Canberra Commission Issue Paper

The Arsenals of the Nuclear Weapons Powers: An Overview

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January 4, 1996

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Introduction

Each of the five declared nuclear powers--the United States, Soviet Union, Great Britain, France, and China--have gone through similar steps to create their nuclear arsenals.[1] After a political decision to develop and test an atomic bomb there followed large scale mobilization of scientific and engineering resources. Huge facilities were built to produce the fissile materials--highly enriched uranium and plutonium--supplemented by laboratories, test sites and other essentials. A parallel effort was undertaken to develop and produce delivery systems, such as aircraft, missiles, ships and submarines. The U.S. and Soviet Union engaged in these activities on an enormous scale. While the three second-tier powers were much more modest in deploying their arsenals, they still managed to spend huge sums when measured on a per capita basis.

I. United States

The first U.S. test, codenamed "Trinity," on July 16, 1945 at the Alamogordo Bombing Range in south-central New Mexico was of a plutonium weapon. This was the culmination of a 27-month crash effort--to develop, test, and use an atomic bomb--known as the Manhattan Project. A B-29 bomber, named the "Enola Gay", flew over Hiroshima, Japan, on August 6, 1945, and at 8:15 in the morning, local time, dropped an untested uranium-235 gun-assembly bomb, nicknamed "Little Boy." A second weapon, nicknamed "Fat Man," a duplicate of the Trinity weapon, was dropped over Nagasaki on August 9, and burst at a height of 503 meters with a force later estimated at 21 kilotons (kt). By the end of 1945 some 200,000 deaths had occurred in the two cities.

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[1] An extensive treatment of the five powers can be found in the Nuclear Weapons Databook series by the Natural Resources Defense Council: Thomas B. Cochran, et al., *U.S. Nuclear Forces and Capabilities*, Volume I (Cambridge, MA: Ballinger Publishing Company, 1984); Cochran, et al., *U.S. Nuclear Warhead Production*, Volume II (Cambridge, MA: Ballinger Publishing Company, 1987; Cochran, et al., *U.S. Nuclear Warhead Facility Profiles*, Volume III (Cambridge, MA: Ballinger Publishing Company, 1987); Cochran, et al., *Soviet Nuclear Weapons*, Volume IV (New York, NY: Ballinger Publishing Company, 1989; Robert S. Norris, et al., *British, French, and Chinese Nuclear Weapons*, Volume V (Boulder, CO: Westview Press, 1994). These volumes should be supplemented by the "Nuclear Notebook" column, in each issue of *The Bulletin of the Atomic Scientists*, since May 1987, and the annual chapter on "Nuclear Weapons" in the *SIPRI Yearbook*, 1986-1995, written by NRDC staff.

In the aftermath of World War it was unclear what role nuclear weapons would play in U.S. security policy. Legislation was introduced in late 1945 that would eventually result in the Atomic Energy Act of 1946. The Act, signed by President Truman on August 1, 1946, established a civilian Atomic Energy Commission (AEC), replacing the Army's Manhattan Engineer District, and gave it authority over all aspects of atomic energy, including oversight of nuclear warhead research, development, testing and production. The Los Alamos Scientific Laboratory received continued support and a series of nuclear tests were conducted in 1946 and 1948. Air Force, Navy, and Army interest in the bomb increased as they attempted to integrate the novel weapon into their strategic and tactical operational plans.

Our best estimate is that the United States produced approximately 70,000 nuclear weapons from 1945 to mid-1990, when production of U.S. nuclear weapons ceased. The U.S. stockpile reached its historic high of 32,500 nuclear warheads in 1967 (see table 7). Since the mid-1950s this stockpile has been characterized by technological dynamism and high turnover. By our count 65 warhead types were produced in quantity and entered the stockpile, configured for approximately 116 distinct weapons systems. Another 25 warhead types were cancelled before production, because either another warhead type was chosen, or the delivery system itself was cancelled.

