following the end of the Cold War. In 1994, American scholar Robert Norris and others projected in the *Nuclear Weapons Databook* that the British nuclear warheads inventory would increase from 200 to 365 by 2000.[123] France, spurred by reinforcing domestic sentiments, was predicted to pursue a somewhat more aggressive course within the limits of its *force de frappe* doctrine.[124] *The Nuclear Weapons Databook* predicted a French weapons stockpile of 465 warheads in 2000.[125] French analyst Bruno Tertrais has recently projected that France is likely to continue a modernization program that would allow for a force necessary to deter any Russian and Nth country threats well into the 2030s. Apart from retaining an independent deterrent, his long-run scenarios include the possibility of

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Vol.63, No.5 (September/October 2007), p. 61. The DOE estimate is contained in Department of Energy, "Complex 2030: An Infrastructure Planning Scenario for a Nuclear Weapons Complex Able to Meet the Threats of the 21st Century", NNSA, DOE/NA-0013, October 23, 2006, p. 8.

[122] Quoted in Joseph Cirincione, "The Asian Nuclear Reaction Chain," *Foreign Policy*, Carnegie Endowment for International Peace, Spring 2000, p. 12.

[123] Robert S. Norris, Andrew S. Burrows, Richard W. Fieldhouse, *British, French, and Chinese Nuclear Weapons, The Nuclear Weapons Databook, Vol. 5* (Boulder, Westview Press, 1994), p. 8.

[124] Bruno Tertrais argues that the public sentiment in France is highly supportive of retaining a strong independent deterrent. Bruno Tertrais, "The Last to Disarm? The Future of France's Nuclear Weapons," *Nonproliferation Review*, Vol.14, No.2, July 2007, pp. 260-262.

[125] Norris, Burrows, and Fieldhouse, *British, French, and Chinese Nuclear Weapons*, p. 8.

a French-British joint program as well as the somewhat improbable option of the Europeanization of France's nuclear program.[126] Much earlier, Sir Michael Quinlan, a highly influential British Civil Servant, had also anticipated a possibility for doctrinal and operational collaboration between Britain and France over the long term.[127] That said, both France and Britain have stayed shy of the projections and have recently suggested the possibility of further cuts. Britain has been contemplating a cut in the warhead inventory by 20 percent while the French Premier, Nicholas Sarkozy has recently stated that France may cut its strategic nuclear warhead inventory to fewer than 300.[128]

By far the most prominent debate on established nuclear powers since 1991 has focused on China, which is widely tipped to replace Russia as the principal long-term U.S. rival. China's nuclear future has remained shrouded in mystery throughout the post-Cold War period. While American skeptics continue to predict that an accelerated modernization program by China will soon establish it as a global power, others have argued that it is likely to pursue a modest agenda focused on qualitative upgrades. Those supporting the former view foresee a bolstered Chinese nuclear capability consisting of robust strategic offensive forces as well as missile defenses and an ambitious space program. Some projected a potential for China to develop 3,000-5,000 warheads by 2010.[129] Similarly, a classified U.S. report forecasted Chinese "aggressive deployment of upwards of 1,000 thermonuclear warheads on ICBMs by 2015".[130] American academics Jacquelyn Davis and Michael Sweeney even suggested that China may attain parity with the declining U.S. arsenal by 2025.[131]

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[126] See Tertrais, "The Last to Disarm?" pp.251-273.
[127] Michael Quinlan, "The Future of Nuclear Weapons: Policy for Western Possessors," *International Affairs*, Vol.69, No.3, July 1993, p.495.
[128] France and Britain are currently believed to have 348 and 165 warheads respectively. "UK Nuclear Weapons Plan Unveiled," *BBC*, December 4, 2006, http://news.bbc.co.uk/2/hi/uk_news/politics/6205174.stm (accessed on June 18, 2008); "Sarkozy says France will Cut Nuclear Arsenal," *International Herald Tribune*, March 21, 2008, http://www.iht.com/articles/ap/2008/03/21/europe/EU-GEN-France-Nuclear.php (accessed on June 18, 2008).
[129] Giles et al., "Future Global Nuclear Threats," p.6.
[130] House Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China (Cox Committee), May 25, 1999.
[131] Jacquelyn Davis and Michael J. Sweeney, "Strategic Paradigms 2025: US Security Planning for a New Era," *Institute for Policy Analysis, Inc*, Cambridge, 1999.

Representing a more optimistic outlook, a 1999 National Intelligence Council (NIC) estimate predicted that China would only have "*tens* of missiles capable of targeting the United States" (emphasis added) by 2015.[132] Earlier, *The Nuclear Weapons Databook* of 1994 had predicted that China would maintain a small SSBN force but that it would continue to rely on land-based missiles as the principal means of delivery. It also predicted that the Chinese warhead inventory would remain unchanged at approximately 450 at the turn of the century.[133]

The key variable underpinning China's choices however was believed to be its threat perception vis-à-vis the United States. For example, a major concern over the past two years has been American interest in deploying a BMD system. The Chinese are believed to see a U.S. BMD as a move to nullify China's second strike capability. They are thus projected to upgrade their own capabilities and incorporate penetrating aids to pierce the defense shield in response.[134]

Nth Country Proliferation

By the mid-1990s, the 'new' threat emanating out of the developing world had taken center stage, led by two interrelated concerns: the diffusion of nuclear weapons to new countries, and the potential for nuclear terrorism.

Carrying over from the Cold War, horizontal proliferation was still considered inevitable. The geographical expanse and even the number of states predicted to acquire nuclear weapons were smaller than was the case in the pre-1991 period. Yet, the potential for proliferation-induced instability and the likelihood of a nuclear war were considered to be much higher. The sense of pessimism with regard to proliferation increased further after the 9/11 attacks on the United States, the revelation of a global nuclear black market

[132] National Intelligence Council, "Foreign Missile Developments and the Ballistic Missile Threat to the United States through 2015," Washington, D.C., September 1999, p. 5, http://www.iraqwatch.org/government/US/CIA/cia-nie99msl.htm (accessed on February 4, 2008).
[133] Norris, Burrows, and Fieldhouse, *British, French, and Chinese Nuclear Weapons*, pp. 8, 372-374.
[134] Brad Roberts, "Alternative Futures" in Paul J. Bolt and Allbert S. Willner, eds., *China's Nuclear Future* (Colorado: Lynne Rienner Publishers Inc., 2006), p. 184.

in 2003, and fears concerning Iran's nuclear ambitions shortly afterwards.[135] This was reflected by American scholar and diplomat Mitchell Reiss. "Should current proliferation trends continue, within the next decade there may be more declared nuclear weapons states, more undeclared nuclear weapons states, and more states developing nuclear weapons than ever before," he wrote.[136]

Apart from the three former Soviet states of Ukraine, Belarus, and Kazakhstan, which inherited nuclear weapons from the Soviet Union, the Nth states most frequently mentioned in post-Cold War literature were ones already identified prior to 1991. Other than Germany, all of them were developing countries.

Owing to the de facto nuclearization of Ukraine, Belarus and Kazakhstan, the proliferation debate was forced to revisit Europe immediately after the Soviet Union's dissolution.[137] However, the focus proved to be short lived as all three republics agreed to disarm.[138] In the wake of the Soviet Union's collapse, there was also a sense of declining U.S. interest in its nuclear forces in Europe.[139] British scholar Lawrence Freedman warned that "there may be a break in the U.S. institutional memory and no tangible reminders of the nature of the nuclear commitment".[140] Germany was tipped to reconsider nuclearization in case of the withdrawal of U.S. nuclear weapons from Europe or a slowdown of the 'Europeanization' of the continent.[141] However, both developments

[135] The global nuclear black market was allegedly operated by renowned Pakistan scientist Abdul Qadeer Khan. Using a network of clandestine entities, the market supplied both nuclear hardware and technology to aspiring states. Libya, Iran, and North Korea are believed to have been the most prominent beneficiaries. For details of the network's operations, see *Nuclear Black Markets: Pakistan, A.Q. Khan and the Rise of Proliferation Networks – A Net Assessment* (London: International Institute for Strategic Studies, 2007).
[136] Mitchell B. Reiss, "The Nuclear Tipping Point: Prospects for a World of Many Nuclear States" in Kurt M. Campbell, Robert J. Einhorn, and Mitchell B. Reiss, eds., *The Nuclear Tipping Point: Why States Reconsider Their Nuclear Choices* (Washington, D.C.: Brookings Institution Press, 2004), p. 4.
[137] John Simpson and Darryl Howlett, "The Future of the Non-Proliferation Treaty: An Overview" in John Simpson and Darryl Howlett, eds., *The Future of the Non-Proliferation Treaty* (New York: St. Martin's Press, 1995), p. 5.
[138] Prior to this development however, there were some commentators who predicted that these countries may retain the strategic capability for some time before deciding on their ultimate fate. See Oudenaren, "Nuclear Weapons in the 1990s and Beyond," p. 44.
[139] Ibid., p. 35.
[140] Lawrence Freedman, "Britain, Nuclear Weapons, and the Future of Arms Control" in Michael J. Mazarr and Alexander T. Lennon, eds. *Toward a Nuclear Peace: The Future of Nuclear Weapons* (New York: St. Martin's Press, 1994), p.151.
[141] Oudenaren, "Nuclear Weapons in the 1990s and Beyond," p. 46.

were considered highly unlikely, as was a reversal of the German pledge to abstain from acquiring nuclear weapons.[142]

Once the initial focus on Europe had disappeared, the emphasis shifted to the developing world. Rather interestingly however, the problem was now considered to be restricted exclusively to Asia. Latin America, virtually all of Africa, and Europe were dismissed as regions unlikely to witness Nth country proliferation.[143] Even within Asia, South East Asia was forecasted to remain non-nuclear for the foreseeable future.[144] On the other hand, with South Asia's nuclear capability already known by the end of the Cold War, Northeast Asia was considered to be the next most likely region to witness further horizontal proliferation; it was projected to be "one of the most volatile regions of the world" by 2016.[145] Asian countries considered Nth states in the post-Cold War era were Japan, South Korea, North Korea (until it tested in 2006), Taiwan, Iran, Iraq, Syria, Saudi Arabia, and Turkey. The only non-Asian countries frequently considered threshold states were Libya and Egypt. Libya was removed from the list when it agreed to abandon its WMD program in 2003.[146] While Egypt still finds mention, it is mostly as part of the discussion on the Asian nuclear chain spreading westward.[147]

Three countries – Pakistan, India and North Korea – have declared their nuclear status since the end of the Cold War. However, since all three countries had declared their intentions and strongly hinted at a nuclear capability well before their tests, their overt declarations were not unexpected. That said, the timing of the Indian test was

[142] While this debate has not died down completely, all subsequent analyses of Germany's position have concluded that there is almost no likelihood of a German nuclear arsenal for the foreseeable future. See for example, Karl-Heinz Kamp, "Germany and the Future of Nuclear weapons in Europe," *Security Dialogue*, Vol.26, No.3, 1995, pp. 277-292.

