NUCLEAR AGE PEACE FOUNDATION
Committed to a World Free of Nuclear Weapons

A Brief History of Nuclear Proliferation

By Volha Charnysh, NAPF Intern

Introduction

In the last hundred years, life expectancy doubled and many deadly illnesses were eradicated. The world would be a better place to live, had the astonishing scientific discoveries not been devalued with building the atomic bomb – an invention that can destroy life on earth in an instant. Fredrick Soddy, who together with Ernest Rutherford discovered in 1901 that radioactivity involved the release of energy, described an atomic future in which humanity could "transform a desert continent, thaw the frozen poles, and make the whole Earth one smiling Garden of Eden."[1] While the poles are indeed thawing, the earth hardly looks like paradise. Instead, people fear nuclear Armageddon, and the power of the atom is becoming synonymous with death and destruction.

Today, nine states have nuclear weapons and many more can easily acquire those, although only five states are officially recognized as possessing nuclear weapons by the 1968 nuclear Non-Proliferation Treaty (NPT). Those are the United States (1945), Russia (1949), the United Kingdom (1952), France (1960) and China (1964).[2] Three states never joined the NPT but are known to possess nuclear weapons: Israel (n/a), India (1974), Pakistan (1998), and North Korea (2006).[3] Two additional states that present immediate proliferation concerns are Iran and Syria. Citizens of those states have paid a heavy price in taxes and/or sanctions and sacrificed opportunities for economic and educational development to build weapons that can destroy their lives.

---

[1] Richard E. Sclove, "From Alchemy to Atomic War: Frederick Soddy's 'Technology Assessment' of Atomic Energy, 1900-1915," *Science, Technology, & Human Values*, Vol. 14 No. 2 (Spring, 1989), pp. 163-194: 170.

[2] Sources give different estimates of the sizes of their nuclear arsenals. Robert S. Norris and Hans M. Kristensen in the *Bulletin of the Atomic Scientists* estimate that the United States has 5,200 strategic warheads, approximately 2,700 operational warheads and about 2,500 additional warheads in reserve, and an additional 4,200 warheads await dismantlement. Russia's arsenal is estimated to comprise 4,830 nuclear warheads in its operational stockpile, including 2,790 strategic warheads and 2,050 nonstrategic warheads; and an additional 8,150 warheads are estimated to be in reserve or awaiting dismantlement, for a total inventory of approximately 13,000 nuclear warheads. China is said to possess 176 deployed warheads, plus an unknown number of stored warheads, for a total stockpile of approximately 240 warheads. France has approximately 300 strategic warheads. According to the Center for Defense Information, the United Kingdom has 180-200 warheads, out of which 48 are available on patrol at any given time. The estimates are approximate because of the secrecy involved. For more information on the global nuclear arsenals and sources, see Table 1.

[3] The dates used correspond to the dates of the fist nuclear tests in respective countries.

This paper is an overview of the 64years of proliferation history. It is intended to help understand the motives behind the decision to acquire the atomic bomb and grasp the subtle causal relationships between all actors involved in the proliferation chain. Comprehending the politics of proliferation is crucial for devising policy measures to curb the further spread of nuclear weapons.

The nuclear-weapon states recognized under the Nuclear Non-proliferation Treaty

The United States (1945): from Little Boy to the W88.

The vicious circle of proliferation started with today's staunchest non-proliferation exponent - the United States. In October 1939, US President Franklin D. Roosevelt received a letter from scientist Albert Einstein, prompted by Leo Szilard, that Hitler's Germany was working on building an atomic bomb.[4] Stirred by the fear of Nazis acquiring the bomb first, Roosevelt launched a secret effort in cooperation with the United Kingdom.

The program known as the Manhattan Project, directed by US physicist Robert Oppenheimer and General Leslie R. Groves, involved over 30 different research, production, and testing sites. These included both plutonium and uranium enrichment facilities as many paths were pursued in parallel to ensure success and speed up the program. [5] By the end of the war, four different technologies were industrialized, and implosion and enrichment strategies succeeded at about the same time.[6] By the time the United States conducted its first nuclear test in 1945, Germany had surrendered and the threat of a Nazi atomic bomb no longer existed. However, the destructive capabilities of the new weapon were tested again in August 1945 in Japan when a uranium bomb "Little Boy" leveled Hiroshima and a plutonium bomb "Fat Man" devastated Nagasaki.

The war ended, but weapons development did not stop. Once the Soviet Union had become a nuclear power, US President Truman decided to develop a more advanced type of nuclear weapon, the hydrogen bomb. The rationale was that the Soviets would be the first to do it otherwise. This fear – of Nazi Germany, of the Soviet Union, of someone getting a yet bigger bomb – powered the nuclear quests in virtually all countries and was eventually elevated to a strategy of its own – the so-called "mutually assured destruction" (MAD). By 1954, the first "H-bombs" were successfully tested by both countries, but the world hardly became safer. The United States has produced an estimated 66,500 nuclear bombs and warheads of 100 types and modifications for its operational stockpile since 1945.[7] Virtually any part of the Earth's surface is within the reach of the current US arsenal.

[4] Some sources suggest that it was Szilard who authored the famous letter subsequently signed by Einstein. Walter Isaacson, "Chain REACTION," *Discover*, Vol. 29 No. 3 (Mar. 2008), pp. 26-29. Frank Wicks, "NO Einstein," *Mechanical Engineering*, Vol. 128 No. 11 (Nov. 2006), pp. 40-44.
[5] Joel Ullom, "Enriched Uranium versus Plutonium: Choice of Fissile Material," *The Nonproliferation Review*, fall 1994, pp. 1-15: 2.
[6] Ibid.
[7] Robert S.; Norris and Hans M Kristensen, "US nuclear warheads, 1945-2009," *Bulletin of the Atomic Scientists*, Vol. 65 No. 4 (Jul. 2009), pp. 72-81: 72.

Three days after the destruction of Nagasaki, the *New York Times* opined that atomic technology could "bring to this Earth not death but life, not tyranny and cruelty, but a divine freedom." "What dazzling gifts the science which split the atom can offer to the heavily laden everywhere! To take one instance, what cannot this science do for the millions of China and India, bound for so many ages in sweat and hunger to the wheel of material existence," marveled the authors.[8] After the Soviets and the British became nuclear powers, similar idealism combined with pragmatic political considerations brought about a change in US proliferation tactics in 1953. With the introduction of the Atoms for Peace program, which involved sharing peaceful nuclear technology with states that renounced nuclear weapons, the United States embarked on a precarious path of promoting civilian use and discouraging military use of nuclear energy.

In a speech to the United Nations on December 8, 1953 the program's main architect, US President Dwight Eisenhower, conceded that nuclear knowledge would "eventually be shared by others—possibly all others."[9] Ironically, his predictions actualized to a large extent as a result of the program he pioneered. Its positive contribution notwithstanding, the Atoms for Peace program accelerated the global spread of nuclear weapons technology as the United States and the Soviet Union began giving out nuclear research reactors to their friends and allies to establish strategic ties with developing countries in the Cold War frenzy.[10] The United States signed more than 40 nuclear cooperation agreements, including the treaties with apartheid South Africa and Francisco Franco's fascist government in Spain. The Soviet Union assisted China and North Korea. Algeria, Bangladesh, Colombia, the Congo, Ghana, Israel, Jamaica, Peru, Syria, Turkey, and many of Eastern European countries were rewarded with nuclear technology. The United States all but gave nuclear weapons to India by training Indian scientists and providing nuclear materials and technology.[11]

The Soviet Union: 1949

Although in the early 1940s Washington relied on information-sharing with the UK and Canada, it soon became a non-proliferation advocate, proposing the luckless Baruch Plan for international control of nuclear technology and then imposing secrecy on its nuclear program in an attempt to thwart the development of the Soviet bomb. After the Japanese surrender on August 15, 1945, the Soviet Union likewise declared that it favored imposing international control on nuclear weapons. The initial attempts to prevent a nuclear arms race failed, however.

Just as the fear of nuclear Germany spurred the American nuclear program, so the awe of Hiroshima propelled the Soviet nuclear endeavor. Stalin is said to have told the Soviet scientists: "A single demand of you comrades. Provide us with atomic weapons in the shortest possible time. You know that Hiroshima has shaken the whole world. The balance has been destroyed.

---

[8] "One Victory Not Yet Won," *The New York Times*, August 12, 1945.
[9] Dwight D. Eisenhower, Address to the 470th Plenary Meeting of the United Nations General Assembly, Dec. 8, 1953, http://www.iaea.org/About/history_speech.html.
[10] Zia Mian & Alexander Glaser, "A frightening nuclear legacy," *Bulletin of the Atomic Scientists*, Vol. 64 No. 4 (Sep./Oct. 2008), pp. 42-47: 42.
[11] Leonard Weiss, "Atoms for Peace," *Bulletin of the Atomic Scientists*, Vol. 59 No. 6 (Nov./Dec. 2003), pp. 34-44. After India's nuclear weapon test in 1998, the USA imposed economic sanctions on the country – only to lift restrictions the very next year.