The first delivery system was the airplane, a specially modified B-29 able to carry a single Little Boy or Fat Man type bomb. Soon after came a great profusion of aircraft types offering greater range and capability, a trend that has continued to today. There have been more than 40 different types of aircraft that the U.S. military has used for nuclear weapons delivery: air force bombers, air force fighters, navy/marine corps fighters, helicopters, maritime patrol aircraft, and several types of non-American NATO aircraft that were certified to carry U.S. nuclear weapons.

Nearly parallel to the development of the atomic bomb was the development of the guided missile. It did not take a great leap of imagination to see that missiles might eventually be mated to an atomic bomb, and flown great distances to strike a target. Eventually nuclear armed missiles would come in every conceivable size, shape, and range for every conceivable mission:

air-to-surface missiles, air-to-air missiles, cruise missiles, ballistic missiles, and anti-ballistic missile (ABM) missiles.

The Army, not to be outdone in an interservice rivalry that greatly stimulated qualitative and quantitative growth, developed a full range of weapons for the nuclear battlefield, including several calibers of artillery, short-range missiles, air defense missiles, and atomic land mines. The Navy had many non-strategic nuclear weapons for the anti-submarine mission, the anti-air warfare mission to defend the carrier battle group, and, with the Marine Corps, the land-attack mission from aircraft carriers and amphibious assault ships.

After tremendous quantitative growth in the 1950s and 1960s, a slightly lower plateau of 24,000 to 28,000 stockpile warheads was sustained throughout the 1970s and 1980s. While warheads on strategic systems increased, especially those on MIRVed ballistic missiles, those on tactical systems decreased, but qualitative improvements continued across the board. Beginning in the late 1980s several arms control treaties and unilateral policy declarations have resulted in reductions in the U.S. nuclear arsenal. These include:

- The INF Treaty, signed December 8, 1987
- The START I Treaty, signed July 31, 1991
- President Bush's initiatives of September 27, 1991
- President Bush's initiatives of January 28, 1992
- The START II Treaty, signed January 3, 1993
- Nuclear Posture Review, announced September 22, 1994

A few words are needed about the 1994 Nuclear Posture Review (NPR) which establishes the missions and levels for U.S. nuclear forces through the year 2003.[2] The general public perception is that by 2003 the United States nuclear stockpile will number 3,500 warheads under

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[2] Office of the Assistant Secretary of Defense (Public Affairs), "DOD Review Recommends Reductions in Nuclear Force," News Release No. 541-94, 22 September 1994; DOD, "Nuclear Posture Review," viewgraphs; SASC, *Briefing on Results of the Nuclear Posture Review*, 22 September 1994.

the START II Treaty. The truth is that the total projected stockpile will be twice as large--closer to 7,400 warheads. The operational stockpile in 2003 is scheduled to be about 5,000 warheads; comprised of some 4,000 strategic warheads (3,500 START-accountable warheads plus spares), and almost 1,000 non-strategic weapons, some of which are assigned to the strategic reserve.

An underemphasized but very important subtext of the NPR was the Pentagon's determination to preserve an option to swiftly increase nuclear forces if relations with Russia change for the worse. In practice this means that the U.S. will keep a substantial number of warheads as a "hedge" for redeployment on ICBMs, SLBMs, and aircraft. Warheads do not have to be destroyed under the START Treaties, nor were they required to be under the 1987 INF Treaty. The Pentagon has kept its plans about this shadow stockpile very secret. The hedge will number some 2,400 warheads, and thus if all categories are considered, as they should be, the actual U.S. stockpile will be about 7,400 warheads.

Key features of the U.S. program

• The current U.S. stockpile has about 10,000 operational warheads (See Table 1) with a cumulative yield of some 2000 megatons, one-tenth of its historic high in 1960. Another 5,000 warheads are in reserve status or are awaiting dismantlement.

• Over a 50-year period the U.S. has produced about 70,000 warheads, including over 1,150 devices used in 1,030 tests.

• Under current plans the U.S. will keep about 7,400 warheads, retain the three national laboratories that support warhead research and development, and decide on a consolidated production complex. No new nuclear warheads have been produced in five and one-half years and no formal requirements for new weapon systems or warheads currently exist. Some existing warheads are being adapted for new roles. For example, some existing B61 bombs are being modified to provide an "earth penetrating" capability. Nevertheless, approximately $20-$25 billion is still being spent annually to operate and maintain the entire arsenal.