[143] In Latin America, Argentina and Brazil, the two principal Nth states, confirmed their adherence to the Treaty of Tlatelolco in 1994. The treaty bans the development or deployment of nuclear weapons in the region. This laid to rest any latent fears of Latin American nuclearization.

[144] Michael Malley argues that while proliferation in the distant future is a possibility, the region is unlikely to go nuclear over the next decade. See Michael S. Malley, "Prospects for Nuclear Proliferation in Southeast Asia, 2006-2016," *Nonproliferation Review*, Vol.13. No.3, November 2006.

[145] James C. Moltz, "Future Nuclear Proliferation Scenarios in Northeast Asia," *Nonproliferation Review*, Vol.13. No.3, November 2006.

[146] Paul Kerr, "Libya Vows to Dismantle WMD Program," *Arms Control Today*, January-February 2004, http://www.armscontrol.org/act/2004_01-02/Libya.asp.

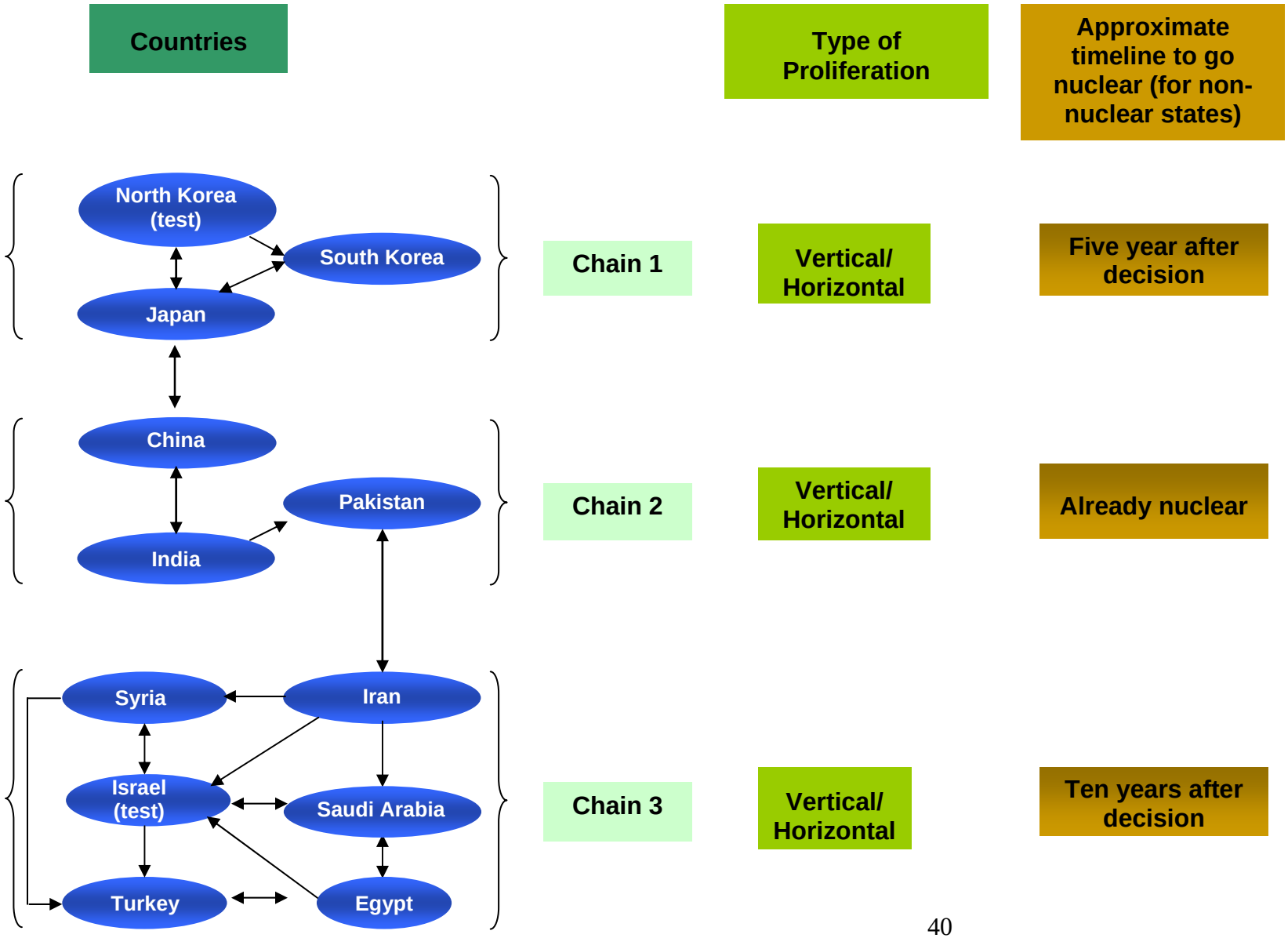
[147] For analysis of the prospects of nuclear proliferation in all major regions of the world over the next decade, see the *Nonproliferation Review*, Vol.13, No.3, November 2006.

unexpected; no one had forecasted the likelihood of an Indian move to declare its capability in 1998.[148] Iran is another suspect state that drew attention after its efforts at creating military spin-offs from civilian nuclear plants and purchasing centrifuges from the nuclear black market were exposed in 2003.[149] Israel is widely believed to possess a bomb and is expected to have a 10,000 km range ICBM by 2020 unless U.S. pressure prevails.[150]

The domino effect thesis naturally remained prominent during this period. Again, extreme pessimism on this count has been prevalent since the revelation of the nuclear black market. CIA Director George Tenet sounded a warning immediately after this revelation: "Additional countries may decide to seek nuclear weapons as it becomes clear their neighbors and regional rivals are doing so. The 'domino theory' of the 21st century may well be nuclear".[151] A number of chain scenarios have been sketched.[152] Most remained as abstract and farfetched as the ones suggested during the Cold War. An Eastern chain starting from Japan spreading to the Koreas, and in turn Taiwan was considered plausible. A Middle Eastern chain is often cited whereby Iranian nuclearization would prompt its Arab neighbors (Saudi Arabia and Syria) and Turkey to follow suit.[153] Israel would potentially declare its status at this point. In addition, a tit-for-tat India-Pakistan arms race could cause a shift in China and Iran's positions, in turn leading the Middle Eastern powers and Taiwan to reconsider their stances. Moreover, Russia may act in reaction to China's vertical proliferation.[154]

[148] While the Indian test was a surprise, a tit-for-tat Pakistani reaction was entirely predictable. The North Korean regime had also signaled its move in 2006 amidst a deepening crisis with the U.S.
[149] Dafna Linzer, "U.N. Finds No Nuclear Bomb Program in Iran," *Washington Post*, November 16, 2004, A.18.
[150] Giles et al., "Future Global Nuclear Threats," p. 10.
[151] Senate Select Intelligence Committee, "Current and Projected National Security Threats to the United States: Hearing Before the Committee on Intelligence," S. Hrg. 108-161, 108th Congress, 1 sess., February 11, 2003, p.28.
[152] For a representative discussion of the various scenarios for an Asian chain reaction, see Joseph Cirincione, "The Asian Nuclear Reaction Chain," pp. 11-19.
[153] Lionel Beehner, "Israel's Nuclear Program and Middle East Peace," *Council for Foreign Relations*, February 10, 2006, http://www.cfr.org/publication/9822/ (accessed on February 1, 2008).
[154] Cirincione, "The Asian Nuclear Reaction Chain," pp. 11-13.

Diagram 2: Most Likely Asian Nuclear Chains Today



Finally, the role of foreign assistance in Nth country nuclear programs has remained prominent. The past four years have seen repeated assertions that if Saudi Arabia seeks a nuclear route, a lack of technical capabilities may prompt it to seek technology and assistance from an allied Muslim state like Pakistan.[155] Similarly, Iran or North Korea could potentially assist Syria in such an endeavor.[156] A new twist to this debate in the wake of the global black market scandal is the ability of non-state actors to supply nuclear material. Individuals, intermediaries, front companies, and transnational presences are deemed likely to play a major role in providing such assistance over the next decade.[157]

The U.S. and Nth Country Proliferation

As was the case during the Cold War, the role of the superpowers – or the United States in the case of the post-Cold War era – was considered paramount in establishing the pace of, and risks involved in, Nth country proliferation. While the geographic expanse of the effect was naturally limited to the region of concern (Asia), the role of U.S. security guarantees was considered vital to stalling proliferation. A recurring theme has been the inverse relationship between U.S. allies benefiting from a security umbrella and the likelihood of their developing independent nuclear forces.[158]

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[155] See Thomas W. Lippman, "Saudi Arabia: The Calculations of Uncertainty" in Kurt M. Campbell, Robert J. Einhorn, and Mitchell B. Reiss, eds., *The Nuclear Tipping Point: Why States Reconsider Their Nuclear Choices* (Washington, D.C.: Brookings Institution Press, 2004), pp.134-138.

[156] Already, there are concerns that Syria may be building a nuclear reactor secretly with North Korean assistance. Israel even bombed the suspected Al-Kibar site in North Eastern Syria in September 2007. The IAEA is scheduled to investigate the site in June 2008. Chris Smyth, "U.N. Nuclear Inspectors to Investigate Al-Kibar Site in Syria," *Times Online*, http://www.timesonline.co.uk/tol/news/world/middle_east/ article4049782.ece (accessed on June 2, 2008).