Provide the bomb -- it will remove a great danger from us."[12] As Professor of International History David Holloway states, "The decision to build that atomic bomb was a profoundly political decision," intended to secure the country's international prestige and security in the post-war period.[13]

To catch up with the United States, the increasingly isolated Soviet Union launched a full-speed secret nuclear weapons program, putting effort into both the processing and the enrichment paths to the bomb. The Soviet luminaries of science were assisted by a group of German physicists taken to the Soviet Union after Germany's surrender[14] as well as by the Soviet military intelligence.

The crash program to get the bomb as soon as possible whatever the cost succeeded in 1949 when a nuclear device made with plutonium was tested. The uranium route to the bomb worked out shortly afterward, and the first thermonuclear weapon was tested in August 1953. However, the country's future had hardly become safer; in fact, the tests marked the beginning of the Soviet-American strategic arms competition, every year of which would push the world closer to the brink of the nuclear war.

The United Kingdom: 1952

In 1941, following a report that building a fission bomb was scientifically feasible, British Prime Minister Winston Churchill authorized a nuclear weapons program. A couple of years later, Churchill signed an agreement with Roosevelt to join the United States in a larger effort – the Manhattan Project.[15] After the bomb was produced, the United States unilaterally broke its nuclear partnership with Britain in 1946 (McMahon Act), fearing further proliferation. The British immediately advanced on an independent push for the bomb and tested a plutonium-implosion bomb in 1952.

The US and Soviet tests of the hydrogen bomb in 1952 and 1954, respectively, led the British government to launch an effort to also develop thermonuclear weapon, which was successfully tested in 1957. Once it was too late to deter the British from acquiring the weapons capabilities, initial qualms evaporated, and the US-UK cooperation was restored. Subsequent purchase of US submarine missiles further enhanced British nuclear capabilities. The British forces even deployed US tactical nuclear weapons under a NATO provision of nuclear sharing. In 2008 the British arsenal was estimated to comprise 180-200 warheads (48 available on patrol at any given time).[16]

---

[12] Quoted in David Holloway, *The Soviet Union and the Arms Race* (New Haven: Yale University Press, 1983), p. 20.
[13] David Holloway, "Entering the Nuclear Arms Race: The Soviet Decision to Build the Atomic Bomb, 1939-45," *Social Studies of Science*, Vol. 11 No. 2 (May 1981), pp. 159-197: 160.
[14] Dan Charles, "In the Beginning was Uranium...," *New Scientist* (Oct. 1992), p. 30.
[15] "The Future of the United Kingdom's Nuclear Deterrent," Foreign and Commonwealth Office, UK Ministry of Defense Factsheet, Accessed July 1, 2009. www.fas.org/nuke/guide/uk/doctrine/sdr06/FactSheet5.pdf.
[16] "United Kingdom Nuclear Forces," Center for Defense Information, July 9, 2008. http://www.cdi.org/program/issue/document.cfm?DocumentID=2970&IssueID=46&StartRow=1&ListRows=10&appendURL=&Orderby=DateLastUpdated&ProgramID=32&issueID=46. Accessed July 13, 2009.

France: 1960

France had been involved in nuclear research before World War II and resumed its nuclear program, devoted to basic and peaceful scientific research, in the 1950s. However, after three of its former allies acquired the atomic bomb, a secret Committee for the Military Applications of Atomic Energy was formed and a development program for delivery vehicles was launched.

Several factors led to the fateful decision to acquire the bomb. To Charles de Gaulle, producing a French bomb meant answering the question "Will France remain France?"[17] Having suffered a loss of status at the end of WWII, and yet another crushing political defeat by a former colony in the Suez Crisis, Paris decided to reinforce its global status by obtaining an independent nuclear deterrent.

A compounding factor was security considerations. France was losing the Indochina war, and Eisenhower's refusal to assist the isolated French army at Dien Bien Phu in 1954 undermined the credibility of American security guarantees.[18] Germany's renewed sovereignty after WWII was also perceived as a threat to French security.[19]

Powered by pride and fear, the French nuclear weapons drive succeeded in 1960 when a device using a byproduct of the civilian program – plutonium – was exploded. "Hurray for France! From this morning she is stronger and prouder!" With these words de Gaulle greeted the first French nuclear test.[20] France conducted a total of 192 tests and currently possesses approximately 300 warheads.[21]

China: 1964

Nuclear anxiety quickly spread across Europe. In the 1950s most wealthy industrialized countries, including Italy and Sweden, began to explore the nuclear option. Anxious about the nuclearization of the West, China signed an agreement with the Soviet Union whereby Beijing supplied uranium ore in exchange for the Soviet technical assistance in developing nuclear weapons. In 1953 China established a research program under the guise of civilian nuclear energy.

Initially, the Chinese decided to pursue both the enriched uranium and plutonium routes, but after the Soviet aid was cut off in 1960, scarcity of technical expertise and financial resources dictated that the more developed enrichment route be continued. China tested an atomic bomb using highly enriched uranium (HEU) in 1964. The first plutonium explosion came in 1968. China has also presumably tested a hydrogen bomb.

---

[17] Barry O'Neill, "Nuclear Weapons and National Prestige," Yale University, Cowles Foundation Discussion Papers, No. 1560. http://ideas.repec.org/p/cwl/cwldpp/1560.html Accessed July 1, 2009.

[18] Avery Goldstein, *Deterrence and Security in the 21st century: China, Britain, France, and the Enduring Legacy of the Nuclear Revolution* (Stanford: Stanford UP, 2000), pp. 189-91.

[19] Jacques Hymans, *Psychology of Nuclear Proliferation* (Cambridge: Cambridge UP, 2006).

[20] Marcel Duval and Dominique Mongin, *Histoire des forces nucleaires francaises depuis 1945*, (Paris: Presses Universitaires de France, 1993), p. 46.

[21] Robert S Norris and Hans M. Kristensen. "French Nuclear Forces, 2008," *Bulletin of the Atomic Scientists*, Vol. 64 No. 4 (Sep./Oct. 2008), pp. 50–53.

Like the Soviet Union, China viewed the atomic bomb as addressing an existential threat. The country's fears were far from groundless. At the time, serious proposals to bomb China to prevent it from stockpiling nuclear weapons circulated Washington. In 1965, a *National Review* editorial, "Should We Bomb Red China's Bomb?," warned of a possibility of a ship carrying "a Chinese bomb into the harbors of New Orleans, San Francisco, New York, or London."[22]

The Nuclear Non-Proliferation Treaty: 1968

Rampant proliferation was slowed once the NPT, seeking to inhibit the spread of nuclear weapons, entered into force in 1970. Out of the treaty's 189 signatories, five "manufactured and exploded a nuclear weapon or other nuclear explosive device prior to 1 January 1967" (the United States, Russia, the United Kingdom, France, and China) and are therefore recognized as nuclear weapon states.[23] The NPT contains their commitments neither to transfer nuclear weapons nor to assist nonnuclear weapon states in acquiring nuclear weapon capabilities. Only four recognized sovereign states are not parties to the treaty: India, Israel, Pakistan, and North Korea. All four acquired nuclear weapons after 1967 and would have to dismantle their nuclear weapons and place their nuclear materials under international safeguards to join the NPT – a unique route so far followed only by South Africa.

The treaty was proposed by Ireland and Finland and consists of a preamble and 11 articles that focus on non-proliferation, disarmament, and the right to peaceful use of nuclear technology. The NPT's Article VI stipulates that "[e]ach of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament."[24] The treaty recognizes the inalienable right of sovereign states to use nuclear energy for peaceful purposes, provided this right is exercised in conformity with Articles I and II. Article X allows a state to leave the NPT if "extraordinary events, related to the subject matter of this Treaty, have jeopardized the supreme interests of its country," giving three months' notice with reasons for leaving.

At the time the treaty was being negotiated, the United States had secret nuclear weapons sharing agreements with other NATO states. In 2005 Bulletin of the Atomic Scientists estimated that the United States still provided about 180 tactical B61 nuclear bombs for use by Belgium, Germany, Italy, and the Netherlands and Turkey.[25] NATO officials deny violating the NPT[26] and stress that no nuclear weapons have ever been given over to non-US control.