• The underlying Presidential Guidance that authorizes U.S. employment policy was developed in the 1970s and is still intact. Certain supplementary refinements were quietly added by the Joint Chiefs of Staff in 1993 to address deterring the use of weapons of mass destruction. But without altering the basic guidance, at the presidential level, further major reductions will be difficult to achieve.

II. Soviet Union/Russia

With the demise of the Soviet Union a fuller history of the Soviet atomic and hydrogen bomb programs, and their behavior in the arms race and the Cold War is being revealed and documented. The opening of archives, interviews with participants, and the efforts of journalists and scholars have all contributed to a clearer picture.[3]

Following the bombings of Hiroshima and Nagasaki, Stalin ordered a crash program to provide atomic weapons in the shortest possible time. His secret police chief, Lavrenti P. Beria was put in charge of the Soviet version of the Manhattan Project. During the War a small-scale project had been initiated under the scientific direction of Igor V. Kurchatov. With enormous effort for a war-ravaged society, including the use of thousands of prison laborers, many of whom died in the effort, the Soviets built the necessary infrastructure to develop, test, and produce an atomic bomb. The first Soviet chain reaction took place on December 25, 1946 using an experimental graphite-moderated natural uranium pile. The first Soviet test occurred on August 29, 1949, using a device based on the Trinity design--obtained through espionage--with a yield of 20 kt.

Like the U.S., the Soviet Union engaged in a massive deployment of nuclear weaponry, though it lagged the U.S. by several years in achieving both qualitative and quantitative milestones (See Table 6). Soviet nuclear warheads have been fitted on over 75 different types of weapons, from atomic demolition munitions (ADMs) to intercontinental ballistic missiles (ICBMs), with yields from under one kiloton to tens of megatons.

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[3] David Holloway, *Stalin and the Bomb: The Soviet Union and Atomic Energy, 1939-1956* (New Haven: Yale University Press, 1995); Thomas B. Cochran, Robert S. Norris, Oleg A. Bukharin, *Making the Russian Bomb: From Stalin to Yeltsin* (Boulder, CO: Westview Press, 1995).

Details about trends in the Soviet stockpile are less well known than the U.S. Starting after the U.S , the USSR steadily built more and more weapons until, according to Ministry of Atomic Energy Minister Viktor Mikhailov, its total stockpile of operational and reserve weapons peaked in 1986 at 45,000 warheads. Whereas the U.S. produced a total of 70,000 nuclear weapons over the post-war period we estimate the Soviets have produced some 55,000. Unlike the U.S., which continuously recycled its weapons, the USSR seems to have kept most of the outmoded ones intact. The peak number of 45,000 could have been composed of an operational stockpile of about 33,000 warheads, with the balance composed of reserve and retired weapons not yet dismantled.

Estimating the current size and composition of the former Soviet nuclear stockpile remains difficult, even with improved--though at times conflicting and ambiguous--information from the Russian government. Three categories are of interest.

Table 2 is an estimate of Russia's current operational stockpile--some 12,000 warheads mounted on or associated with deployed nuclear and dual-capable forces. Russia may be planning to create a "hedge" of its own with a significant fraction of its arsenal, but a formal "Nuclear Posture Review" outlining such plans has yet to be presented publicly. A third set of warheads is scheduled to be dismantled eventually, but is now stored in depots.

The current annual rate of Russian warhead dismantlement is approximately 2,000 to 2,500 warheads, performed at Sverdlovsk-45 near Nizhnaya Tura, Zlatoust-36 at Yuryuzan, and the Avanguard facility at Arzamas-16. Some additional workload capacity is taken up in modifying existing warheads and in producing a small number of new warheads for the SS-25 ICBM. Higher dismantlement rates probably could not be sustained at this time in a safe and environmentally responsible manner.

Key features of the Russian program

- The current Russian stockpile has about 12,000 operational warheads, with an equal number in reserve or awaiting dismantlement.

• Over a 46-year period the Soviet Union has produced about 55,000 warheads, including approximately 1,000 used in 715 tests.