[157] James A. Russell, "Peering into the Abyss: Non-State Actors and the 2016 Proliferation Environment," *Nonproliferation Review*, Vol.13, No.3, November 2006.

[158] Kurt M. Campbell and Robert J. Einhorn, "Avoiding the Tipping Point: Concluding Observations" in Kurt M. Campbell, Robert J. Einhorn, and Mitchell B. Reiss, eds., *The Nuclear Tipping Point: Why States Reconsider Their Nuclear Choices* (Washington, D.C.: Brookings Institution Press, 2004), pp. 321-22. For example, Turkey is tipped to alter its non-nuclear status only if its relations with the U.S. become strained or if U.S. seems reluctant to extend its blanket security cover to cater to any eventualities. See Leon Fuerth, "Turkey: Nuclear Choices Amongst Dangerous Neighbors" in Kurt M. Campbell, Robert J. Einhorn, and Mitchell B. Reiss, eds., *The Nuclear Tipping Point: Why States Reconsider Their Nuclear Choices* (Washington, D.C.: Brookings Institution Press, 2004), pp. 147-69.

At the same time however, the debate on U.S. security umbrellas has become increasingly complex. In the early-1990s, one view suggested that the end of the Cold War would leave both the United States and Russia less interested in extending security guarantees to Nth powers, a move that was anticipated to spur the developments of independent deterrents. Moreover, nuclearized developing countries, it was feared, would not allow the United States to interfere in regional crises, thus reducing Washington's independence to act.[159] This would have provided a free hand to regional powers, essentially eliminating the dampening effect of the superpowers on Nth country conflicts.[160]

After the mid-1990s, a subtle shift in the discourse meant that while acknowledging the complexity of the post-Cold War situation, commentators argued that the United States would realize the effect of withdrawing security guarantees and would thus seek to continue playing the role of the "global sheriff", thereby keeping a lid on regional conflicts.[161] After the turn of the century however, the U.S. has come under criticism for taking its global role too far. The Bush administration's propensity to employ the doctrine of prevention against states like Iraq on the one hand, and its inability to tackle belligerent nuclear threshold countries like North Korea in a similar fashion on the other, have led to fears of increased demand for nuclear weapons in the developing world.[162] In a similar vein, the late physicist and arms control specialist Wolfgang Panofsky, argued that the United States' inclination towards developing new third generation warheads, and lending importance to active nuclear responses against Nth states will further undermine the global non-proliferation regime and may increase

[159] This argument was actually carried over from the Cold War. However, during the Cold War, the prevalent sense was that the superpowers would not disengage. See Dunn, *Controlling the Bomb*, pp.79-85.
[160] The dampening effect of superpower involvement was a prominent argument during the Cold War. See for example, R. N. Rosecrance, "International Stability and Nuclear Diffusion" in R.N. Rosecrance, *The Dispersion of Nuclear Weapons: Strategy and Politics* (New York: Columbia University Press, 1964), p.314.
[161] Victor A. Utgoff, "The Coming Crisis: Nuclear Proliferation, U.S. Interests, and World Order – A Combined Perspective" in Victor A. Utgoff, ed., *The Coming Crisis: Nuclear Proliferation, U.S. Interests, and the World Order* (Cambridge: MIT Press, 2000), pp.294, 299.
[162] Moeed Yusuf, "Mini Nukes: A New Age of Nuclear Weapons, *The Friday Times*, January 30-February 5, 2004, http://www.vanguardbooks.org/cgi-bin/tftstorycomments.pl (accessed on February 7, 2008). See also Cirincione, *Bomb Scare*, p.108. Some prominent views disagree with this argument suggesting that the Bush administration's policy is unlikely to have any major impact on proliferation. Kurt Campbell and Robert Einhorn arrive at this conclusion in an edited volume comprising of cross-country case studies. See "Avoiding the Tipping Point," pp. 322-23.

the likelihood of the bomb's diffusion.[163] A similar view was propounded by Chair of CISAC, John Holdren who argued that Bush administration's policies were increasing the demand-side incentives for Nth states.[164]

Another fresh challenge to the non-proliferation regime is the policy of the United States to provide certain non-members of the Non-Proliferation Treaty (NPT) access to civilian nuclear energy.[165] India has become the first country to attain such a deal while remaining outside the NPT. While transfer of technology is yet to begin, *ex ante* impact analysis is split, with some arguing that this may well strengthen non-proliferation by bringing a NPT non-member under stringent controls, others have argued that the development will set a bad precedent and encourage other commercially-oriented exporters to supply technology to Nth states.[166] The concern is grave given that access to civilian nuclear power has been portrayed in an unfavorable light ever since Iranian and Libyan intentions to create military spin-offs were exposed.[167]

The debate about superpower (and middle power) supremacy in the nuclear arena carried over from the Cold War. However, unlike the previous era, Nth powers were believed to have the capacity to compromise U.S. and Russian supremacy if the latter chose to slash their inventories to a handful of weapons. A 1994 study by the Center for Strategic and International Studies' Nuclear Strategy Study Group pointed to the

[163] See Wolfgang K. H. Panofsky, "Nuclear Insecurity," *Foreign Affairs*, September/October 2007. Also see, Cirincione, *Bomb Scare*, pp. 101-02.

[164] John P. Holdren, "The Proliferation Challenge and the Future of Nuclear Energy," presentation at the Break-Out Session at the Annual Meeting of the National Academy of Sciences, Washington, D.C., May 1, 2005.

[165] In August 2007, India and the U.S. inked a bilateral agreement on civilian nuclear cooperation as envisioned in the joint statement released by U.S. President Bush and Indian Prime Minister Manmohan Singh on July 18, 2005.

[166] For an optimistic viewpoint on the deal, see Stephen P. Cohen, "U.S.-India Atomic Energy Cooperation: Strategic and Nonproliferation Implications," Testimony before the U.S. Senate Committee on Foreign Relations, April 26, 2006, http://www.brookings.edu/~/media/Files/rc/testimonies/2006/0426india_cohen/20060426.pdf (accessed on January 21, 2008). For a more cautious view, see George Perkovich, "Faulty Promises: The US-India Nuclear Deal," Policy Outlook, *Carnegie Endowment for International Peace*, September 2005, http://www.carnegieendowment.org/files/PO21.Perkovich.pdf (accessed on December 17, 2007). Also see "Issues and Questions on July 18 Proposal for Nuclear Cooperation with India," letter to U.S. House of Representatives, November 18, 2005, http://www.armscontrol.org/pdf/20051118_In-dia_Ltr_congress.pdf (accessed on December 17, 2007).

[167] Republican presidential candidate John McCain has emphasized this weakness in the non-proliferation regime, and has suggested that Article IV of the NPT needs to be reconsidered. See John McCain, "An Enduring Peace Built on Freedom", *Foreign Affairs*, Vol.86, No.5, November/December 2007.

potential for other countries to be enticed into increasing their arsenals if the U.S. cut its weapons to a level they saw as attainable.[168] In addition, there were concerns that a small American or Russian inventory may even help developing country leaders initiate programs by convincing their populations that they could actually deter the U.S. by developing a small sized arsenal, a move that was impossible during the Cold War.[169] Although challenged by optimists on this count, pessimists feared that a successful catch-up by a few states would take away U.S. nuclear superiority and thus take away its option of intervening in regional crises.[170] Commenting on the proposed deep cuts in the arsenals of the superpowers, former U.S. National Security Advisor Brent Scowcroft said: "arguments in favor of this course seem singularly unpersuasive. What are the rewards of deep cuts which would lead us to undergo the kinds of risks they may present?"[171] Stansfield Turner, former Director of the CIA argued that an arsenal in the low hundreds would be "very difficult to sell" as it would open up a 'window of vulnerability'.[172] Those concerned with an excessive decrease in U.S. nuclear stockpile pointed out that any move in this direction would necessarily require arms control negotiations that included all states with a nuclear weapons capability.[173]

Rather interestingly, unless provided with an incentive by excessive superpower cuts, no new power was predicted to be able to close the gap with the five nuclear weapons states. In fact, some of the most influential voices in new nuclear states were advocating against any move to imitate the trajectory of superpower nuclear development

[168] Nuclear Strategy Study Group, "Regional Deterrence" in Michael J. Mazarr and Alexander T. Lennon, eds. *Toward a Nuclear Peace: The Future of Nuclear Weapons* (New York: St. Martin's Press, 1994), p.58.
[169] George Quester, "Unavoidable Importance of Nuclear Weapons" in John Baylis and Robert O'Neill, *Alternative Nuclear Futures: The Role of Nuclear Weapons in the Post-Cold War World* (Oxford: Oxford University Press, 2000), p. 35.
[170] Optimists argued that a few hundred strong inventory would be enough to deter an attack on the United States in addition to impacting regional crises positively. See for example, Ivo H. Daalder, "What Vision for the Nuclear Future?" *The Washington Quarterly*, Vol.18, No.2, 1995, pp.134-36. Also see Ibid., pp.82-83; and Harold A. Feiveson, ed., *The Nuclear Turning Point: A Blueprint for Deep Cuts and De-Alerting of Nuclear Weapons* (Washington, D.C.: The Brookings Institution, 1999), p.152.
[171] Quoted in Thomas Wander, Elizabeth J. Kirk, and Eric H. Arnett, eds., *Science and Security: Technology and Arms Control for the 1990s* (Washington, D.C.: American Association for the Advancement of Science, 1989), pp. 79-80.
[172] Stansfield Turner, "The Dilemma of Nuclear Weapons in the Twenty-First Century," *Naval War College Review*, Vol.54, No.2, 2001, p. 18.
[173] Committee on International Security and Arms Control, National Academy of Sciences, *The Future of U.S. Nuclear Weapons Policy*, pp. 79-84.

in the first place. For instance, K. Subrahmanyam, India's most prominent strategic thinker argued that the "main purpose of a third world arsenal is deterrence against blackmail," and that new nuclear powers had the benefit of learning from the "highly risky and totally non-viable policies" of the superpowers and thus would not repeat their mistakes.[174] Indeed, Israel, India and Pakistan, the three countries with a considerable head start over other current or potential nuclear powers have only upgraded their programs at a modest pace and are estimated to have 75-130, 40-50 and 60 assembled warheads respectively.[175] Moreover, future estimates suggested an inventory between 100-400 warheads over the next decade for India and a smaller one for Pakistan.[176] Israel was also predicted to retain a small arsenal.[177]

Overshadowing this comforting projection however were forecasts that suggested that Nth powers with anti-U.S. leanings would still be able to target the U.S. homeland directly. In 2001, Iran, Iraq and North Korea were tipped to be able to have such an ICBM capability within 10-15 years.[178] Regional powers like Israel also exaggerated the danger from missile proliferation, but these remained limited to a perceived threat to their homeland. For instance, in 1998, Israeli intelligence assessed that, not counting Egypt and Iran, "between one to two thousand ballistic missiles could threaten their country by 2010".[179] Both Iraq and Libya had been neutralized as active threats by 2003.

