

Proliferation, Nuclear.

Nuclear proliferation refers to the acquisition of nuclear weapons technology by nations that did not previously possess them. The spread of nuclear weapons technology has been considered a major threat to global security since even before the first nuclear weapons were developed. Between 1945 and 2006, at least eight different states acquired and tested nuclear weapons: United States (1945), Soviet Union (1949), United Kingdom (1952), France (1960), People's Republic of China (1964), India (1974), Pakistan (1998), and North Korea (2006). South Africa developed a small arsenal of nuclear weapons in the 1980s but dismantled them in the 1990s. Israel is widely considered to have been a nuclear-armed state since the 1960s, though it has never publicly admitted this. A substantial number of other states have begun nuclear weapons programs of greater or lesser extent but without eventual success.

Historical overview

After the 1939 announcement that a fission chain reaction was possible, scientists in the United States, the United Kingdom, the Soviet Union, Germany, and Japan each attempted to notify their governments that a potentially new energy source or weapon was derivable from work in nuclear physics. Each of these countries began small, exploratory nuclear programs. In 1941, encouraged by scientific calculations suggesting the feasibility of a bomb, American officials launched a full-scale industrial effort to manufacture nuclear arms in time for use during World War II, which became what was known as the Manhattan Project. This effort culminated in the nuclear bombs used against the Japanese cities of Hiroshima and Nagasaki in August 1945.

The American program, which had derived considerable initial support and cooperation from the United Kingdom and Canada, was initially launched out of a fear that National Socialist Germany would develop its own nuclear arms. Even when it was discovered, by the end of 1944, that the German nuclear program was insubstantial, the fear of a nuclear-armed Soviet Union led officials on the Manhattan Project to pursue long-term counter-proliferation strategies. Most significant of these was an attempt to secure the rights to all significant known deposits of uranium ore, the necessary raw material for any nuclear weapons program.

In the immediate postwar period, the threat of nuclear weapons proliferation and of a clandestine nuclear arms race motivated many scientists and politicians in the United States to lobby for the international control of atomic energy. Specifically, it was held that the only way to avoid secret proliferation was for an international consortium to have authority over certain weapons-related activities, as well as provide for the inspection mechanisms necessary to verify that states were not creating contraband arms. Political conditions in both the United States and the Soviet Union prevented any workable control scheme from being realized during the 1940s.

The Soviet Union began developing its first nuclear arms out of a desire for security and parity with the United States. The USSR obtained considerable espionage information from the Manhattan Project by means of ideological volunteer spies well-placed among scientific and diplomatic ranks. As such, Soviet officials had a reasonably complete picture of what the Manhattan Project efforts had been, and what had worked. It had been long assumed that this espionage information was instrumental to the speed of the development of the Soviet atomic bomb, but archival sources released after the end of the Cold War have shown that the Soviet administrators did not trust the data wholeheartedly, and required their scientists to replicate it independently. The primary limiting factor for the development of the first Soviet plutonium bomb, detonated in August 1949, was availability of raw materials.

Both the United Kingdom and France sought nuclear arms in the 1950s for similar reasons. Both were interested in independent deterrence against the Soviet Union, and both were motivated by desire for international political and scientific prestige. The United Kingdom had the advantage of having played a significant role in the Manhattan Project, and was able to draw upon that experience to produce a relatively economical bomb by 1952. France had been a world leader in nuclear physics in the 1940s, and had begun a serious reactor program by the mid-1950s, and detonated its first plutonium bomb in early 1960.

The People's Republic of China initially sought nuclear capability after confrontations with the United States over Taiwan and Korea in the 1950s during which the possibility of American use of nuclear forces was publicly entertained by U.S. officials. Until the Sino-Soviet split, the Chinese were aided by Soviet technicians. By the early 1960s, however, they had become autonomous. In 1964, they detonated their first weapon: a comparatively sophisticated implosion device fueled by enriched uranium.

Non-proliferation regimes

The initial plan for the control of nuclear weapons, proposed by the United States to the United Nations in 1946, called for the eventual destruction of existing U.S. nuclear arms should other nations forswear developing them and submit to inspections verifying their renunciation. The Soviet Union, then working on its own clandestine nuclear program, could not be persuaded to submit to such a plan. In 1953, U.S. President Dwight D. Eisenhower announced a program of "Atoms for Peace," meant to emphasize the sharing of non-military nuclear technology with non-nuclear nations. This activity led to the creation of the International Atomic Energy Agency (IAEA) in 1958, with participation from the United States, the Soviet Union, France, and other nations. The "Atoms for Peace" program included the distribution of small quantities (not enough individually to produce a weapon) of highly enriched uranium for research reactor development.

In the early 1960s, as a result of increased experience with nuclear technology and the addition of the United Kingdom, France, and eventually China to the "nuclear club," the question of a general treaty to prevent further spread of military nuclear technology was raised repeatedly in the United Nations. Political obstacles relating to negotiation of

nuclear weapon deployment in NATO states stalled negotiations until the end of the decade. In 1968, however, the United States, Soviet Union, and United Kingdom became the founding signatories to the Nuclear Non-Proliferation Treaty (NPT), which went into force in 1970. The NPT divided the world into "nuclear weapons states" and "non-nuclear weapons states," requiring that the states with preexisting nuclear stockpiles should not assist in the spread of nuclear weapons, and that those without nuclear stockpiles would refrain from developing them. The treaty asserted that the "research, production and use of nuclear energy for peaceful purposes" was an "inalienable right" of all parties, providing that non-nuclear states submit their peaceful sites to inspections by the IAEA. The IAEA thus became the primary international agency charged with enforcing nuclear weapons safeguards and detecting the diversion of nuclear materials from peaceful purposes to military uses. Nearly all major states eventually became signatories to the NPT. France and China, both nuclear states at the time of initial treaty, did not initially sign, though France pledged to uphold its requirements. Both eventually signed the treaty in 1992, and are recognized as "nuclear weapons states" under the NPT.