Initially conceived to last 25 years, the NPT was extended indefinitely in 1995 and is reviewed

[22] Cited in Gordon H. Chang, "JFK, China, and the Bomb," *The Journal of American History*, Vol. 74, No. 4 (Mar. 1988), pp. 1287-1310: 1287.
[23] The NPT, Article IX, http://www.armscontrol.org/documents/npt. Accessed July 1, 2009.
[24] Ibid., Article VI.
[25] Hans M. Kristensen, "US Nuclear Weapons in Europe: A Review of Post-Cold War Policy, Force Levels, and War Planning," *National Resources Defence Council* (Feb. 2005).
[26] Article I prohibits transferring "nuclear weapons or other nuclear explosive devices or control over such weapons or explosive devices." Article II prohibits "receiv[ing] the transfer from any transferor whatsoever of nuclear weapons or other nuclear explosive devices or of control over such weapons or explosive devices."

every five years. At the Seventh Review Conference in May 2005, there were stark differences between the United States, which wanted the conference to focus on non-proliferation, and most other countries, which emphasized the lack of serious nuclear disarmament by the nuclear powers. Their views were expressed by the representative of Ghana at the UN General Assembly in 2006. Speaking on behalf of the Non-Aligned Movement and the African Group, he said that "[w]ithout tangible progress in disarmament, the current emphasis on non-proliferation cannot be sustained."[27]

The treaty helped to roll back nuclear weapons programs in Argentina, Brazil, Taiwan, South Africa and South Korea, but has faced mounting challenges in the past two decades. Iraq was cited by the IAEA and sanctioned by the UN Security Council for violating its NPT safeguards obligations; North Korea withdrew from the NPT and tested multiple nuclear devices; Iran did not comply with the NPT safeguards and Libya pursued a covert nuclear weapons program. The next Review Conference to be held in May 2010 is crucial to addressing the mounting challenges to the nuclear non-proliferation regime.

De-facto Nuclear-Weapon States

India: 1974

Peaceful technology sharing under the Atoms for Peace in the 1950s has become "the bedrock" for the Indian nuclear program, as Homi Sethna, chairman of the Indian Atomic Energy Commission from 1972-83, acknowledged.[28] More than 1,000 Indian scientists have participated in US nuclear energy research projects from 1955-1974, [29] and the United States assisted India in building and fueling the Tarapur reactors.[30] Signing the Atoms for Peace program agreement, India specifically insisted on a clause not to exclude "peaceful explosions."[31] Had the initial efforts been aimed at producing the bomb,[32] the Indian test would certainly have come before 1974,[33] but the country focused on civilian use of nuclear power and advocated against nuclear weapons proliferation. In the 1950s, as nuclear weapons were routinely tested, India's first prime minister, Jawaharlal Nehru, called for an end to all nuclear weapons testing.[34] India participated in the negotiation of the NPT, but refused to join, criticizing it as discriminatory.

---

[27] "Thousands of nuclear weapons on high alert makes mockery of disarmament progress, with non-proliferation threatened by lopsided approach, first committee told. World Risks Return To Unregulated Competition For Nuclear Weapons Unless Non-Proliferation Norm Reinforced," Sixty-first General Assembly. First Committee; 6th Meeting (AM), Oct. 6, 2006. http://www.un.org/News/Press/docs/2006/gadis3322.doc.htm

[28] Homi Sethna, "Opening the Door to Nuclear Development," Atoms for Peace, p. 102. Cited in Weiss, 44.

[29] Weiss, 44.

[30] J. A. Yager, ed., *Non-proliferation and US Foreign Policy* (Washington, DC, Brookings Institution, 1980), p. 216. Cited in Weiss, 44.

[31] Joseph S. Nye, Jr., "New Approaches to Nuclear Proliferation Policy," *Science*, New Series, Vol. 256 No. 5061 (May 29, 1992), pp. 1293-1297: 1294.

[32] G. G. Mirchandani, *India's Nuclear Dilemma* (New Delhi: Popular Book Services, 1968), pp. 3-7. Cited in Ullom.

[33] The development of reprocessing technology made sense in light of the Indian vision, shared by most other states at the time, of succeeding generations of breeder reactors. G. G. Mirchandani and P. K. S. Namboodiri, *op. cit.*, pp. 33, 71 and Leonard Spector, *Nuclear Proliferation Today,* (New York: Vintage Books, 1984), p. 30. Cited in Ullom.

[34] Jaswant Singh, "Against Nuclear Apartheid," *Foreign Affairs,* Vol. 77 No. 5 (Sep. / Oct. 1998), pp. 41-52.

How did a decision to build the bomb spring in a country that revers Mahatma Gandhi? As Indian politician Jaswant Singh argues in his article "Against Nuclear Apartheid," the rise of China, continued strain with Pakistan, and the fact that the five "nuclear weapon states showed no signs of moving decisively toward a world free of atomic danger" made the 1980s and 1990s a greatly troubling period for India.[35] A successful nuclear test in China in 1964, which had attacked India on its Himalayan border two years before, was the last straw needed to spur Indian efforts to research and design nuclear weapons. In 1965, the second war between India and Pakistan broke out, strengthening the case for developing nuclear weapons. The desire to boost its position in the 1971 Indo-Pakistani War motivated India to test a nuclear device in 1974.[36] Ironically, plutonium for this explosion was produced by an unsafeguarded Canadian reactor using the heavy water sold to India by the United States in the 1960s. The reaction of the US Congress to the Indian nuclear tests resulted in amendments to the US Atomic Energy Act of 1954, which prohibited the United States from providing additional nuclear assistance to India and a few other states.

Even after the first nuclear test, India claimed the peaceful character of its nuclear program and even allegedly halted research. When the time came, however, the country easily reverted from power generation to producing weapons. The second series of nuclear tests, known as Operation Shatki, was conducted in 1998 – within months of Pakistan's missile tests. The incumbent Bharatiya Janata Party (BJP) vowed not to compromise India's national sovereignty and security: "We do not wish to see India blown apart by Pakistan or China because we did not possess the deterrent nuclear power."[37] Another aspect of India's decision to build the bomb was pride, as often happens in post-colonial countries. "We don't want to be blackmailed […]. Nuclear weapons will give us prestige, power, standing. An Indian will talk straight and walk straight when we have the bomb," a Bharatiya Janata Party spokesman said in 1993.[38] Thus, desires to redress perceived discrimination and improve national security in precarious political environment provided an impetus to build the bomb.

Israel: 1979?[39]

Israel probably developed nuclear capabilities in late 1960s,[40] receiving its nuclear weapons production facilities from the French firms[41] allegedly "acting with the blessings of their government."[42] The Suez crisis in 1956 reinforced both Israel's determination to acquire nuclear weapons and France's inclination to provide the necessary technology.[43] The Israelis asked for a

[35] Ibid.
[36] "India's Nuclear Weapons Program—India's First Bomb: 1967– 1974," *Nuclear Weapons Archive*, Mar. 30, 2001, http://nuclearweaponarchive.org/India/IndiaFirstBomb.html. Accessed July 1, 2009.
[37] Krishna M. Bhatta and Mahesh Mehta, the Bharatiya Janata Party, "Policy On Major Issues: Nuclear Issue," http://nuclearweaponarchive.org/India/BJPPolicy.txt. Accessed June 28, 2009.
[38] George Perkovich, "Nuclear Proliferation," *Foreign Policy*, No. 112 (fall 1998), pp. 12-23: 16.
[39] The date of the Vela Incident, an unidentified double flash of light detected by US Vela satellite on 22 September 1979, which is thought to be the result of a joint South African-Israeli nuclear test. Thomas C. Reed and Danny B. Stillman, *"The Nuclear Express: A Political History of the Bomb and its Proliferation,"* (MBI Publishing Co., 2009).
[40] Nye, 1293.
[41] Avner Cohen, *Israel and the Bomb* (New York: Columbia Universty Press, 1998), p. 45. Cited in Weiss, 44.
[42] Ullom, 5.
[43] Leonard Spector, *The Undeclared Bomb* (Cambridge: Ballinger, 1988), p. 168.

natural uranium-fuelled, heavy-water moderated reactor to take advantage of their indigenous uranium deposits.[44] The French-Israeli cooperation resulted in construction of a reactor and reprocessing facility at Dimona, Israel.

The country has not publicly conducted a nuclear test, and its arsenal – believed to consist of 75 to 200 weapons, comprising bombs, missile warheads, and possibly non-strategic (tactical) weapons[45] – has never been officially confirmed or denied. At the same time, Israel officially declared that it will not be the first state to introduce nuclear weapons into the Middle East. The state has insisted on maintaining this policy even after its nuclear secrets were leaked to a British newspaper by technician Mordechai Vanunu.[46] The US government pursued a policy of silence towards the Israeli nuclear weapons program.

Israel founder Ben-Gurion's decision to develop nuclear weapons was taken up as a matter of national survival. However, if an Arab state should acquire nuclear weapons, the risk a nuclear confrontation in the Middle East will grow exponentially.