• Over the past five years there has been an enormous logistical effort to consolidate thousands of Soviet warheads to fewer and safer sites in Russia. In the mid-1980s Soviet weapons probably were deployed in all of the fifteen republics of the USSR, as well as East Germany, Hungary, Poland, Bulgaria, and Czechoslovakia. The number of weapon storage sites is being consolidated from over 600 throughout the former Soviet Union in 1989 to approximately 100 in Russia today. The last remaining warheads outside of Russian borders are in Belarus and Ukraine and those should be returned in 1996.

• Russia may keep fewer warheads than the U.S., an equivalent number, or many more. The size and composition of its future nuclear arsenal are less clear than the U.S. But whatever size is decided upon the laboratories that support warhead research and development and a production complex will be essential. A limited number of new warheads are being produced (for the SS-25 ICBM). Plans for other new warheads are unknown.

• In November 1993 Russia dropped its no-first use pledge. The Russian military leadership sees nuclear weapons as preeminent in deterring both conventional and nuclear war. They are spoken of as counters to the proliferation of nuclear and other weapons of mass destruction and essential if NATO becomes larger. Russian hard liners argue that large stocks of nuclear weapons are needed to offset a conventional imbalance, a logic reminiscent of NATO's position vis-a-vis the Soviet Union and Warsaw pact throughout the Cold War.

III. Great Britain

The British were the first nation to seriously explore the possibilities of building an atomic bomb. A committee of British scientists was established in April 1940 to examine the fission phenomenon. Known as the Maud Committee, these scientists concluded in a report, dated July 2, 1941, that a bomb was possible and that it would take two and a half years to develop. Soon after they shared this knowledge with the Americans and a collaborative effort was agreed upon. Eventually many British scientists worked in the U.S. at Los Alamos and elsewhere. Through participation in the Manhattan Project the British scientists went home with, in Sir John Cockcroft's words, "an almost complete knowledge of [the bomb's] technology."

The formal decision to actually build an atomic bomb was made by a small committee of Ministers, operating in total secrecy, on January 8, 1947. This led to an accelerated effort to build the plants, factories, and bureaucracy necessary to carry out an atomic weapon program. As there were no extensive, uninhabited areas suitable for atmospheric nuclear testing in the UK, the British government had to look abroad for a test site, and eventually chose Australia.

The first test, called Hurricane was conducted 90 feet underwater off Trimouille Island, in western Australia, on October 3, 1952 with a yield estimated at 25 kt. During the five-year period between 1952 and 1957, Britain conducted a total of twelve tests in Australia.

Prime Minister Winston Churchill and a small subcommittee of the Cabinet decided on June 16, 1954 that Britain should develop and manufacture a hydrogen bomb. This led to a series of nine tests in 1957 and 1958 at Christmas and Malden islands in the Pacific. A two-stage thermonuclear device was successfully demonstrated on November 8, 1957 with a yield of 1.8 megatons.

After a testing moratorium from 1958 to 1961, and a ban on atmospheric testing in 1963, the British shifted their test program to the Nevada Test Site in the U.S. During the thirty years from 1962 through 1992, there have been twenty-four underground tests conducted jointly by the UK and the U.S. This infrequency suggests that, Britain's access to U.S. design information, has allowed only a very small number of joint tests to be conducted prior to deployment of each new "British" warhead. Most British warhead designs are believed to be nearly direct copies of American warheads and thus did not need a full testing program.

For example, we strongly suspect that during the 1960s the British copied the W58 warhead for its Polaris missile and the U.S. B57 and B61 bombs for its WE 177 bomb. In the cases of Chevaline and Trident, the warheads seem to be of British design but were no doubt developed in close collaboration with the U.S.

Key features of the British program are:

- The current British stockpile has about 300 warheads of three types with a cumulative yield of approximately 45 megatons. Britain has the smallest operational stockpile of the five declared weapons states (See Table 3).

- Over a 43-year period Britain has produced about 950 warheads of ten types, including 45 for the nuclear test program.