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[174] K. Subrahmanyam, "Nuclear Policy, Arms Control, and Military Cooperation," paper presented at the Carnegie Endowment for International Peace- India, International Conference on India and United States after the Cold War, New Delhi, March 7-9, 1993, p.7; K. Subrahmanyam, "Talbott is Stuck in Pre-'85 Nuclear Groove," *Times of India*, November 17, 1998.

[175] Natural Resources Defense Council, "Nuclear Notebook," *Bulletin of Atomic the Scientists* No. 63, Vol. 3, May-June 2007, p.72; Robert S. Norris and Hans M. Kristensen, "India's Nuclear Forces, 2005," Natural Resources Defense Council, *Bulletin of the Atomic Scientists* Vol.61, No.5, September-October 2005, p. 73.

[176] Most independent projections for India fall within this range. See for example, Ashley J. Tellis, *India's Emerging Nuclear Posture: Between Recessed Deterrent and Ready Arsenal* (Santa Monica: RAND, 2001), pp.481-498, 692. Also see, Vivek Raghuvanshi, "India to Stay the Course on Nuke Doctrine," *Defense News*, November 1, 2004; and Bharat Karnad, *Nuclear Weapons and Indian Security* (New Delhi: Macmillan India, 2002), p.617.

[177] For an authoritative overview of Israel's nuclear program, see Avner Cohen, *Israel and the Bomb* (New York: Columbia University Press, 1998).

[178] Giles et al., "Future Global Nuclear Threats," p. 21. For a recent criticism of U.S. projections regarding Iran's missile capability as being strong enough to reach its territory, see Dinshaw Mistry, "European Missile Defense: Assessing Iran's ICBM Capabilities," *Arms Control Today*, October 2007, http://www.armscontrol.org/act/2007_10/Mistry.asp?print (accessed on June 17, 2008).

[179] Dinshaw Mistry, *Controlling Missile Proliferation: Strategic Technology, Security Regimes and International Cooperation in Arms Control* (Seattle: University of Washington Press, 2003), p.90. The

Table 3: Global ballistic missile inventory 2002

Countries with only short-range (<1,000 km) capability	Afghanistan, Argentina., Armenia, Azerbaijan, Bahrain, Belarus, Bulgaria, Congo, Egypt, Georgia, Greece, Iraq, Kazakhstan, Libya., Slovak Republic, South Korea, Syria, Taiwan. Turkey, Turkmenistan. Ukraine. UAE, Vietnam. Yemen
Countries with medium-range (1,000-3,000 km) capability	China, India, Iran, Israel, North Korea, Pakistan, Saudi Arabia
Countries with intermediate-range (3,000-5,500 km) capability	China
Countries with intercontinental (>5,500 km) capability	U.S., Russia, China, France, Britain

Source: Cirincione, *Deadly Arsenals*, p.14.

The Effects of Nth Country Proliferation

Recent efforts to predict the future of nuclear weapons and proliferation agree overwhelmingly that Asian proliferation would eventually undermine the post-Cold War nuclear equilibrium. The kind of stability that existed in the superpower nuclear relationship during the Cold War was not expected to take root in regions like the Middle East, which none the less remains central to the domino effect thesis.[180] Indeed, there

Israeli estimate was made at a time when its defense establishment was trying to justify for deployment of the Arrow ballistic missile defense system.

[180] National Intelligence Council, "Global Trends 2025: A Transformed World," NIC 2008-003, November 2008, http://www.dni.gov/nic/NIC_2025_project.html (accessed on December 1, 2008), pp. 61-62.

seems to be a continuing implicit assumption that developing countries would act less maturely with nuclear weapons under their belt, thus inevitably leading to regional, and in turn global, instability. Post-Cold War arguments were largely deterministic on this count and the pessimism was much more accentuated than was the case during the Cold War.

Like the Cold War, much of the debate focused on domestic political issues within developing countries. One common concern in the early-1990s centered on the post-communist states. The argument was that the renegotiation of boundaries by countries such as Russia would prompt nuclear ambitions. Australian security expert Robert O'Neill presented a scenario in which Russia lost control of its nuclear weapons or more Russian states opposed to Moscow broke away and used inherited nuclear weapons to further their political goals or even settle scores with Moscow militarily.[181] Similarly, Korean reunification, although improbable, was anticipated to prompt Korea to go nuclear unilaterally.[182]

The other, new facet of the debate on the political stability of Nth powers was the inclusion of the democratic peace theory. Proponents argued that since democracies tended to vie for safe neighborhoods, democratic polities would be more averse to nuclearization.[183] Given that most Nth countries in Asia were ruled by dictatorships, under threat of military coups, or quasi-democracies at best, the likelihood of the use of weapons for political ends was considered to be extremely high. Pessimism also resulted from the realization that nuclearization among most Asian rivals could only be prevented over the long run by addressing the root causes of their conflicts. However, the virtual consensus that these animosities were deep-rooted, and thus extremely difficult to

[181] Robert O'Neill, "Weapons of the Underdog" in John Baylis and Robert O'Neill, eds., *Alternative Nuclear Futures: The Role of Nuclear Weapons in the Post-Cold War World* (Oxford: Oxford University Press, 2000), pp. 197-98.
[182] In a survey of retired Korean generals in the late-1990s, 96 percent believed that Korea would require an independent deterrent following unification. Cirincione, "The Asian Nuclear Reaction Chain," p. 16.
[183] Campbell and Einhorn, "Avoiding the Tipping Point," pp. 326-27.

ameliorate permanently, made many believe that the nuclearization of these regions was all but inevitable.[184]

The perception that conflicts between many threshold states carried exorbitant stakes that could potentially cause one or both sides to contemplate suicidal moves increased fears of the use of nuclear weapons.[185] The 'mad ruler' scenario was frequently mentioned during this period as was the concern with an abrupt regime collapse in dictatorial systems like North Korea.[186] Others argued that countries would be likely to pursue nuclear policies that would lead them to develop operational first strike capabilities in a quest to attain regional supremacy.[187] Pre-emption was also considered a realistic option. Low intensity conflicts between traditional rivals like Pakistan and India were believed to carry with them an escalatory potential that could lead to a broader conflict.[188] Moreover, given the consensus that technological expertise and requisite nuclear material would be available relatively easily, Asian states were anticipated to enter into regional arms races. John van Oudenaren, formerly of the U.S. Department of State, argued in 1992 that Nth states could end up developing not only rudimentary capabilities but even tactical nuclear weapons and anti-tactical ballistic missiles (ATBMs).[189] Moreover, the long-standing fears of accidental or unauthorized use induced by shortened warning times between contiguous states, the inability of new countries to create robust command and control structures, and their need to disperse their small arsenals, were also present.[190]

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[184] The majority of Asian Nth states continue to be embroiled in inter-state disputes. Pakistan and India, Iran and Israel, Syria and Israel, North and South Korea, North Korea and Japan, and Iraq and Israel all had antagonistic relationships and had been party to at least one armed conflict against the other in the past.
[185] For an excellent overview of the potential impacts of proliferation in Asia, see Paul Bracken, *Fire in the East: The Rise of Asian Military Power and the Second Nuclear Age* (New York: Harper Collins Publishers, 1999), pp.95-124.
[186] National Intelligence Council, "Global Trends 2025," p.x.
[187] Buchan et al. argue the new Nth powers would acquire weapons to use them against regional adversaries. Buchan et al., "Future Roles of U.S. Nuclear Forces," p.22.
[188] National Intelligence Council, "Global Trends 2025," p.x.
[189] Oudenaren did however recognize the constraints the small economic and technological capacities of Nth states would impose on such efforts. Oudenaren, "Nuclear Weapons in the 1990s and Beyond," p.51. For an overview of the potential for arms races, see Bracken, *Fire in the East*, pp.115-116.
[190] For a pessimistic take on the potential for developing countries to avoid a nuclear mishap and the various technical constraints in this regard, see Nathan E. Busch, *No End in Sight: The Continuing Menace of Nuclear Proliferation* (Lexington: The University Press of Kentucky, 2004), pp.275-302.