Pakistan: 1998

Pakistan's program began in the mid-1950s with Islamabad's participation in the Atoms for Peace initiative.[47] India's 1974 testing of a nuclear "device" gave new momentum to Pakistani nuclear aspirations. An independent nuclear deterrent seemed necessary because Pakistan's conventional forces were significantly weaker than its neighbor's, as was proven by Pakistan's defeat in the 1971 war with India. As Ali Bhutto, who established the Pakistani nuclear program in 1972, remarked, people would "eat grass" to keep up with India.[48]

The French suspended their contracts with Islamabad in 1977 in response to US pressure. However, Pakistani nuclear program was revitalized in 1975 when Dr. Abdul Qadeer Khan, a German-trained metallurgist, returned to the country. Previously employed by a contractor at the European Urenco enrichment consortium, Khan used stolen centrifuge designs to develop a large, unsafeguarded centrifuge plant at Kahuta.[49] Under Khan's direction, a clandestine proliferation network of materials, knowledge, and machines from Pakistan to Libya, Iran, and North Korea developed.[50]

---

[44] Ullom, 5.

[45] Robert S. Norris and Hans M. Kristensen. "Israeli nuclear forces, 2002." *Bulletin of the Atomic Scientists,* September/October 2002, pp. 73-75; "Nuclear Weapons: Who Has What at a Glance**,"** Strategic Arms Control and Policy Fact Sheet, Oct. 2007, *Arms Control Association,* http://www.armscontrol.org/factsheets/Nuclearweaponswhohaswhat. Assessed July 13, 2009.

[46] Nye, 1295.

[47] Weiss, 44.

[48] William Epstein, "Why states go- and don't go- nuclear," *Annals of the American Academy of Political and Social Science*, Vol. 430, *Nuclear Proliferation: Prospects, Problems, and Proposals* (Mar. 1977), pp. 16-28: 19.

[49] An entire plant for producing the process gas UF6 was smuggled from Germany. US Congress, Senate, *Hearing before the Subcommittee on Energy, Nuclear Proliferation, & Federal Services of the Committee on Governmental Affairs*, 96th Cong., 1st sess., May 1, 1979. See also US Congress, House of Representatives, *Hearing Before the Subcommittees on Asian & Pacific Affairs and on International Economic Policy and Trade of the Committee on Foreign Affairs*, 100th Cong., 1st sess., July 22, 1987. Cited in Ullom, 7.

[50] "A Brief History of Pakistan's Nuclear Program, *Federation of American Scientists,* http://www.fas.org/nuke/guide/pakistan/nuke. Accessed June 25, 2009.

The US Congress passed the Pressler Amendment in 1985, prohibiting US assistance to Pakistan unless it was proven that the state possessed no nuclear explosive devices. But even after the 1987 interview with an Indian journalist, in which Khan stated that Pakistan had the ability to produce nuclear weapons,[51] the United States, waging war in Afghanistan, continued to ignore on Pakistani capabilities. Only in 1990 was the US economic and military aid cut off and sanctions to deter the country from developing nuclear weapons enacted.[52] The United States took the matter even more seriously after Indian explosions in May 1998,[53] but it was too late. Only two weeks after the Indian testing, Pakistan announced that it had successfully conducted five nuclear tests.[54]

North Korea: 2006

North Korea was harboring plans to get the bomb early on and may have been prodded by South Korean nuclear venture. While the IAEA Board of Governors never made a formal finding of South Korea's noncompliance,[55] Seoul did enrich uranium to levels near weapons grade. South Korea said it had voluntarily reported an isolated activity,[56] and was not punished in the end, but the consequences of decisions of all the countries involved will continue to reverberate.[57] North Korean nuclear aspirations are also linked to the need for development assistance and, more importantly, prestige. Even when negotiating the halt its nuclear program, the North demands that the world call it a nuclear state to increase its international importance.[58]

North Korea acceded to the NPT in 1985 and, after South Korea announced that no US nuclear weapons existed on its territory, signed the IAEA safeguards agreement.[59] In 1991 the state joined the United Nations and entered into a denuclearization agreement with its southern neighbor. Because of these positive developments, no alarms sounded when a nuclear fuel

---

[51] Christopher C. Lary, "A.Q. Khan and the limits of the non-proliferation regime," 2005 NPT Renewal Conference, Disarmament Forum, http://www.unidir.org/pdf/articles/pdf-art2188.pdf Accessed July 6, 2009.
[52] Robert M. Hathaway, "Confrontation and Retreat: The US Congress and the South Asian Nuclear Tests," *Arms Control Association*, http://www.armscontrol.org/act/2000_01-02/rhchart. Accessed July 5, 2009.
[53] Farzana Shaikh, "Pakistan's Nuclear Bomb: Beyond the Non-Proliferation Regime," *International Affairs (Royal Institute of International Affairs 1944-)*, Vol. 78, No. 1 (Jan. 2002).
[54] Michael Tkacik, "Pakistan's Nuclear Program," Conference Papers -- Southern Political Science Association; 2008 Annual Meeting, p. 1.
[55] "Exposing Nuclear Non-compliance," *Survival*, Vol. 51 No. 1 (Feb. 2009), pp. 143 - 164.
[56] Jungmin Kang, Peter Hayes, Li Bin, Tatsujiro Suzuki and Richard Tanter, "South Korea's nuclear surprise: as more and more countries adopt the IAEA's Additional Protocol, all kinds of nuclear secrets will come spilling out. Currently under microscope: South Korea," *Bulletin of the Atomic Scientists*, (Jan. 1, 2005).
[57] "The official position is that "it was a one-time experiment conducted without government authorization and it was geared toward the country's nuclear energy program". Ironically, "without the authorization or knowledge of the government" was also an explanation offered by Pakistan in explaining the rogue activities of Dr A. Q. Khan in the realm of global nuclear proliferation." Ehsan Ahrari, "Nuclear genie out of S Korean bottle," *Asia Times*, Sep. 8, 2004. http://www.atimes.com/atimes/Korea/FI08Dg05.html. Accessed July 5, 2009.
[58] The US Forces Joint Command (JFCOM) listed North Korea as a nuclear power in 2008 document, subsequently issuing a clarification regarding the nuclear status of North Korea, stating that this does not reflect US policy. Kang Hyun-kyung, "N. Korea Links Nuclear Status to National Prestige," *The Korea Times*, Apr. 5, 2009, http://www.koreatimes.co.kr/www/news/special/2009/06/180_44330.html. Accessed June 25, 2009.
[59] Daniel Poneman, "The History of the 1994 Agreed Framework," Information Brief, The Forum for International Policy, Mar. 7, 2003.

reprocessing facility appeared at its Yongbyon plant in 1989.[60] Tensions reemerged only when the IAEA inspections uncovered troublesome information on the North's programs. Since then a one-step-forward and one-step backward dance became a continued pattern of action between the international community and North Korea until the nuclear club expanded yet again as North Korea detonated a nuclear weapon in October 2006. On May 25, 2009, the country conducted a second nuclear test, in violation of UNSC resolution 1718. The state pulled out of multilateral talks on its nuclear activities, and is believed to possess 5-15 warheads.[61]

Immediate Nuclear Proliferation Risks

Iran

Like many other nuclear aspirants, Iran is a legatee of the Atoms for Peace program and has a US-supplied research reactor and a power plant built with foreign assistance. Its interest in nuclear technology began in the 1950s with Shah Mohammad Reza Pahlavi's efforts to transform Iran into a modern state with a "full-fledged nuclear power industry." Although His Imperial Majesty insisted on the peaceful use of nuclear technologies, his minister of court recounted that the Shah had "a great vision for the future of this country which [...] probably include[d] manufacturing a nuclear deterrent."[62]

Having concluded several nuclear deals with France and West Germany in the 1970s, Iran continued to face US opposition until a US-Iranian nuclear agreement was signed in 1978, imposing a US veto on indigenous reprocessing and providing alternative suggestions for handling spent fuel. However, in 1979 the Iranian Revolution nullified the nuclear agreement and the nuclear program, along with the Shah himself.

The same nationalism that led the Shah to reject proposals for multinational nuclear facilities inspires Iran's current leadership to demand honoring Tehran's nuclear "rights" under the NPT.[63] The US antipathy toward post-1979 Iran and the presence of Israeli nuclear arsenal next door has only increased the country's interest in acquiring an independent nuclear deterrent.