- The weapon stockpile remained fairly steady in the 300 to 350 range from the 1960s through the late 1980s. In the early 1990s, the British government withdrew some naval weapons and air force bombs, reducing the stockpile to around 200 weapons. After the withdrawal of the Tornado bomber from nuclear service in 1998, and completion of the Vanguard submarine/Trident II missile program around the turn of the century, the stockpile will stabilize at a level of about 200 warheads.

- During the Cold War Britain had a supplementary stockpile of American nuclear weapons that at times has exceeded its own. British forces planned to use these American nuclear warheads and weapon systems to accomplish a variety of NATO missions, thus freeing themselves from developing or producing certain weapons of their own. Since 1958, these U.S. weapons have included 14 distinct weapon types: five gravity bombs, two nuclear depth charges, three missiles, two calibers of artillery shell, and two atomic demolition munitions. These warheads were deployed in Great Britain, and with British forces in Germany and Italy. At the peak in the late 1970s, there were almost 400 of these American warheads, earmarked for British forces. Today there are none.

- The "special relationship" with the United States has fundamentally shaped British nuclear practices and policies. This relationship has been perhaps the single most important factor in determining the kinds of nuclear programs the British have pursued and the numbers of warheads they have built.

IV. France

The manner in which France decided to actually build the bomb was not the result of a single decision, nor was it the result of a clear-cut long-range policy rationally planned and executed. The decision was taken without any public knowledge or Parliamentary debate. As in the U.S., the Soviet Union, and Great Britain, a small group of scientists, in collaboration with military and government officials, brought the bomb program to fruition.

Political events helped to form the belief that France should have the bomb. The loss at Dien Bien Phu (Indochina) in May 1954 found France's self-esteem at a low point. The bomb was seen as an instrument to help recover France's grandeur, to establish international prestige, and to help provide a greater voice among Western allies.

With the creation of the Fifth Republic in late 1958, there was a marked acceleration of the bomb program, now led by the dominant personality of Charles de Gaulle, serving in the powerful office of President. De Gaulle had kept himself abreast of the secret program throughout the previous decade. Far more so than other leaders, de Gaulle and Gaullism is closely associated with nuclear weapons. For de Gaulle, French possession of the bomb symbolized independence and a greater role in European and geopolitical affairs. Without a French bomb, de Gaulle felt that the superpowers would carry on their dialogue, taking little notice of the smaller nations.

The first French nuclear test took place on February 13, 1960 in Algeria. Four years later the first French nuclear weapons (the AN 11 plutonium implosion bomb) were delivered to the Forces Aériennes Stratégiques (FAS) for service on Mirage IVA aircraft.

During the mid-1960s, the Commissariat à l'Energie Atomique (CEA) began development of the MR 31 warhead for the 18 single-warhead SSBS S2 intermediate-range ballistic missiles (IRBM), the second leg of France's *force de frappe*. The S2 entered service with the FAS in 1971. This 120-kt plutonium warhead represented the limit of pure fission weapons for the French. The MR 41, a similar warhead was tested in 1968 and became operational in 1972 with the single-warhead MSBS M1 submarine-launched ballistic missile (SLBM), the third leg of France's strategic triad.

The first French two-stage thermonuclear device was tested on August 24, 1968, some eight and one-half years after the first atomic fission test. The design of the 1-megaton TN 60 thermonuclear warhead was completed by mid-1971, and entered service in early 1977 with the single-warhead MSBS M20 SLBM. A slightly modified TN 61 was used for the 18 single-warhead SSBS S3 IRBMs, which entered service in June 1980.

The development of tactical warheads began in 1965. The AN 51 warhead (10- and 25-kt) was deployed with the Pluton missile in 1974, while the AN 52 bomb (6 to 8- and 25-kt) was deployed on the Mirage IIIE, Jaguar A, and Super Etendard aircraft in 1973, 1974, and 1981 respectively. Both the AN 51 and the AN 52 were based on the same nuclear device (the MR 50), known as the common tactical charge (*charge tactique commune*) since all three armed services shared the same nuclear device.