Some strong rebuttals to this pessimistic outlook were forwarded by those who saw the developing world as no less cautious in their actions than the established NWS.[191] However, there was an overwhelming belief that developing country proliferation would raise the specter of nuclear war. American analyst Joseph Cirincione pointed to India-Pakistan crises and a conflict over Taiwan as examples of situations where an escalation to the nuclear level may be swift and uncontrollable.[192] Such predictions were reinforced by India-Pakistan behavior. The two sides found themselves embroiled in one limited war and one near-war crisis under the nuclear umbrella in 1999 and 2001-02, respectively.[193] The pessimism regarding their future crisis behavior was extreme. American scholar Michael Krepon argued: "If the means chosen to pursue advantage in the next India-Pakistan crisis show signs of success, they are likely to prompt escalation, and escalation might not be easily controlled. If the primary alternative to an ambiguous outcome in the next crisis is a loss of face or a loss of territory, the prospective loser will seek to change the outcome."[194]

A New Menace: The Nuclear Terrorist

Perhaps the most striking development in efforts to predict the role of nuclear weapons in the post-Cold War era has been the importance accorded to nuclear terrorism. While the mention of the issue remained peripheral for the most part prior to the collapse of the Soviet Union, it came into the limelight immediately after the USSR's dissolution. Ever since, the inevitability of the spread of nuclear terrorism and that of a successful terrorist attack in the distant future were taken for granted. The period after the 9/11

[191] Perhaps the most influential optimist in recent times has been Kenneth N. Waltz. He argues that diffusion of the bomb to a limited number of Nth powers would ensure greater stability. Moreover, he also sees no danger of inadvertent, irrational, or accidental nuclear catastrophes in new nuclear states. For a succinct overview of the optimist-pessimist debate, see Waltz's debate on the issue with Scott Sagan. Scott D. Sagan and Kenneth N. Waltz, *The Spread of Nuclear Weapons: A Debate Renewed* (New York: W. W. Norton, 2002).
[192] Cirincione, *Bomb Scare*, pp. 100-102.
[193] For an overview of India-Pakistan nuclear crises, see P.R. Chari, Parvez I. Cheema, and Stephen P. Cohen, *Four Crises and a Peace Process: American Engagement in South Asia* (Washington, D.C.: The Brookings Institution, 2007), pp. 118-183.
[194] Michael Krepon, "From Confrontation to Cooperation," *Henry L. Stimson Center*, 2004, http://www.stimson.org/southasia/pdf/NRRM-Chari.pdf (accessed on January 11, 2008).

attacks on the United States and the 2003 revelation of the nuclear black market fostered considerable pessimism about the menace of terrorism.[195] As confirmed by former State Department Official William J. Perry in a recent Congressional testimony, nuclear terrorism is widely considered to be the "greatest danger today".[196]

For much of the initial period after the end of the Cold War, the focus with regard to nuclear terrorism remained confined to former Soviet territory. Concerns were raised about the high likelihood of the outflow of fissile material from the former Soviet republics and Russia. The scientific community drew extreme alarm from the fact that Russia's plans to scale back its nuclear inventory implied the presence of substantial quantities of excess plutonium and HEU. Plutonium, whose global stocks were predicted to increase from 1100 metric tons (MT) in 1992 to 1600-1700 MT by the turn of the century (50 MT of these were to come from Russia), caused the greatest concern given the technological difficulties in securing this material against reuse, and acquisition by suspect states or terrorist outfits.[197] Such fears remain widespread even today. American scholar Nathan Busch argues that domestic crises in Russia since the end of the Cold War make the country's nuclear facilities prime targets for insider thefts, "causing them to be

[195] Joseph Cirincione with Jon B. Wolfsthal and Miriam Rajkumar, *Deadly Arsenals: Tracking Weapons of Mass Destruction* (Washington, D.C.: Carnegie Endowment for International Peace, 2002), p.4. For a sense of the pessimism that continues to drive the nuclear terrorism debate, see *World at Risk: The Report of the Commission on the Prevention of WMD Proliferation and Terrorism* (New York: Vintage Books, 2008).
[196] "Current Nuclear Threat Worse Than During Cold War," *Space Daily*, July 20, 2007, http://www.spacedaily.com/reports/Current_Nuclear_Threat_Worse_Than_During_Cold_War_999.html (accessed on May 25, 2008).
[197] The most comprehensive work on this issue is contained in CISAC's studies on the threat from excess plutonium and the means by which the material can be secured. CISAC estimated in 2005 that the United States and Russia could conceal enough fissile material to manufacture "several hundred nuclear weapons" while the other states could escape detection for another 15-30 weapons. Committee on International Security and Arms Control, National Academy of Sciences, *Monitoring Nuclear Weapons and Nuclear-Explosive Materials (*Washington, D.C.: The National Academies Press, 2005), p.195; Committee on International Security and Arms Control, National Academy of Sciences, *Management and Disposition of Excess Weapons Plutonium* (Washington, D.C.: National Academy Press, 1994), pp.1-18; 4. Also see German-American Academic Council and National Academy of Sciences, "U.S.-German Cooperation in the Elimination of Excess Weapons Plutonium," National Academy Press, Washington, D.C., 1995, p.9. Although a much larger quantity – approximately 500 MT for Russia – of HEU was expected to become excess to military needs, for HEU, the blend-down option to low-enriched uranium (LEU) was relatively straightforward. The principal initiative to secure Russian LEU was an agreement between Moscow and Washington whereby the latter agreed to purchase 500-tons of blended-down LEU from Moscow between 1993-2003. While the agreement remains on track - by 2006, 292 tons of LEU had been sold to Washington - the expiry of the agreement in 2013 will still leave Russia with large quantities of HEU whose fate is undecided. International Panel on Fissile Materials, "Global Fissile Material Report 2007," 2008, http://www.fissilematerials.org/ipfm/site_down/gfmr07.pdf (accessed on June 1, 2008), ,pp. 25-27.

a potential and actual source of nuclear leakage".[198] Fears are further heightened due to demand-side prospects. Iran and North Korea's clandestine efforts to pursue nuclear weapons programs suggest a strong market for siphoned fissile material.

More recently, nuclear powers in the developing world that suffer from political instability have also come under fire. Pakistan is at the forefront of this debate, not only due to the political instability within its borders but also because of the role of A.Q. Khan – popularly (but incorrectly) known as the father of Pakistan's bomb – in clandestine proliferation activities.[199] The IAEA Director General, Mohammad El Baradei recently underscored the concern about Islamabad's arsenal in light of political instability in the country: "What I really fear is the aftermath in Pakistan, a troubled country with too many problems…I fear that an anarchic or radical regime will take over this nation which has up to 30 or 40 nuclear weapons."[200]

Another facet introduced into the debate in the 1990s was the linkage between proliferation to non-state actors and the increased mobility of human movement and enhanced communications brought about by globalization.[201] Some experts even saw the possibility of states willingly providing terrorists with operational weapons to use against opponents.[202] However, the majority continued to believe that the repercussions were high enough for states not to contemplate such a move.[203] A more important strand of this argument however was the concern about non-states actors benefiting from the relatively easy access to nuclear technology, not only as end users but also as suppliers of sensitive materials and technology to those seeking weapons capabilities.[204] Interestingly, nuclear scientists were considered to pose a serious threat. Following the demise of the

[198] Busch, *No End in Sight*, p.131.
[199] The recent U.S. Commission report on the Prevention of WMD Proliferation and Terrorism has singled out Pakistan as being at the intersection of nuclear weapons and terrorism. See Commission on the Prevention of WMD Proliferation and Terrorism, *World at Risk*, pp.65-75.
[200] El Baradei stated this in an interview to Arab media portal Dar-al-Hayat on January 10, 2008, http://english.daralhayat.com/Spec/01-2008/Article-20080110-639032eb-c0a8-10ed-01ae-81ab2ea588db/story.html (accessed on February 19, 2007).
[201] The impact of the information era on future of nuclear weapons is succinctly analyzed by Carl H. Builder, "The Future of Nuclear Deterrence," paper presented at a symposium on Measures of Deterrence in a Rapidly Changing World, November 28-30, 1990, pp.13-22.
[202] Busch, *No End in Sight*, pp.279-80.
[203] Robin M. Frost, *Nuclear Terrorism after 9/11* (London: Routledge, 2005), pp. 67-68.
[204] Ibid., p.21; and Reiss, "The Nuclear Tipping Point," p.4.

Soviet Union, a number of ex-Soviet nuclear scientists were left jobless and were seen as key targets for terrorists interested in gaining technological know-how.[205] The danger of nuclear scientists divulging valuable knowledge was proven by the revelation of the A.Q. Khan-led nuclear black market.[206]

Table 4: Global stocks of weapons usable fissile material (Metric tons)

	Separated Plutonium	**HEU***	**Total**	**Bomb Equivalent*****
Civil stocks	229.5	437.5**	667	46,187.5
Military	260.1	958.4	1,218.5	70,848.5
Total	489.6	1,395.9	1,885.5	117,036
Bomb equivalent	61,200	55,836	117,036	

Note: The estimates for HEU have an error range of +/- 300 due to uncertainty about Russian uranium stockpile

* Excludes 328 MT of fresh and irradiated HEU possessed by U.S. and Russia for naval use. Estimates also have an error range of +/- 300 due to uncertainty about Russian uranium stockpile.

** HEU estimates include excess uranium for blend-down.

*** To calculate bomb equivalent, the official IAEA estimate is 25 kg of HEU and 8 kg of plutonium for each warhead.

Source: International Panel on Fissile Materials, "Global Fissile Material Report 2007," 2008, http://www.fissilematerials.org/ipfm/site_down/gfmr07.pdf (accessed on June 2, 2008).

[205] Jayantha Dhanapala, "Nuclear Non-Proliferation: The Current Context" in John Simpson and Darryl Howlett, eds., *The Future of the Non-Proliferation Treaty* (New York: St. Martin's Press, 1995), p.14.
[206] In 2001, a report in the US press indicated that Al Qaeda had contacted at least 10 Pakistani nuclear scientists. The contacts have been acknowledged since. For the original report, see Jack Kelley, "Terrorists Courted Nuclear Scientists," *USA Today*, November 15, 2001.

Towards the end of the 1990s, even the most conservative estimates contended that the threat of nuclear terrorism would continue to grow and, however improbable, could not be written off completely. Many based their arguments on the fact that the lethality of terrorist attacks was likely to intensify and that religiously motivated and apocalyptic groups were likely to seek and employ a nuclear device.[207] While some still argued that most terrorist outfits would remain sensitive to public opinion and thus would be rational in their calculations, the belief that terrorists were now willing to employ nuclear devices was a major departure from the Cold War era.