Notably, a number of states did not sign the NPT. These included India, Pakistan, Israel, and South Africa. Though India had been a participant in NPT negotiations, it rejected the treaty on the grounds of maintaining sovereign military flexibility, especially in light of the Chinese development of nuclear weapons in 1964. Pakistan similarly rejected the treaty because of its rejection by the rival Indian state. India detonated a nuclear device in 1974, claiming it was a "peaceful" nuclear explosion and not weaponized. Pakistan similarly developed nuclear weapons capability of its own. Both India and Pakistan detonated nuclear explosions in 1998, announcing themselves as fully nuclear states at that point.

It is widely believed that Israel developed nuclear weapons capability by the 1960s. The Israeli government has neither confirmed nor denied this accusation, despite compelling evidence for Israel's existing nuclear capabilities that has been either leaked or discerned by intelligence agencies. South Africa, initially a non-signer of the NPT, developed a small arsenal of uranium-based weapons by the 1980s. These were dismantled in the early 1990s, evidence was submitted to the IAEA, and South Africa became a NPT signatory in 1991.

Numerous other states pursued nuclear weapons research and development programs over the course of the Cold War. These included Argentina, Australia, Brazil, South Korea, Switzerland, and Taiwan, among others. For various reasons, both technical and political, these countries did not develop weapons. Furthermore, many of these nations are now members of various Nuclear-Weapons-Free Zones established by the United Nations since the late 1960s. The Treaty of Tlatelolco (1967) bans the development and basing of nuclear weapons in Latin and South America; the Treaty of Rarotonga establishes such a zone in the South Pacific; the Treaty of Pelindaba (1996) prohibits nuclear arms from Africa.

Post-Cold War developments

The end of the Cold War had decidedly mixed effect on existing nonproliferation regimes. There have been notable successes: three former Soviet republics which had "inherited" nuclear weapons after the collapse of the USSR—Belarus, Kazakhstan, and Ukraine—all agreed to relinquish their stockpiles to the Russian Federation and become NPT signatories after negotiations with both Russia and the United States. On the other hand, however, numerous incidents have highlighted the possibility of NPT-signatories purposefully evading IAEA inspections and successfully hiding clandestine nuclear programs until very late dates. Iraq managed to conceal a large nuclear program until just before the Gulf War in 1990; Iran has shown ability to conceal the development of large nuclear sites from IAEA inspection regimes; and North Korea was able to pull out of the NPT entirely, seize formerly safeguarded facilities, and use them to develop nuclear arms in a relatively short amount of time.

The development of gas centrifuge technology, particularly in the 1970s and 1980s, has arguably created novel problems for non-proliferation efforts. Gas centrifuge enrichment of uranium is cheaper and requires less energy than other enrichment processes (e.g. gaseous diffusion or the electromagnetic method). Individual centrifuges are difficult to construct and operate, but the process itself can be done incrementally over time and in comparatively small and hard-to-detect facilities. Centrifuges are also inherently dual-use: the same setup is used for both civilian and military purposes, and their coverage under the "peaceful" technologies permitted by the NPT is controversial. These facts raise a number of difficulties for non-proliferation regimes. First, they make clandestine enrichment programs increasingly feasible. Second, they allow for a rapid acceleration of civilian enrichment programs for military purposes. Third, their relative inexpensiveness and their inescapable connection with civilian enrichment makes dissuading their use difficult.

The distribution of centrifuge enrichment technology was greatly aided by Pakistani metallurgist Abdul Qadeer Khan. Khan first learned about the technology through working at a civilian enrichment facility in the Netherlands in the mid-1970s. He later took blueprints the back to Pakistan and developed the infrastructure for Pakistan's nuclear weapons program. (Pakistan tested its first nuclear bomb in 1998, but is thought to have acquired weapons much earlier.) In the early 1990s, Khan began to covertly sell old Pakistani centrifuge technology and engaged an international network of suppliers to manufacture the parts. He sold the technology to Libya, Iran, and North Korea. Libya abandoned its nuclear program in 2003. North Korea has apparently pursued plutonium technology for its main nuclear program, and it detonated its first bomb in 2006. Controversy currently exists over whether Iran is actively pursuing nuclear weapons now.

The threat of non-state actors acquiring nuclear weapons has been entertained seriously since at least the 1980s. The general conclusions reached are that a sufficiently well-organized and well-financed terrorist group could conceivably acquire and detonate nuclear weapons only by means of acquiring fissile nuclear material from a pre-existing nuclear state. Securing fissile material in existing states, in particular those in the former

Soviet bloc, has hence been a major preoccupation of non-proliferation regimes. The Nunn-Lugar Cooperative Threat Reduction program, for example, begun by the United States in 1992, sought to upgrade critical nuclear infrastructure in the former Soviet states and to aid in deactivating and destroying weapons facilities.

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See also Weapons, Nuclear; United Nations; Strategy, Nuclear; Missiles, Nuclear; Bombs, Nuclear; Arms Sales, International; Military Science;

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