At the end of 1977, the CEA started development of miniaturized warheads for the ASMP missile, which could be used in a strategic or tactical role. The result was the 300 kt TN 80 warhead, deployed on the Mirage IVP aircraft in 1986, followed by the TN 81 warhead on the Mirage 2000N and Super Etendard aircraft in 1988 and 1989. After retirement of the Mirage IVP and Super Etendard the ASMP will be transferred to the new Rafale aircraft, scheduled for service entry with the Navy in 1999 and the Air Force in 2002. Consideration of a replacement or supplement to the ASMP is at an early stage.

Key features of the French program.

• The current French stockpile has about 480 warheads of four types with a cumulative yield of approximately 100 megatons (See Table 4).

• France has produced about 1,250 warheads of ten different types--including over 200 for the nuclear test program--over a 35-year period.

• There will be no quantitative increase in the French nuclear stockpile. After peaking at around 540 warheads in the early 1990s, the stockpile will decrease to about 465 by the end of the century.

• French nuclear forces exist in greater variety than the British or Chinese systems. Historically these forces were of two basic categories: the strategic weapons, structured in a "triad" of silo-based missiles, bombers, and submarine-launched missiles; and the tactical weapons, comprised of land- and carrier-based aircraft, and short-range land-based missiles. If plans for a future strategic land-based mobile missile are shelved, French nuclear forces will be structured in a dyad instead of a triad. The Army has abandoned its nuclear role (Pluton was retired and Hades mothballed), leaving only the Air Force and Navy with nuclear weapons.

• French weapons designers continue to work on a variety of features concerning warhead safety (including the incorporation of insensitive high explosives), security (against unauthorized use), variable yields, improvements in yield-to-weight ratios, hardening, and simulation techniques.

• A debate has emerged in France on whether the traditional deterrent policy, first articulated by de Gaulle is relevant for the late 1990s and the 21st century. Key issues being discussed are whether the French deterrent might be extended to other European nations, and whether it should be used in counterproliferation situations.

V. China

The Chinese decision to develop an atomic bomb was made on January 15, 1955, on the basis of political and military factors. A Chinese nuclear arsenal would vault China to major power status and also stop the "nuclear bullying" by the U.S. The Korean War, events in Indochina, and the Taiwan Strait crisis all demonstrated China's insecurity in the face of U.S. nuclear weapons and threats. Despite much talk of self-reliance, China undertook its nuclear weapons program with tremendous assistance from the Soviet Union. The Soviet Union basically designed and built the fledgling nuclear industry in China until 1960, when the USSR abruptly ceased all nuclear cooperation and the two nations engaged in a Cold War of their own. From 1955 to 1958, the Chinese were almost completely dependent upon the Soviet Union for scientific and technological assistance. During this period six Sino-Soviet nuclear accords were signed, ranging from joint uranium prospecting to the transfer of Soviet nuclear weapons technology.

In the most remarkable agreement, the New Defense Technical Accord dated October 15, 1957, the Soviet Union promised, among other things, to supply China with nuclear weapon design information and even a prototype atomic bomb, as well as surface-to-surface and surface-to-air missiles. The Soviet withdrawal, which took until mid-August 1960 to complete, came as a great blow to China's nuclear program, but served as the impetus for China to redouble its efforts.

The Chinese designed their own first fission bomb and successfully tested it on October 16, 1964 at Lop Nur atop a 102 meter tower. The device, nicknamed "596" (for the year and month--June 1959--that Nikita Khrushchev refused to provide the Chinese with a prototype) weighed 1550 kilograms. Device 596 was an implosion device using uranium-235--a difficult first design, chosen because it was technically more advanced than a gun assembly design and also because it required less nuclear material.

The Chinese proceeded in only 32 months from the first fission tests to a full yield hydrogen bomb test on June 17, 1967 and used a Hong-6 bomber to drop the bomb. It detonated at an altitude of 2960 meters above the ground with an estimated yield of 3.3 megatons.

With a limited test program of 43 tests through the end of 1995 China has fielded a comparatively small arsenal, estimated at about 425 weapons of two basic categories. There is a deployed force of some 275 "strategic" weapons structured in a "triad" of land-based missiles, bombers, and submarine-launched missiles. Our estimate includes about 150 artillery shells, atomic demolition munitions or short-range missile warheads; however the size and composition of China's tactical nuclear arsenal is not known.