Despite such a pessimistic outlook, it is remarkable that prior to the revelation of the nuclear black market, the majority of analyses anticipated great difficulties for terrorists who were attempting to acquire and deliver even a basic nuclear device.[208] A much more likely scenario was believed to be a radiological explosion through a RDD device which would be easy to manufacture and did not require a sophisticated delivery mechanism.[209]

Only after A. Q. Khan's network came to light were anxieties increased on this count. Matthew Bunn and Anthony Weir stated that a nuclear attack "would be among the most difficult types of attacks for terrorists to accomplish" but "a capable and well-organized terrorist group plausibly could make, deliver, and detonate at least a crude nuclear bomb capable of incinerating the heart of any major city in the world".[210] A Congressional Research Service report even hinted at a direct threat as it foresaw a realistic possibility of terrorists smuggling nuclear weapons into the United States.[211]

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[207] While downplaying fears about purely religious or nationalist groups undertaking nuclear terrorism, Robin Frost points to apocalyptic religious groups as a realistic threat. See Frost, *Nuclear Terrorism*, pp.70-71.

[208] The most detailed analysis of the requirements for terrorists to build a nuclear device successfully and the kind of difficulties the process entails can be found in William Langewiesche *The Atomic Bazaar: The Rise of the Nuclear Poor* (New York: Farrar, Straus and Giroux, 2007); Also see Kevin O'Neill, "The Nuclear Terrorist Threat," *Institute for Science and International Security*, August 1997, http://www.isis-online.org/publications/terrorism/threat.pdf (accessed on January 11, 2008).

[209] Robin Frost reaches this conclusion after an exhaustive study of the threat of nuclear terrorism. See Frost, *Nuclear Terrorism*, pp. 8, 69, and 75-78.

[210] Matthew Bunn and Anthony Weir, "Securing the Bomb: An Agenda for Action," Project on managing the Atom, Harvard University, May 2004, p. vii.

[211] Jonathan Medalia, "Nuclear Terrorism: A Brief Review of Threats and Responses," CRS Report for Congress, *Congressional Research Service*, September 22, 2004, pp. 4-8.

Subsequently, most others have concurred with the view that a terrorist-led nuclear explosion is indeed possible.[212]

The Future of Arms Control and Disarmament

The global disarmament debate in the post-Cold War period was dominated by the nuclear 'haves'/'have not's' dichotomy. This was considered to be an insurmountable barrier for arms control.

Barring the handful of euphoric pronouncements that drew encouragement from the 1987 Intermediate-Range Nuclear Forces (INF) treaty,[213] START I, South Africa's denuclearization, and the Argentine and Brazilian decisions to abstain from nuclear weapons, there was a consensus that global disarmament was impossible. The focus was – and has remained – on the need to ensure quantitative reductions and the marginalization of nuclear weapons. Even those who were categorical in pointing to the merits of global disarmament were quick to realize the near-impossibility of the task and thus ended up presenting a recipe for arms control.[214] According to American academic William Potter, the current U.S. administration's "principle number one is that nuclear proliferation is inevitable, at best it can be managed, not prevented".[215] Indeed, actual progress towards disarmament in the post-Cold War era has been limited to cuts in stockpiles of the two major nuclear powers in line with their arms control agreements.[216]

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[212] Another inherently pessimistic take on the potential for nuclear terrorists to acquire nuclear material is provided by Busch, *No End in Sight*. The author conducts case studies of various nuclear and Nth states. Also see Graham Allison, *Nuclear Terrorism: The Ultimate Prevent able Catastrophe* (New York: Henry Holt and Co ., 2004), pp.17-120; Cirincione, *Bomb Scare*, pp.89-95; John Mueller, "The Atomic Terrorist: Assessing the Likelihood," paper presented at the Program on International Security Policy, University of Chicago, January 15, 2008; and Matthew Bunn, *Securing the Bomb 2007* (Cambridge: Harvard University, 2007).

[213] The INF treaty eliminated nuclear and conventional ground-launched ballistic and cruise missiles with intermediate ranges, i.e. between 500-5500 km.

[214] See for example, Committee on International Security and Arms Control, *The Future of U.S. Nuclear Weapons Policy*, pp.58-98.

[215] William Potter made these remarks during a panel on The New Look of U.S. Non-proliferation Policy held during Carnegie Endowment for International Peace's International Non-proliferation Conference, Washington, D.C., November 7-8, 2005.

[216] For one projection of the trend U.S. and Russian strategic force levels during the 1990s, see CISAC, *The Future of U.S.-Soviet*, p.53.

The sense of the 'haves' versus 'have not's' – also a major concern during the Cold War – was now considered the single most important factor that would determine both the future of the NPT as well as of arms control in general.[217] American strategic experts Joseph Pilat and Robert Pendley anticipated problems resulting from this dichotomy in light of the 1995 NPT review: "…in the absence of significant reductions of U.S. and Soviet nuclear weapons between now and 1995…faced with the need to choose between renewal of the NPT on the grounds that it serves their security interests even without effective implementation of article VI and non-renewal…the majority of developing countries…may choose the latter".[218]

The possibility of a Comprehensive Test Ban Treaty (CTBT) was also considered nil even in the early-1990s.[219] Again, such a perception was largely a result of indifference on the part of the western nuclear powers. A commentator on European affairs highlighted the sentiment across the continent at the time: "if [the CTBT] fails to pass, there will be no profound disappointment".[220] In the run up of the CTBT negotiations in 1994, France was considered to be biggest challenger. As it turned out, the United States failed to ratify the Treaty.[221]

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[217] Arguably, this sentiment has been the most acute among South Asian nuclear states, namely India, China and Pakistan. India's official rationale for the nuclear capability is the discriminatory nature of the NPT. For a sense of the sentiment in the region during the 1990s, see Brahma Chellaney, "Regional Proliferation: Issues and Challenges" in Stephen P. Cohen, *Nuclear Proliferation in South Asia: The Prospects for Arms Control* (Boulder: Westview Press, 1991), pp.315-19.

[218] Joseph F. Pilat and Robert E. Pendley, "Conclusions" in Joseph F. Pilat and Robert E. Pendley, eds., *Beyond 1995: The Future of the NPT Regime* (New York: Plenum Press, 1990), p.167. The obligation of the NWS to disarm was further underscored by developments during the 1990s. These included a 1996 advisory opinion by the International Court of Justice which interpreted Article VI of the NPT as "an obligation to pursue in good faith and bring to a conclusion negotiations leading to nuclear disarmament in all its aspects" as well as taking practical steps towards implementing Article VI obligations. Further, during the 2000 NPT Review Conference the five original NWS offered an "unequivocal undertaking…to accomplish the total elimination of their nuclear arsenals." International Court of Justice, "Legality of the Threat or Use of Nuclear Weapons," Advisory Opinion of July 8, 1996, available at http://www.cornnet.nl/~akmalten/unan5a.html (accessed on May 14, 2008); Rebecca Johnson, "The 2000 NPT Review Conference: A Delicate, Hard-Won Compromise," *Disarmament Diplomacy*, Issue 46, May 2000, http://www.acronym.org.uk/46npt.htm (accessed on May 14, 2008).

[219] Ashok Kapur, "World and Regional Power Relations Without the NPT" in Joseph F. Pilat and Robert E. Pendley, *Beyond 1995: The Future of the NPT Regime* (New York: Plenum Press, 1990), p. 129.

[220] This remark was made by a U.S. expert on Europe during a conference on the Future Role of United States' Nuclear Weapons. See Walsh, "The Future Role of United States' Nuclear Weapons," p. 10.

[221] "Aftermath of US Senate CTBT Rejection," *Disarmament Diplomacy*, Issue No. 41, The Acronym Institute, November 1999, http://www.acronym.org.uk/dd/dd41/41after.htm (accessed on December 4, 2007).

While the double standards of the five recognized NWS with regard to disarmament continues to be a key concern, the 9/11 attacks and the revelation of the A. Q. Khan network has brought an entirely new dimension to the debate. In a major switch from the mid-1990s when the NPT's renewal was being viewed as essential for the goal of disarmament, experts have lately called into question the NPT's validity in the face of the current threat. Primarily, the potential use of civilian nuclear technology guaranteed under Article IV of the Treaty for military purposes has become increasingly controversial.[222] Recent studies suggest that as long as the NPT allows countries access to civilian technology, military spin-offs will be inevitable. Joseph Cirincione argues that the supply of sensitive nuclear materials for civilian purposes puts Nth powers a "screwdriver's turn" away from converting it into a weapons capability.[223] A study conducted by the Massachusetts Institute of Technology highlights the extreme sensitivities attached to each stage of the nuclear fuel cycle.[224] By the same token, world-renowned physicist Richard Garwin cites a CISAC study to interrupt his largely positive outlook towards nuclear energy, highlighting the concern that nuclear weapons – even somewhat sophisticated ones – can be produced by utilizing nuclear reactors producing civilian energy.[225] Garwin and fellow physicist Georges Charpak allude to the elaborate procedures required to physically protect nuclear reactors against terrorist sabotage.[226]

The dangers of military spinoffs of civilian nuclear programs were seen as so strong that even those like John Holdren who stressed the imperative need to utilize nuclear technology to meet the world's energy demands, admitted that the prospects of civilian nuclear energy would remain bleak until the risk of military spin-off could be

[222] Joseph F. Pilat and Kory W. Budlong, "A Nuclear Renaissance and the Future of the Atoms-For –Peace Bargain" in Joseph F. Pilat, *Atoms for Peace: A Future After 50 Years?* (Washington, D.C.: Woodrow Wilson Center Press, 2007), p. 217.
[223] Cirincione, *Bomb Scare*, p. 107.
[224] "The Future of Nuclear Power," *Massachusetts Institute of Technology*, 2003, pp. 65-70. Also see, Chaim Braun, "The Nuclear Energy Market and the Nonproliferation Regime," *Nonproliferation Review*, Vol.13, No.3, November 2006.
[225] Richard L. Garwin, "Can The World Do Without Nuclear Power?: Can the World Live With Nuclear Power?" paper presented at the Nuclear Control Institute, Washington, D.C., April 9, 2001.
[226] Richard L. Garwin and Georges Charpak, *Megawatts and Megatons: A Turning Point in the Nuclear Age* (New York: Alfred A. Knopf, 2001), p. 169.

minimized.[227] One outcome of this was an emphasis on the need to monitor and verify activities related to nuclear power and fissile material. The scientific community emphasized the need to set up a verifiable regime with proposals ranging from increased transparency to monitoring and accounting, and multilateral safeguard regimes.[228] While some groundwork is being laid, the fate of such proposals is still uncertain.[229]