In 2005, Ayatollah Ali Khamenei issued a fatwa forbidding the production and use of nuclear weapons, which, however, failed to dispel international concerns over Iran's objectives. If thirty years ago the world questioned Iran's need for indigenous reprocessing, today it is Tehran's enrichment program that makes headlines. Iran's increasing ability to produce highly enriched uranium is no longer questioned, although experts disagree on how long it would take Tehran to

[60] Ibid.
[61] "North Korean Nuclear Arsenal (DPRK)," Center for Defense Information, May 9, 2008. http://www.cdi.org/program/issue/document.cfm?DocumentID=3950&IssueID=46&StartRow=1&ListRows=10&appendURL=&Orderby=DateLastUpdated&ProgramID=32&issueID=46.
Accessed July 13, 2009.
[62] Asadollah Alam, *The Shah and I* (New York: St. Martin's Press, 1993) p. 353. See also comments by Akbar Etemad in Maziar Bahari, "The Shah's Plan Was to Build Bombs," *New Statesman*, September 11, 2008, available at www.newstatesman.com/print/200809110030.
[63] Iran's demands are supported by the Non-Aligned Movement. See, for example, Arshin Adib-Moghaddam, *Iran in World Politics: The Question of the Islamic Republic* (New York: Columbia University Press, 2008), pp. 76–77; Ervan Abrahamian, *A History of Modern Iran* (Cambridge: Cambridge University Press, 2008), p. 195.

weaponize it. In 2003, the IAEA investigation concluded that Iran had systematically failed to meet its obligations under the NPT safeguards agreement. No evidence of links to a nuclear weapons program was found, however.

Syria

The nuclear program of Syria, a party to the NPT and a signatory to the IAEA standard safeguards agreement, came as yet another unpleasant surprise to the world. Syria allegedly began a military nuclear program in 1979, claiming that it was interested in nuclear research for medical rather than military purposes. However, the Syrian research reactor could also serve as an important step toward the building of a nuclear weapon. In September 2007, Israel bombed a Syrian facility believed to have been a nuclear reactor under construction with North Korean assistance.[64] Syrian officials denied that the facility was nuclear related.

States that gave up nuclear weapons capabilities

While the number of nuclear-armed states has grown from five to nine since the NPT was signed, many more countries have abandoned their nuclear ambitions and arsenals— Argentina, Brazil, South Africa, Ukraine, Belarus, and Kazakhstan among them. Understanding their choices may be instructive for finding ways to dissuade other nuclear weapons hopefuls.

South Africa

South Africa rolled back its uranium-based nuclear weapons program after 15 years of efforts toward the bomb. The state joined the NPT and concluded a comprehensive safeguards agreement with the IAEA in 1991. Acceding to the NPT did not require Pretoria to publicly disclose its nuclear past. Why did the country first secretly launch a nuclear weapons program and then unilaterally and voluntarily dismantle its fully-fledged nuclear arsenal?

South Africa's interest in developing a nuclear program was born when the United States and Britain hurried to secure its abundant uranium reserves for the Manhattan Project. In the late 1950s, Pretoria established an indigenous civilian nuclear research program. Its efforts were assisted by the participation in the Atoms for Peace program. South Africa received a safeguarded SAFARI I research reactor from the United States. It is also reported to have received enrichment assistance from the German firm STEAG.[65]

In 1974, South Africa's Prime Minister John Vorster approved development of a nuclear explosive capability.[66] Just how peaceful South African initial intentions were in reality is still disputed, however. Significantly, South Africa did not sign the NPT and increased its defense expenditures six-fold between 1961 and 1968, as physicist Joel Ullom points out. [67]

[64] "06 September 2007 Air strike," *Global Security*, http://www.globalsecurity.org/military/world/war/070906-airstrike.htm. Accessed June 26, 2009.
[65] David Fischer, "Reversing Nuclear Proliferation: South Africa," *Security Dialogue* 24 (1993), p. 276.
[66] J. W. de Villiers, Roger Jardine and Mitchell Reiss. "Why South Africa Gave up the Bomb," *Foreign Affairs* (Nov./Dec. 1993), p. 99.
[67] Ullom.

Political developments in the 1970s catalyzed Pretoria's nuclear ambitions giving them less civilian coloration as South Africa's relations with the outside world deteriorated due to the mounting international concern over apartheid. South Africa's participation in the UN General Assembly was suspended; the Security Council had imposed a mandatory weapons embargo and voluntary oil embargo on the country; Pretoria was denied a seat on the IAEA's Board of Governors and participation in its General Conference.[68] With the build-up of Cuban forces in Angola in 1975, South Africa started to fear Soviet expansion to southern Africa and was well aware that the Western governments were unlikely to come to its aid. Beleaguered by these problems, the country persisted along the nuclear path, and by the 1990s it assembled several nuclear weapons, however inferior.

Luckily, political realities changed with the end of the Cold War, the collapse of the Soviet Union, and the withdrawal of Cuban forces from Angola. A nuclear deterrent has become an unnecessary political liability while the country's accession to the NPT was seen as a chance to improve its international relations.[69] As a result, South Africa disclosed its nuclear weapons program, dismantled its arsenal and acceded to the NPT.

South Africa's decision establishes a precedent to be followed by other states if, like Pretoria, they realize that nuclear ambitions are counterproductive to achieving a nation's political, military and economic objectives.

Brazil and Argentina

Brazil and Argentina also benefited from the increasing openness surrounding nuclear technology and in the 1970s developed civilian nuclear facilities, keeping the option of weapons production open.

In Brazil, which possesses the world's largest uranium reserves, first experiments with nuclear fission go back to the 1930s. However, the country's curiosity about the atom grew into earnest efforts to master nuclear technology only after Argentinean president Juan Perón's erroneous claim to have mastered thermonuclear fusion in 1951.[70] In response, Brazil launched a full-scale nuclear program, comprising a secret military project pursued in the shadow of its civilian nuclear program.[71] Under a 1955 Atoms for Peace cooperation agreement, the country purchased several research reactors and three centrifuges[72] and began to eagerly train its technicians and physicists in the United States and Germany.[73] The world gasped at its 1975 agreement with West Germany for a complete nuclear fuel cycle, including plants for uranium enrichment and reprocessing. In the end, the United States persuaded West Germany to require safeguards.[74]

---

[68] J. W. de Villiers, et. alia, 101.
[69] Ibid.
[70] John R. Redick, "Nuclear Illusions: Argentina and Brazil," Henry L. Stimson Center Occasional Paper, No. 25, Dec. 1995.
[71] Ullom, 8.
[72] David Albright, "Bomb Potential for South America," *Bulletin of the Atomic Scientists* (May 1989), pp. 16-20: 20.
[73] Leonard Spector and Jacqueline Smith, *Nuclear Ambitions* (Boulder: Westview Press,1990), p. 64.
[74] Sharon Squassoni and David Fite, "Brazil's Nuclear History," *Arms Control Today,* Oct. 2005.

Military application of the country's growing nuclear skills was advocated in 1978 by a frigate captain, Othon Pinheiro da Silva, who also studied nuclear power in the United States. The captain advocated mastering the nuclear fuel cycle and developing submarine reactors, which led to building a centrifuge plant to enrich uranium.[75] Developing nuclear weapons was a second objective of the Brazilian military, as was confirmed by former Brazilian President José Sarney in August 2005.[76]

In Argentina, a formal decision to make a bomb was never made. However, while under military rule (1973-83), Argentina defended its right to develop any atomic technology, including weapons, and refused to ratify the Treaty of Tlatelolco, which bars nuclear weapons in Latin America, and sign the NPT. The nuclear program served as a source of Argentina's national pride, and the country aspired to remain as self-sufficient as possible in developing nuclear capabilities. Although Argentina's three power reactors were purchased from abroad, they incorporated many locally manufactured parts and the country's natural uranium-fueled designs were selected, in part, to avoid relying on foreign enrichment.[77] Argentina's nuclear pattern reveals the country's reaction to the nuclear efforts in Brazil, its military and political rival of 60 years. The country reached capability to produce fissile material and stopped its efforts on the very brink of producing nuclear weapons, ensuring the ability to easily catch up with nuclear developments in neighboring Brazil.

Nuclear superiority was viewed as ensuring "political mastery of the Southern Cone and beyond,"[78] and the competition between the two countries quickly escalated. Luckily, with the change of governments in both states, Brazil and Argentina increased transparency in their nuclear programs and discontinued its military branches. The two countries signed an agreement in 1991 providing for mutual inspections of each other's facilities and prohibiting the production of nuclear explosives. The Brazilian-Argentinean Agency for Accounting and Control of Nuclear Materials (ABACC) was established, and the former adversaries proceeded to defuse international anxiety over their nuclear programs by agreeing to full-scope safeguards applied by the ABACC and the IAEA under the Quadripartite Safeguards Agreement.

However, in May 2006, with opening a new centrifuge facility at the Resende nuclear plant, Brazil quietly opened the door into the nuclear club, as it is now capable of enriching indigenous uranium.[79] Brazilian scientists claimed that their centrifuges are 25 times more efficient than those in France or the United States and promised to meet all of Brazil's nuclear energy needs within a decade. Tortuous negotiations with the IAEA notwithstanding,[80] Brazil's act caused

[75] *Folha de Sao Paulo*, Oct. 25, 1990, p. A3; in FBIS-LAT-90-211 (31 Oct. 1990), p. 24. Cited in Ullom.
[76] Daphne Morrison, "Brazil's Nuclear Ambitions, Past and Present," Issue Brief, NTI, Sep. 2006. http://www.nti.org/e_research/e3_79.html Accessed July 20, 2009.
[77] Cheaper bids for designs requiring enriched uranium fuel were ignored in at least one case. Cynthia Watson, "Argentine Nuclear Development: Capabilities and Implications," Ph.D. diss.,University of Notre Dame, 1984, p. 71. Cited in Ullom, 14.
[78] Squassonie, et. al.
[79] Steve Kingstone, "Brazil joins world's nuclear club," *BBC News*, 6 May 2006. http://news.bbc.co.uk/2/hi/americas/4981202.stm. Accessed July 25, 2009.
[80] Brazil did not grant IAEA inspectors full access to its facilities, but agreed to a system of safeguards precluding it from advancing to weapons production.

little ado in the international community, as all eyes were focused on the nuclear aspirations of less predictable North Korea and Iran.