As for future plans it is unclear whether China plans to deploy missiles with MRV (multiple reentry vehicles) or MIRV (multiple independently targetable reentry vehicles) capabilities China maintains a nuclear bomber force that is old and nearly obsolete, but is developing a new supersonic bomber, known as the Hong-7, that was scheduled for deployment several years ago, but is still a year or two away from active service.

The third and most recent leg of China's triad is the small force of submarine-launched ballistic missiles carried aboard nuclear-powered ballistic missile submarines (SSBNs). Deployment of the force has been slow because of technical difficulties in developing solid fuel for the missiles and nuclear reactors for the submarines. Only one submarine is operational, armed with 12 missiles. How many more vessels are planned is unknown.

Key features of the Chinese program

- We estimate that China maintains an arsenal of about 425 weapons of two basic categories, with a cumulative yield of approximately 400 megatons (See Table 5).

- China has produced about 650 warheads of six different types--including 43 for the nuclear test program--over the period 1964-1995.

- China is working on several programs to modernize its forces. These include a new bomber, several new ballistic missiles, and nuclear submarines. The speed of introducing new systems has traditionally been very slow.

- The future role of nuclear weapons in China's security policy appears to be undergoing some revision, as ongoing technological improvements combine with more graduated ideas of nuclear use.

- It is difficult to predict China's future plans with regard to nuclear weaponry. Politically, China has tried to have it both ways. On the one hand, it succeeded in developing nuclear weapons and did become one of the "big five." On the other hand, China has sought to be the leader of the Third World in disarmament matters and tries to underscore its sincerity by referring to its limited number of tests and modest sized arsenal.

VI. Weapon State Fissile Material Inventories

The U.S. government produced and separated about 103 tonnes (t) of plutonium, and the current inventory is estimated to be about 98 t. Of this amount about 84 t is weapon-grade plutonium that was produced for weapons. Of the weapon-grade plutonium, about 64 t is in

21,500 plutonium pits, including those in weapons and those stored at Pantex[4]. Each pit contains, on average, 3 kilograms (kg) of plutonium. The U.S. total production of highly-enriched uranium ($\geq$20 percent U-235) from 1945 to 1992 was 994 t. Of this amount we estimate the U.S. in recent years had about 500 t of oralloy (~93.5 percent U-235) in weapons or assigned for weapon use.[5] In addition, some thermonuclear secondaries contain uranium that has been enriched above 20 percent U-235. To date the U.S has declared that 173 t of HEU and about 40 t of plutonium are in excess of military needs.

Soviet/Russian warhead plutonium production, which began in 1948, probably amounts to some 150-170 t, of which an estimated 115-130 t was actually fabricated into weapon components (the rest is assumed to be in production scrap, solutions, and residues).[6] With the much smaller contributions from the other nuclear powers, totaling about 12 t, the global stocks of military plutonium today total about 245-265 t.[7] The precise Soviet/Russian total production of HEU for weapons is not known, but is believed to be on the order of 1200 t. Russia has agreed to sell to the U.S. up to 500 t of HEU (90 percent U-235 equivalent) from weapons.

For the three second-tier states the material inventories are correspondingly smaller. The best estimate states that Britain has an inventory of 2.4 t of plutonium and 10 t of HEU, France 4.8 t of plutonium and 25 t of HEU, and China 3.5 t of plutonium and 20 t of HEU. The

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[4] These U.S. warhead and plutonium inventory data are taken from Thomas B. Cochran, "U.S. Inventories of Nuclear Weapons and Weapon-Usable Fissile Material," NRDC Nuclear Weapon Databook Series, Revised 26 September 1995.

[5] Cochran, et al., *Nuclear Weapons Databook, Volume II: U.S. Nuclear Warhead Production*, p. 191.

[6] The upper limit of Soviet plutonium production is from Cochran, et al., *Making the Russian Bomb: From Stalin to Yeltsin*, Appendix C. The lower limit is from Anatoli S. Diakov, "Disposition of Separated Plutonium: an Overview of Russian Program," paper presented at the Fifth International Conference on Radioactive Management and Environmental Remediation, September 3-8, 1995, Berlin, Germany. The fraction of pipeline materials, i.e., solutions, scrap, and residues, in the Russian weapon program is assumed to be comparable to that in the U.S. weapon program.