At the same time, the growing averseness to Article IV of the NPT is likely to put even greater pressure on the global non-proliferation regime. What is more, U.S. experts have even begun to argue that in light of the global security threat, it no longer remains practical to ask for implementation of Article VI of the NPT.[230] The current sentiment is summed up by the following statement of a high-level U.N. panel constituted to study security threats to the world: "we are approaching a point at which the erosion of the non-proliferation regime could become irreversible and result in a cascade of proliferation".[231]

Evaluating Sixty Years of Prediction

- Intelligence estimates remained inherently contradictory throughout the Cold War. The NIE projections were constantly revised, earlier claims were often retracted and fresh forecasts were offered that ran contrary to original estimates. Pertinent examples include the revision of the timeline for European states

[227] Holdren, "The Proliferation Challenge." Holdren provides a number of recommendations to ensure that military spin-offs can be prevented from civilian nuclear energy.
While estimates of growth of nuclear power till 2030 predict an increase from the current 371 GWe to between 400-600 GWe, given the current sentiment, one could at best expect the low-end of depicted range to be realized. For various prominent estimates, see International Panel on Fissile Materials, "Global Fissile Material." This report also highlights that the worry about weapon spin-offs is not the only constraining factor for nuclear power. Instead, high capital costs, slower than projected global electricity demand, and lack of capital for nuclear-power investments in developing countries have also stifled growth of nuclear energy and is expected to continue to do so. See pp. 83-87.
[228] CISAC has maintained this position since the last years of the Cold War. Virtually all CISAC publications cited in this document contain detailed recommendations along these lines. For the most up to date discussion on the need and status of international safeguards in NWS, see International Panel on Fissile Materials, "Global Fissile Material," pp.67-81.
[229] For a brief overview of the proposals for production of nuclear energy without raising proliferation concerns, see Braun, "The Nuclear Energy Market," pp.640-42.
[230] Michael A. Levi and Michael E. O'Hanlon, *The Future of Arms Control* (Washington, D.C.: Brookings Institution, 2005), p.131; Cirincione, *Bomb Scare*, p.107.
[231] "A More Secure World: Our Shared Responsibility," Report of the U.N. Secretary General's high level panel on Threats, Challenges, and Change, United Nations, 2004, pp.39-40.

crossing the nuclear threshold between 1957 and 1960, multiple contradictions on the position on China's likelihood to go nuclear, and the removal of all developed countries – even those like Sweden and West Germany who were previously considered certain to weaponize – from the list of suspect states between 1963 and 1966. In essence, the analysis reinforces a 200-year-old quote from Carl von Clausewitz: "many intelligence reports…are contradictory…and most are uncertain".[232]

Table 5: Select U.S. Intelligence Predictions for First Nuclear Tests

Country	Year of Projection	Year Projected to Conduct First Test	Year of Actual First Test
Soviet Union	1946	1953	1949
Soviet Union	1948	1950-1953	1949
China	1957	Post-1967	1964
China	1960	1962-1964	1964
China	1963	1963-1964	1964
India	1963	1967-1968	1974
India	1966	1967	1974

- Another striking fact is the methodological weakness of many forecasts. While the absence of details on data gathering is understandable in intelligence reports, even the public academic and think tank literature is practically devoid of any

[232] Carl Von Clausewitz, *On War* [1832] (Princeton: Princeton University Press, 1984), p.114.

robust methodology to guide estimates of the nuclear future. Other than NPA's 1960 and 1961 studies on Nth country proliferation, where various indices were used to conduct the analysis, no other work explicitly stated the basis for its projections. For the most part, broad overarching claims were made in highly deterministic tones. This is especially true for the 1965-1991 time periods, when a number of Nth powers were being identified as potential proliferators. For example, Beaton's 1966 prediction of a 32-member strong nuclear club by 1995 seemed to be little more than conjecture. The lack of methodology in part explains the presence of a number of widely varying forecasts during the analyzed time frame.

- Contrary to projections for horizontal proliferation, there were few attempts to attach concrete numbers to vertical proliferation estimates during the Cold War. Even with regard to the superpower rivalry, there was virtually no discussion of the number of nuclear warheads in NIEs. During the Cold War, there was also a marked absence of any serious numerical analysis of the two European nuclear weapon states, France and Britain. In the post-Cold War era, however, there have been numerical projections for warhead stockpiles of NWS. This could be attributed to the fact that the Cold War superpowers publicly announced definitive cuts within set time frames and thus their arsenals became relatively easy to forecast. Meanwhile, the other nuclear states had small programs for which fissile material production rates and the pace of modernization could be used to make reasonable predictions. Today, future estimates for weapon stockpiles exist for all NWS. That said, unlike the pre-1991 period, hardly anyone has attempted to provide approximate timelines by which specific Nth countries are likely to cross the threshold.[233]

[233] The only exception was Joseph Cirincione who recently predicted a theoretical possibility of five nuclear powers in the Middle East within a decade after the first one chooses to go nuclear. For North East Asia, the time frame is five years. However, these estimates were referring to the relative technical capabilities of countries in the two regions rather than predicting their actual intention to go nuclear. Cirincione, *Bomb Scare*, pp.104-105.

Trends

- In terms of trends in the analyzed literature, perhaps the most evident characteristic is the persistent pessimism throughout the sixty year period. While there have been frequent disagreements between intelligence estimates and expert opinions as well as within them, the pessimists have overwhelmed the minority that took exception to alarmist projections at different points in time. Moreover, in general, expert opinion seems to have been more pessimistic than intelligence estimates. The fact that virtually no one saw unlimited proliferation as beneficial is hardly surprising. However, more interesting is the fact that not a single projection disagreed with the presumption that the spread of nuclear weapons was inevitable. Even the most optimistic voices such as Beaton and Maddox based their optimism merely on the possibility of slowing down the pace of proliferation. The lack of a nuanced view regarding Nth country proliferation among the pessimistic majority is obvious. As mentioned, one reason why fears of future proliferation during the 1965-1991 period were highly exaggerated was the failure of most estimates to distinguish between the capacity of a country to weaponize and its desire to do so. Only an extreme minority explicitly differentiated between states that could cross the threshold versus those that actually would go nuclear. The current sentiment on nuclear terrorism has acquired the same tone.

- The pessimist outlook was accentuated by three external ‘shocks’. Following each of these, pessimism intensified and those who pushed the worst case scenarios seemed to gain in influence. The first such instance was the Chinese nuclear test in 1964. It was after Beijing’s move that the reality of developing-world Nth country proliferation dawned upon the western strategic community. The sense of pessimism was further exacerbated by the Indian nuclear test of 1974. Estimates immediately

after the test – both from intelligence sources and independent experts – became even more alarmist in tone. Going from a prediction that only one country could cross the threshold between 1966 and 1976, the CIA listed 10 potential Nth powers just a year after India's test. Independent estimates also went from having divided opinions in the run up to New Delhi's test, to presenting fatalistic scenarios. Finally, this was intensified by the revelation of the global nuclear black market in 2003. Estimates ever since have focused on the potential for nuclear terrorism as well as the acquisition of nuclear weapons by states inimical to the United States, the so called "rogue states."

- An evident shortcoming of historical predictions was their inability to accurately estimate the pace of developments. Clearly, the pace of proliferation has been much slower than anticipated by most. Moreover, while all countries that have chosen the nuclear route were mentioned as suspect states prior to their weaponization, the majority of countries listed never even came close to crossing the threshold. In fact, most did not even initiate a weapons program. This is true for all the European countries that abstained from the nuclear option. The three most obvious errors – states whose nuclearization was considered inevitable at some point in time but that never opted for weaponization – were Sweden, Japan, and West Germany. It is worth noting that had all the countries which were considered first-tier suspects at some point time during the 60-year period chosen the nuclear route, the world would have at least 19 nuclear powers today. In contrast, the small number of analyses and intelligence estimates that contemplated future delivery systems broadly agreed that none of the Nth powers would be able to develop highly sophisticated delivery systems over a short period of time. With the exception of China, that forecast was largely accurate.

- Contrary to conventional wisdom, there is only a weak link between the tones of estimates and actual developments taking place at the time of the

projections. Intelligence estimates do not always seem to be affected by on-the-ground developments. For instance, despite the American emphasis on disarmament under President Kennedy and the PTBT breakthrough in 1963, the arms control dialogue became progressively more pessimistic from the mid-1960s onwards. Moreover, intelligence estimates during the 1980s did not make any mention of the SDI despite the fact that independent sources were raising fears that it may undermine Mutually Assured Destruction (MAD). Similarly, the immense economic burden of the arms race on the Soviet Union during the 1980s was completely ignored as Western sources continued to predict Soviet supremacy (or at least parity) and an intensification of the superpower rivalry over the long term. On the other hand, examples where intelligence was clearly impacted by events include the Chinese and Indian nuclear tests. Similarly, in the post Cold-War period, the Soviet collapse resulted in heightened fears about the proliferation of nuclear material and technology.

- There is evidence both of government policy being shaped by intelligence reports and times when policies ignored classified projections. For instance, NSC-68 in 1950 which exaggerated estimates of Soviet military upgradation was instrumental in President Henry Truman's decision to pursue an aggressive build-up of American military strength.[234] Similarly, the well-known emphasis of the Kennedy and Johnson administrations on arms control may well have been a consequence of repeated assertions by the intelligence community (complemented by scholars) during the late-1950s that such agreements could have a beneficial impact on horizontal proliferation. To the contrary, however, periods where official policy seemed to diverge from intelligence estimates included the Truman and Kennedy administrations' signals that they may be willing to dilute the

[234] The U.S. military build up during the Cold War began under President Truman and was a direct outcome of the alarmist outlook of the NSC-68, the 1950 NIE specially prepared on the request of the President.

role of security umbrellas when projections clearly suggested that Nth states would likely forego nuclear weapons if the U.S. continued to show commitments to defending them.[235] By the same token, dim intelligence forecasts vis-à-vis the Soviet Union in the 1970s did not reduce the momentum of arms controls agreements carrying over from the 1960s. It was only after the Reagan administration took office that alarmist intelligence projections seemed to have been reflected in the policy to toughen the stance on arms control and undertake new initiatives such as the SDI.