Ukraine, Belarus, and Kazakhstan

The cases of Ukraine, Belarus, and Kazakhstan – while often considered unique –represent a development that could recur in the future: the collapse of a nuclear weapon state. In the early 1990s, to help eliminate and secure excess Soviet nuclear weapons, Senators Sam Nunn and Richard Lugar proposed the Cooperative Threat Reduction (CTR) program. The CTR provided funds necessary to redirect Soviet nuclear workers as well as to destroy, disable, transport, and safeguard nuclear and other non-conventional weapons thereby reducing opportunities for their proliferation.[81] Although the cases of three former Soviet states cannot be projected directly on other states (since none of three aspired to join the nuclear club), the lessons learned in the process of securing the Soviet "loose nukes" are crucial to addressing current proliferation threats increasingly arising from nonstate actors.

These three states inherited parts of the Soviet nuclear arsenal, including nuclear expertise, and the fate of at least one of these countries – Ukraine – was far from certain. However, all three states became parties to the 1991 Strategic Arms Reduction Treaty (START) between the United States and the Soviet Union and joined the NPT as nonnuclear states. In July 1990, before the dissolution of the USSR (and thus the official increase of nuclear powers by three) shocked the western world, Belarus and Ukraine had voluntarily pledged nonnuclear status in their declarations of independence.

Having endorsed the NPT from the outset, Belarus signed the Lisbon Agreement in May 1992 and followed through with formal accession to the NPT in July 1993. It was proud to have been the first former Soviet state to join the non-proliferation regime and celebrated the removal of 81 road-mobile SS-25s[82] from its territory with pomp. Receiving compensation for the removed weapons was never on top of its agenda, although it was eventually rewarded for compliance.

By contrast, Ukraine's nuclear ambivalence and frequent suspension of the weapons' transfer process gave Russian and American policymakers many reasons to worry. In 1992, Kiev took ownership of the Soviet nuclear arsenal on its territory, claiming that the Soviet deterrent was created with resources of many republics and therefore belonged to all of them. The Ukrainian Rada deputies repeatedly rejected Ukraine's membership in the NPT, kept demanding greater security guarantees and greater compensation from Russia and the West, and eventually threatened to retain the weapons or even sell them to the highest bidder.[83] Ukraine placed after-the fact conditions on the Lisbon Protocol to the START I Treaty, which committed the country, along with Belarus and Kazakhstan, to nonnuclear status "in the shortest possible time,"[84] and

[81] "Cooperative Threat Reduction," Defense Threat Reduction Agency, http://www.dtra.mil/oe/ctr/index.cfm. Accessed July 15, 2009
[82] Belarus Profile, NTI. http://www.nti.org/e_research/profiles/Belarus/index.html. Accessed July 13, 2008.
[83] Thomas Bernauer, Stefan Brem, and Roy Suter, "The Denuclearization of Ukraine" in Bernauer, Ruloff, *The Politics of Positive Incentives in Arms Control* (Columbia: University of South Carolina Press, 1999), pp. 111-156: 119.
[84] "Lisbon Protocol to the START I Treaty," US Department of State, http://www.state.gov

renounced freshly concluded Massandra Accords, which, among other things, reaffirmed its nonnuclear status.[85]

However, the problems were solved in 1994 when Ukraine signed the Trilateral Agreement with Russia and the United States. In the end, the "problem child" was handsomely rewarded. As American diplomat Mitchell Reiss noted, "For weapons that Ukraine did not control and had not built, it received (twice) American, Russian, and British security assurances, one hundred tons of nuclear fuel, forgiveness of its multibillion-dollar oil and gas debt to Russia, and a commitment of $900 million in US financial assistance."[86]

Kazakhstan also adopted tactics of ambiguity about the nuclear arsenal on its territory. [87] Although its decision to accede to the NPT and transfer the weapons to Russia was a result of complex internal and external processes,[88] the three main factors that helped secure its nonnuclear status are considerable financial compensation, security guarantees from other nuclear states, and the need to establish political ties with the West. [89]

Libya

A more recent success in non-proliferation was Libya's renouncement of its nuclear program in December 2003. A surprise to the rest of the world, the declaration followed nine months of secret negotiations between the Libyan leader Muammar Qadhafi, the United Kingdom, and the United States and was prompted by the interception of enrichment centrifuges shipped to Libya. It is estimated that the state was 3-7 years away from acquiring a nuclear weapons capability.

Libya embarked on a nuclear weapons program in the 1970s, in response to the Israeli nuclear program and, ironically, at the same time that it acceded to the NPT. The country procured technological resources through the clandestine nuclear network of Pakistani scientist A. Q. Khan, but was held up by inadequate resources and infrastructure. As a reward for giving up its nuclear weapons, in September 2004 the United States lifted economic sanctions on Libya.

/t/isn/rls/fs/ 2001/3523.htm. Accessed May 2, 2008.

[85] Bernauer, et.al, pp. 121-23.

[86] Mitchell Reiss, *Bridled Ambition: Why Countries Constrain Their Nuclear Capabilities* (Washington, D.C.: Woodrow Wilson Center Press, 1995), 129.

[87] Maria Zaitseva, "Giving Up the Bomb: In Search of a Model Describing States' Nuclear Behavior," *Paper presented at the annual meeting of the American Political Science Association, Hilton Chicago and the Palmer House Hilton, Chicago, IL*, Sep 02, 2004, http://www.allacademic.com/meta/p60078_index.html, pp. 25-26. Accessed July 29, 2009.

[88] Togzhan Kassenova, "Kazakhstan's Denuclearization: The Decision-Making Process and Lessons for the Future," *Paper presented at the annual meeting of the ISA's 50th ANNUAL CONVENTION "EXPLORING THE PAST, ANTICIPATING THE FUTURE", New York Marriott Marquis, NEW YORK CITY, NY, USA*, Feb 15, 2009, http://www.allacademic.com/meta/p311943_index.html. Accessed July 19, 2009.

[89] Zaitseva, pp. 27-30.

Virtual Nuclear Arsenals

Another qualitatively different, but no less important proliferation concern emanates from so-called virtual nuclear arsenals.[90] Most technologically advanced nonnuclear weapon states with civilian nuclear capabilities can relatively quickly assemble and deploy full-fledged nuclear arsenals if they choose to do so. This was acknowledged by Mohamed ElBaradei, the outgoing director general of the International Atomic Energy Agency (IAEA), who predicted that the next wave of proliferation would involve "virtual nuclear weapon states" – the states that can produce plutonium or highly enriched uranium and possess the know-how to make warheads, but stop just short of assembling a weapon, remaining technically compliant with the NPT.[91] There are currently 44 countries[92] operating nuclear power reactors or research reactors worldwide, nine of which already possess nuclear weapons and two of which (Iran and Syria) may be pursuing them.[93]

The case of Japan is instructive in this regard. While Japan does not have experience grounded in the actual development and manufacture of nuclear weapons, its advanced technological infrastructure can likely overcome this limitation within a few months. Japan's long-standing plutonium program, its geopolitical position, and its geostrategic vulnerability to an attack from North Korea make it feasible that the country will consider an independent deterrent.

Conclusion

Out of over 40 states that are capable of producing nuclear weapons, less than a quarter have done so. Acquiring the atomic bomb remains a deviation rather than the norm. However, when existential threats are concerned, one nuclear weapon state is already too many. The current pattern of nuclear proliferation suggests expansion of the nuclear club in the near future unless some decisive measures are taken.