- As for the academic literature, it seems to be only partly proactive; most commentaries were obviously shaped by contemporary events. Notwithstanding some important exceptions, those projecting proactively during the Cold War mostly made broad pronouncements about the future of proliferation and remained inherently pessimistic. In the post-Cold War period, the same was visible in pronouncements on nuclear terrorism. On issues of U.S. nuclear weapons policy or the nature of threats however, scholars correctly predicted future courses during the 1990s. The Bush administration's policy to develop new kinds of nuclear weapons and defenses for instance was widely predicted beforehand.

- The tone of reactive assessments – those impacted by events or government policies – was generally pessimistic as well. For instance, much of the pessimism during the 1980s when scholarly views clearly diverged from intelligence estimates were a result of the growing Soviet arsenal, the toughened stance of the Reagan administration, and the failure of key arms control talks in the early-to-mid 1980s. By the same token, the revelation of the A.Q. Khan network led to excessively pessimistic retroactive pronouncements on the future threat from nuclear terrorism.

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[235] See note 67.

- There is no obvious relationship between nuclear projections and the U.S. administrations in office at the time. While it is impossible to make a deterministic claim from the preceding analysis, intelligence estimates do not seem to follow any pattern based on whether the Republican or Democratic Party was in office, or the administration's leanings with regard to nuclear policy. The alarmist projections regarding the Soviet Union during the 1950s were retained even after the White House switched from Democratic to Republican in 1953.[236] While the arms control diplomacy of Presidents Kennedy and Johnson may have been an outcome of intelligence estimates during the late-1950s, their efforts did not find the backing of intelligence estimates which were progressively pessimistic. Moreover, the rigid forecasts from the early-1970s onwards remained consistently so until the end of the Cold War even though the period saw both Republican and Democratic presidents.[237] In essence, none of the earlier-mentioned major contradictions in intelligence reports coincided with changes of parties or administrations in the White House.

- An interesting trend is evident in terms of the geographical and numerical spread of nuclear weapons over time. During the early years of the Cold War, the geographical areas of concern in terms of proliferation were Europe and Japan. However, once the focus shifted to the developing countries, suspect states spanned Asia, Africa, Latin America, and Australia. Post-1991 however, virtually all suspect states were located within Asia. Moreover, since no new Asian country has been added to the list of threshold powers since 1991, the number of Nth powers has steadily decreased.

- There was a stark difference between the anticipated impacts of developed versus developing country proliferation. Developed countries were

[236] Republican Dwight Eisenhower took over as Democratic President Henry Truman in 1953.
[237] During this period, Richard Nixon (1969-1974), Gerald Ford (1974-1977) and Ronald Reagan (1981-1989) were Presidents who belonged to the Republican party while Jimmy Carter (1977-1981) was a Democrat.

predicted to behave rationally and global strategic stability was forecast as remaining intact, even if the European threshold states or Japan had weaponized. On the other hand, developing countries were largely viewed as reckless and more likely to initiate a nuclear war. While both tactical and political reasons did underpin such fears since the issue came to the forefront post-1965, literature on this count has been highly deterministic.[238] The close relationship between developing country proliferation, global instability and a higher likelihood of nuclear weapons use is taken for granted by the overwhelming majority of Western analysts.

- Similarly, the domino effect is often considered to be unique to the developing world. The concern of a chain reaction was hardly brought up when developed countries were the focus of proliferation literature. Even when the action-reaction syndrome was mentioned, it was limited to a group of two or three European countries. Sweden often found mention as a reactionary state that might have gone nuclear if West Germany or Switzerland chose to do so. However, the chain did not extend much beyond that. In contrast, with regard to developing countries, the domino effect was considered inevitable.

- The issue of nuclear terrorism has come to the forefront in a remarkably short amount of time. While merely a peripheral concern until the end of the Cold War, fears of a nuclear terrorist attack and the role of non-state actors in perpetrating nuclear violence have come into the limelight since 1991. The development seems to have been triggered by the fall of the Soviet Union and has been further exacerbated by the 9/11 attacks on the United States and the subsequent revelation of the A.Q. Khan-led black market. As already mentioned, it is today considered to be the most serious long-term threat.

[238] See for example, Greenwood, "Nuclear Weapons and National Purposes," p.28.

- The role of external assistance has remained important in forecasts since the beginning of the nuclear era. The issue found persistent mention in the NIEs during the early years of the Cold War. Intelligence reports suggested the possibility of countries hastening across the threshold courtesy of external support. China, a joint European effort, and second-tier suspects like Italy and Switzerland were often mentioned in this vein. With regard to the developing world, the lack of resources and technical know-how were believed to make the role of external assistance even more important. Indeed, the nuclear capabilities of countries like Pakistan and Israel are believed to have been acquired through substantial support from China and France respectively. In the post-Cold War period, an additional element was the growing emphasis on the role of non-state actors as external supporters.

- Arguably, the role of the superpowers was one of the most important variables in determining the pace of proliferation. The extension of security guarantees to Nth power allies was believed to be responsible for deterring these states from pursuing independent nuclear programs. Naturally, while either American or Soviet guarantees would have sufficed during the Cold War, this argument only applied to American allies post-1991. Such arrangements have become more complex since 1991. Unlike during the Cold War when a number of Nth states depended heavily on the United States for their security, the majority of threshold powers today do not consider the United States to be a staunch ally. Fatalistic projections of a regional conflict spiraling out of control post-1991 were partly based on the perceived inability of the United States to intervene in Nth power conflicts.

Table 6: Nth states in terms of their relationship with the U.S.

Relationship with the U.S.	1981	2007
Major ally	West Germany, Japan	Japan
Potential or actual regional ally	Pakistan, South Korea, Taiwan, Yugoslavia	Taiwan, South Korea
Neutral	Argentina, Brazil, South Africa	Saudi Arabia, Egypt, Turkey[239]
Adversary or adversary of regional ally	Iran, Iraq, Libya, Syria	Iran, Syria, North Korea

Source: The 1981 statistics are extracted from Nacht (1981). The 2007 statistics are the author's compilation based on the list of threshold states.

- It was only during the post-Cold War period that long-term U.S. nuclear supremacy was questioned. While there was a virtual consensus during the Cold War that no one would close the gap with the United States or USSR, China has subsequently been recognized as a country that could potentially attain parity with the United States. Moreover, declining superpower arsenals are also considered a potential incentive for developing countries to try and play 'catch up'.

- The arms control debate is the only aspect that has followed a linear progression over time. The agenda was considered realistic until the mid-1960s. Thereafter, the sentiment grew increasingly somber until the 1980s, when some

[239] While these countries are considered U.S. allies, they are categorized as 'neutral' as the public sentiment in each is overwhelmingly anti-American. If these countries do take the nuclear route, it will certainly be in defiance of the U.S. and perhaps will be an outcome of their dissatisfaction with the United States' ability to provide robust security guarantees against regional adversaries.

commentators even argued that the quest for arms control was counterproductive. By the 1990s, total disarmament was considered unrealistic and concerns were raised regarding deep cuts in superpower arsenals. Minor breakthroughs like the INF Treaty, START I and START II, and SORT have not radically altered projections. The revelations of the global nuclear black market and Iran's attempt to defy its NPT obligations have further reinforced the pessimistic argument, placing the non-proliferation regime under greater pressure. The provision to supply civilian nuclear energy under the NPT seems to have become critical for the first time since the Treaty was instituted in 1970.

Overall, estimates from the intelligence community and, even more so, from academic sources exaggerated concerns regarding nuclear weapons. Although all states that have crossed the nuclear threshold to date were mentioned as Nth states, the accuracy, or lack thereof, of the projections ought to be judged by the fact out of an extremely large pool of states on the suspect list only eight actually went nuclear. Moreover, as already mentioned, the pace of proliferation was miscalculated for most states. By the same token, while the optimism-pessimism debate still continues, the stance of the optimists seems to have been vindicated thus far given that no nuclear strike has taken place in the reviewed period despite modest proliferation. Intelligence sources and a majority of the scholars were largely correct in predicting the inability of the Nth powers to challenge the superpowers. Academic sources were also correct in highlighting the potential for new kinds of threats to the U.S. and the concern about non-state actors in the post-Cold War period. Although much of the focus remained on Russia, nuclear black markets had been correctly projected in the 1990s.

Conclusion: The Nuclear World in 2020

The key characteristics of the most reliable predictive analyses can be used to conjecture the shape of the nuclear world in 2020. First, the role of nuclear weapons in international politics has transformed dramatically since the beginning of the Cold War. Starting with an outright focus on the Cold War rivals, the sole emphasis today is on

proliferation within the developing world. This is likely to continue. Moreover, if the disconnect between reality and projections regarding the nuclear future over the past sixty years is instructive, one could, at most, expect modest paced proliferation until 2020. The nuclear club will remain smaller than that anticipated by the extreme pessimists. The nuclear world in 2020 could resemble the one we live in today. This means that there are unlikely to be any large-scale chain reactions among Asian nuclear and threshold states. Even in the case of North Korea, South Korea and Japan have not shown any signs of reversing their non-nuclear stances in the wake of Pyongyang's 2006 tests.

Moreover, the U.S. role in global politics is likely to be a major determinant of the ultimate pace of proliferation. If threshold states perceive the United States either as an antagonistic power or as an unreliable ally, they are more likely to pursue independent nuclear weapons programs. As for vertical proliferation, American and Russian warheads will likely continue declining at a steady pace, while other nuclear powers will likely remain content will small, diverse nuclear forces. Notwithstanding that fact that the current pessimism regarding the prospects of nuclear war is exaggerated, a larger number of nuclear powers in the developing world will and should continue to be seen as a negative development.

Finally, while a major nuclear incident involving a terrorist organization is by no means a certainty, the menace of nuclear terrorism will become increasingly important over the next decade. The non-proliferation regime will then come under greater pressure. Access to civilian nuclear energy will either end up being curtailed or even more stringent inspections will be introduced for countries running civilian nuclear power plants. At the same time, the dream of global disarmament will remain unfulfilled. Indeed, nuclear weapons appear here to stay.

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