1. Inferring nuclear proliferation trends

Civilian and military uses of nuclear energy are too close for comfort

There is an inextricable link between civilian and military uses of nuclear energy. Most of the countries presenting proliferation challenges today got a foot in the door of the nuclear club by developing civilian nuclear programs with the assistance of a nuclear weapon state. Iran and Iraq

[90] Joseph F. Pilat, "Virtual Nuclear Weapons," US Instiute for Peace, http://www.osti.gov/bridge/servlets/purl/615627-yBBEOO/webviewable/615627.pdf. Accessed July 19, 2009.
[91] Julian Borger, "Mohamed ElBaradei warns of new nuclear age," *Guardian*, May 24, 2009, http://www.guardian.co.uk/world/2009/may/14/elbaradei-nuclear-weapons-states-un. Accessed July 19, 2009.
[92] This is the number of states listed in Annex 2 of the CTBT, whose ratification is necessary for the treaty to enter into force. These states possessed nuclear power reactors or research reactors at the time CTBT was negotiated between 1994 and 1996. As of June 2009, nine Annex 2 states have not ratified the treaty: China, Egypt, India, Indonesia, Iran, Israel, North Korea, Pakistan and the United States.
[93] Catherine Auer, "Atoms for What?" *Bulletin of the Atomic Scientists*, Vol. 59 No. 6 (Nov./Dec. 2003), pp. 42-43.

are two alarming examples of the NPT members that used their membership to receive the technology useful to developing nuclear weapons.[94]

By 2025, experts are estimating a 75 percent growth in electricity demand. This means that the number of states developing or expanding nuclear power capacity may double by 2050.[95] Most of them do not intend to embark on a nuclear weapons program. However, the spread of civilian nuclear capabilities expands the *potential for* proliferation by significantly reducing the number of steps and the time needed to build the bomb. The volatility of the international environment and political leadership increases the probability that in the long run new leaders in some of those states may make the fateful decision to acquire the bomb. We should not allow history repeat itself half-a century after launching the Atoms for Peace program.

Existing treaties are a necessary, but insufficient, proliferation barrier

Recurring offenses have gradually tightened the screws on the violators of the nuclear non-proliferation regime.[96] However, proliferation measures remain a step behind the ever-changing proliferation challenges. All of the existing treaties (NPT, CTBT, etc.) reflect state-centric solutions to the problem and focus on the physical aspects of nuclear weapons.[97] Nonetheless, today we face qualitatively different proliferation risks.

It is no longer enough to guard against the intentions of a pariah head of state. Nuclear capabilities and responsible leadership do not prevent states from failing. Weak nuclear weapon states present proliferation risks of their own, as the uncovering of A. Q. Khan's proliferation network showed. Even in strong states, sophisticated technologies are increasingly being transferred into private hands, immune to deterrence, sanctions, and international condemnation.

Upholding non-proliferation norms is becoming secondary to the economic benefits of globalization, as recent nuclear cooperation agreements (US-India, France-Pakistan) demonstrate. The global financial crisis has increased the proliferant opportunities even more, as the desperate states become more likely to sell military technologies to third parties.

Technological revolution has democratized access to nuclear know-how, and controlling knowledge borders on infringing on scientific freedom. Unfortunately, the IAEA system of declarations and inspections aimed at identifying physical aspects of proliferation cannot detect the spread of dangerous nuclear knowledge and expertise.[98]

While the intentions of states choosing not to join the NPT are apparent (for example, India from the very beginning decided not to commit to a nonnuclear status), intentions of the 188 members of the NPT are less straightforward, and their signing the treaty should not be considered cast in

[94] Weiss, 44.
[95] Brian Finlay and Elizabeth Turpen, "The Next 100 Project: Leveraging National Security Assistance to Meet Developing World Needs," *Stanley Foundation*, Feb. 2009.
[96] For example, after India's nuclear explosion in 1974, the Nuclear Suppliers Group (NSG) was established, imposing stricter rules on nuclear commerce.
[97] Pilat.
[98] Ibid.

iron. Even the five nuclear members of the UN Security Council are hardly abiding by the NPT to the letter. While Article VI of the treaty envisions their "good faith" negotiation for nuclear disarmament, their arsenals are still capable of destroying life on earth many times over. Moreover, as the case of North Korean withdrawal from the NPT demonstrates, NPT membership can be easily abrogated, and the IAEA additional protocol is insufficient to prevent a state from gaining weapons capabilities. If nuclear proliferation escalates, it will not take long for some parties to give notice of withdrawal. As the Shah of Iran said in September 1975 in an interview with *The New York Times*: "I am not really thinking of nuclear arms. But if 20 or 30 ridiculous little countries are going to develop nuclear weapons, then I may have to revise my policies. Even Libya is talking about trying to manufacture atomic weapons."[99]

2. Extrapolating proliferation motives

Fear and pride motivate states to build the bomb

Few would openly argue today with the notion that nuclear weapons are extremely dangerous and that proliferators must be punished. But even though everyone seems to condemn the atomic bomb, its the slow but sure spread around the world continues. Moral considerations failed to stop the states from craving nuclear weapons because ethics and reason hardly play a big role in the decision to build the bomb. Examining proliferation history, one comes across decisions made in fear and distrust, on one hand, combined with pride and envy, on the other.[100] Security and prestige considerations lie behind the fateful choices of virtually all nuclear weapon states.

Links of fear and distrust connecting nuclear weapon states are easy to discern: American nuclear ambitions were spurred by those of Nazi Germany; Soviet nuclear aspirations were rooted in the existence of the US bomb; China's nuclear program originated in its fear of UK's and America's arsenals; India's nuclear ambitions were spurred by the fear of China's; Pakistan's bomb was meant to counter India's. Israel hoped its nuclear arsenal would deter its many enemies in the Middle East. Iran claimed it was threatened by Israel and the United States. North Korea invokes the danger emanating from South Korea, the United States, and the West in general. Similarly, it is the fear of rogue states' acquiring atomic weapons that the five nuclear members of the Security Council use to justify dragging their feet on nuclear disarmament stipulated by Article VI of the NPT.

However, security considerations alone do not drive nuclear proliferation. Nuclear weapons are also seen as a status symbol. The leaders of France, Britain, and South Africa launched the nuclear weapons program primarily in quest for national grandeur and independence. Stroking one's ego by initiating a nuclear blast seems to be no less important than testing the capabilities of a new weapon. As William Epstein notes, because of their nuclear weapon capability, the United Kingdom and France, who have fallen behind Japan and Germany in economic strength, are still regarded as great powers, and China and India are also treated as having achieved great power status.[101]

---

[99] John B. Oakes, "Shah offers a New Aid Plan for Developing Nations," *The New York Times,* Sep. 24, 1975.
[100] Jacques Hymans provides an excellent research and analysis of proliferants' intentions by examining four nuclear proliferation cases in his book "Psychology of Nuclear Proliferation."
[101] Epstein, 21.

The sense of unfairness embedded in the non-proliferation regime makes the pride and envy of nuclear "have-nots" even stronger. This is why many countries[102] explain their decisions to go nuclear by the need to overcome nuclear apartheid, racism, or discrimination on religious grounds.

Proliferation hinges on political decisions

While virtually every state is guided by security and status considerations, only a few ended up building the ultimate weapon. In the end, acquiring nuclear weapons capabilities is a political choice made by a head of state. It is a political choice whether to adhere to the NPT and comply with the IAEA safeguards. It is a political decision that separates the civilian and the military uses of nuclear technology. It is a political rather then economic issue whether to allow a nation's producers to sell sensitive dual-use equipment to countries with seedy proliferation records. It is political reverberations that a violator of international non-proliferation norms faces. Finally, it is changing political realities rather than external pressures or moral considerations that explain why the states that eventually rolled back their nuclear programs did so. Realizing this is important for coming up with adequate measures to curb proliferation because disarmament is possible only under right political conditions.

3. Curbing nuclear proliferation

While we cannot completely eliminate fear and pride caused by the structure and changing nature of the international system, we can certainly decrease their influence on political decisionmaking by the following measures.

Supporting a global effort for abolishing nuclear weapons

Changing political decisions of others involves making one's own bold political decisions. It is important to frame and pursue the issue as a global effort for the abolition – not reduction – of nuclear weapons. When it comes to nuclear weapons, the difference between zero and just a few is enormous. [103] As long as nuclear arsenals continue to exist – no matter in whose hands and however few in numbers – the reason to acquire nuclear capabilities remains. Nonproliferation goals can only be achieved if the current nuclear weapon states are unequivocal about moving toward the goal of "Global Zero." Moreover, possessing the strongest conventional forces in the world, NATO members and particularly the United States only face existential danger in the world with nuclear weapons. [104] Therefore, the states that already have nuclear weapons must stop dodging their responsibilities under the NPT, and advance a serious effort to reduce the number of their nuclear warheads to zero. Otherwise, their behavior only weakens the treaty they try to use as a proliferation remedy. Article VI of the NPT commits the parties in possession of nuclear arsenals to pursue negotiations "in good faith" to end the nuclear-arms race and to

[102] For example, India, South Africa, Argentina, Iran, and Brazil. Perkovich, 21.
[103] Lawrence Freedman, "A new theory for nuclear disarmament," *Bulletin of the Atomic Scientists***,** Vol. 65 No. 4 (July 2009), pp. 14-30.
[104] Nelson, pp. 53-54.

achieve "nuclear disarmament,"[105] but the five nuclear weapon states have been slow to fulfill their commitments and continue to put high value on their nuclear arsenals. No wonder the rest of the world cannot be convinced not to forgo nuclear weapons. President Barack Obama promised to seek a world free of nuclear weapons, and the United States should lead in this effort by providing political and financial support.

Building confidence in destabilized regions

Since the NPT was signed, nuclear proliferation has been occurring in conflicted and/or unstable states in the Middle East and Asia. States' interest in nuclear weapons is animated by fear of vulnerability in regional crises. For example, an expert on Iran, Pakinam al-Shakawry, who teaches political science at Cairo University, says any government in the unstable Middle East would acquire the nuclear bomb if it had the capability.[106] Arms races result from escalating political tensions, and effective disarmament is only possible when political agreement is achieved. A very concrete example of how reducing tension can lead to reducing arms is US-Russia START talks at the end of the Cold War.
Therefore, countering proliferation threats in the long term means trying to resolve the Kashmir issue, achieving a peaceful solution in the Middle East, reducing tensions in the Persian Gulf, addressing antagonism between the two Koreas and eventually resuming reunification efforts on the Korean peninsula, and so on. By reducing incentives for conflict, we are reducing fear and eliminating incentives to acquire nuclear weapons capabilities.

Strengthening existing non-proliferation treaties

Improving compliance with existing export regulations, negotiating a reasonable cutoff of fissile materials production, ratifying the Comprehensive Test Ban Treaty (CTBT),[107] and increasing the price paid for NPT violations are four sure steps to strengthen the current non-proliferation regime. Stricter standards are necessary to ensure that countries obtaining nuclear reactors do not contribute to nuclear weapons proliferation.[108] Most agree that current Nuclear Suppliers Group (NSG) guidelines are not adequate. It is time for NSG members to settle their differences and agree on new guidelines for govern enrichment and reprocessing transfers as soon as possible.[109]

It is also important to remember that one of the major frustrations with the current non-proliferation regime is its biased character. For example, it is easy to understand the Arab states' vexation with Israel's refusal to reduce and eventually eliminate its covert nuclear arsenal.[110] Therefore, in addition to trying to negotiate with pariah leaders that are unlikely to identify with

[105] Nuclear Non-Proliferation Treaty, Article VI, http://www.un.org/events/npt2005/npttreaty.html
[106] "Iran's Nuclear Ambitions Seen as Adding to Tehran's Prestige in Region," *VOA*, Cairo, 06 August 2003.
[107] Robert Nelson, "Three reasons why the US Senate should ratify the test ban treaty," *Bulletin of the Atomic Scientists***,** Vol. 65 No. 2 (Mar./Apr. 2009), pp. 52-58: 53.
[108] "Confronting nuclear energy's proliferation problem," *Bulletin of the Atomic Scientists*, Vol. 65 No. 2 (Mar. /Apr. 2009), pp 1-3: 3.
[109] James, Goodby and Fred, McGoldrick, "Reducing the risks of nuclear power's global spread," *Bulletin of the Atomic Scientists***,** Vol. 65 No. 3 (May 2009), pp. 40-47: 43.
[110] In order for CTBT to enter into force, 44 countries listed in Annex 2 of the treaty must ratify it. So far, only 35 have done so. The United States has failed to ratify CTBT along with eight other countries – including North Korea and Iran. Most of these "hold-outs" are looking at the United States in making up their minds. Perkovich, 13.

non-proliferation concerns of the international community, we should take advantage of the long-existing ties between many of the nuclear haves to reduce both tensions and deadly arsenals thus advancing non-proliferation goals.

Establishing Nuclear-Weapon-Free-Zones (NWFZ)[111]

Elimination of nuclear weapons region by region by means of establishing NWFZ is one of the most effective paths toward global nuclear disarmament. NWFZ complement the NPT by preventing the deployment of nuclear weapons in non-nuclear weapon states (currently used by NATO). NWFZ also foster regional cooperation and help build confidence among countries in the region by increasing transparency and strengthening verification measures.[112] Even more importantly, members of a NWFZ can effectively band together to press for greater progress on nuclear disarmament. NWFZ are also a means of preventing nuclear testing in their respective regions as well as addressing the threat of global nuclear terrorism. Finally, NWFZ members set a strong example to the rest of the international community.

The success of the five existing NWFZ with over 100 states parties notwithstanding, progress toward the establishment of NWFZ has stalled in the late 1990s. States face enormous difficulties in their attempts to establish a NWFZ, as the example of Central Asian NWFZ effort showed. This needs to change because the NWFZ concept is instrumental to addressing the nonproliferation challenges on the Korean peninsula and in the volatile Middle East.[113]

Reducing the risks of global nuclear power spread

The need to meet growing energy needs and limit carbon dioxide emissions has increased global interest in nuclear power and with it grow the threats to the nuclear non-proliferation regime. Stricter controls on exports of enrichment technology are one measure to discourage states from acquiring nuclear weapon capabilities. Using "multinational enrichment facilities as an alternative to nationally controlled plants" is another.[114] Multinational enrichment facilities are cheaper and have been proved effective by the already existing enrichment plants with multinational participation.[115] It is also important to realize that new nuclear power plants are not a solution for a country's energy needs and that investment in renewable energy offers a more cost-effective and practical alternative.

---

[111] "A nuclear-weapon-free zone (NWFZ) is a specified region in which countries commit themselves not to manufacture, acquire, test, or possess nuclear weapons. […] Article VII of the nuclear Nonproliferation Treaty (NPT), which entered into force in 1970, affirms the right of countries to establish specified zones free of nuclear weapons. The UN General Assembly reaffirmed that right in 1975 and outlined the criteria for such zones. Within these nuclear-weapon-free zones, countries may use nuclear energy for peaceful purposes." Nuclear-Weapon-Free Zones (NWFZ) At a Glance, Arms Control Association, Fact Sheet, November 2007. http://www.armscontrol.org/factsheets/nwfz. Accessed August 3, 2009.

[112] In 2003, the UN General Assembly adopted a resolution "Nuclear Weapon Free Southern Hemisphere and Adjacent Areas," in which the members of the existing NWFZ pledged to work together to "pursue common goals," and "to explore and implement further ways and means of cooperation among themselves." "Nuclear Weapon Free Southern Hemisphere and Adjacent Areas," UN General Assembly Resolution 58/49, December 8, 2003.

[113] Scott Parrish and Jean du Preez, "Nuclear-Weapon-Free Zones: Still a Useful Disarmament and Nonproliferation Tool?" Report for Weapons of Mass Destruction Commission, 2006.

[114] Goodby, et. al., 44.

[115] Ibid., 46.

Preventing nuclear terrorism

Evidence that terrorist organizations are seeking nuclear weapons capabilities is mounting, and the risks are growing exponentially with the emergence of every new nuclear state and the weakening of controls in some existing nuclear weapon states. Adequate assistance to states with insufficient financial controls, inadequate border security, nonexistent or anachronistic export controls are needed.[116] The lessons of cooperative non-proliferation programs in the former Soviet Union suggest that such assistance is most effective when it contributes to general development and when security and developmental goals are combined. The cases of Ukrainian and Belarusian denuclearization also suggest that economic conditions alone are insufficient to provide for denuclearization and that the United States and other third parties wishing to influence denuclearization need to be aware of the power dynamics between the negotiating countries and pay attention to ethnicity and culture problems as well as a state's need for sovereignty or political recognition. This approach may provide the negotiators with some carrots and avoid the counterproductive effects that sticks may have.

Threat reduction programs with former Soviet states can serve as models to create new, peaceful jobs for North Korea's cadre of nuclear scientists and bomb makers. More than simply removing nuclear material and infrastructure, it's vital to provide the North's nuclear workers with alternative civilian jobs, since they could presumably resume the country's nuclear activities in the future or hire themselves out to help others build nuclear weapons. An approach similar to the Cooperative Threat Reduction (CTR) program between the United States and former Soviet states could be the best way to prevent future clandestine North Korean nuclear activities. The CTR program, established in 1991, has made a positive contribution, helping to destroy the excess nuclear, chemical, and biological weapons and to support related non-proliferation objectives in Russia, Kazakhstan, Belarus, and Ukraine. [117]

The hand of "The Doomsday Clock," maintained since 1947 by the *Bulletin of the Atomic Scientists* to represent the threat of global nuclear war, is currently standing at five minutes to midnight. Half-measures will not turn the humanity back from the brink of a second nuclear age. Committing to the goal of reducing global nuclear arsenals to zero is the only way to stop nuclear proliferation and save the Earth from nuclear Armageddon.

Volha Charnysh was a 2009 summer intern at Nuclear Age Peace Foundation. She graduated from Smith College in 2009.

[116] Finlay, et. al.
[117] Jungmin Kang, "Redirecting North Korea's nuclear workers," *Bulletin of the Atomic Scientists,* Vol. 65 No. 1 (Jan./Feb. 2009), pp. 48-55: 48.