[7] David Albright, William M. Arkin, Frans Berkhout, Robert S. Norris and William Walker, "Inventories of Fissile Materials and Nuclear Weapons," *SIPRI Yearbook 1995: Armaments, Disarmament and International Security* (Oxford: Oxford University Press, 1995), pp. 317-336.

estimates for Britain and France have margins of error of 20-30 percent while the estimate for the Chinese plutonium calculation is 50 percent.[8]

The amount of plutonium in civil reactor programs is not precisely known. A typical 1000 megawatt-electric (Mwe) light water-cooled power reactor produces about 200 kg of reactor-grade plutonium per year. There are about 432 operating nuclear power plants in the world with a combined capacity of about 340,000 Mwe. The nuclear spent fuel discharged annually from these plants contains some 60-70 t of reactor-grade plutonium. Most of this spent fuel has not been processed, and the cumulative amount of unseparated plutonium today is on the order of 800 t. A few countries, most notably the UK, France, Japan, and Russia, have active programs of commercial spent fuel processing. The new Thermal Oxide Reprocessing Plant (THORP) in the UK is capable of separating about 6-7 t of reactor-grade plutonium per year. On a global scale the ability to separate plutonium has greatly exceeded the ability to turn the plutonium into fresh reactor fuel. As a consequence the global surplus of plutonium separated from civil fuel exceeds 150 t and should exceed that separated for weapons by the year 2000.

VI. Nuclear Weapons Policies

It is useful to distinguish between four distinct kinds of nuclear weapons policies: declaratory, acquisition, deployment, and employment. The five nuclear weapon states have these policies, but define them and implement them differently.

A nations's declaratory policy is that collection of public statements by officials which address the basic questions: why the nation possesses nuclear weapons; how they might be used; and proposals on how to decrease the dangers of living with them. Declaratory policies serve many political and psychological purposes and are directed at several audiences. They are designed to send signals to adversaries, to reassure allies, to comfort anxious domestic publics, and to placate opponents of nuclear arms.

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[8] Ibid.

Acquisition policies are developed to explain why new weapons are needed and eventually purchased. The professional military, civilian officials and bureaucrats, and manufacturers and members of legislative bodies (if relevant) determine that a new weapon will be better than its obsolete predecessor and thus it should be researched, developed, procured and deployed.

Deployment policy focuses on where nuclear forces are based, either at home or abroad, and is intimately intertwined with employment policy.

Employment policy establishes and directs how a nation would actually use its present nuclear weapons to fight a war. The actual plans themselves are among the most secret of all information, known only to a few. The U.S. nuclear war plan is called the Single Integrated Operational Plan, or SIOP. The other nations, no doubt, have nuclear war plans of their own that are similar.[9]

These four types of policy do not necessarily fit together into a coherent whole, nor do they always keep pace with fast moving geopolitical changes. To take the U.S. as an example. Current U.S. employment policy remains, in its basic elements, that which was formulated in the late 1970s and implemented in the early 1980s. It was a nuclear warfighting, counterforce strategy that relied on high accuracy missiles to hold Soviet leadership and high value military targets at risk. At the time this was what was defined as essential for deterrence. Deterrence, we should add, always has been an all purpose rationale, an elastic concept invoked to justify everything and anything that was done. Characteristic of the American definition and practice were very high degrees of readiness with a forces spanning the globe. The image of a coiled spring is an appropriate metaphor for the way U.S. forces were deployed and postured. At the time, but even more so now, we can see that this coiled spring was very dangerous, very costly, arbitrary, and excessive, even for the purposes for which it was said to be needed. Deterrence could have been defined in many other ways than it was. For the future a less expansive definition of deterrence can be a crucial place to begin to effectuate fundamental change.

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[9] Desmond Ball and Jeffrey Richelson, eds., *Strategic Nuclear Targeting* (Ithaca: Cornell University Press, 1986).

VII. Nuclear Weapon Budgets

How much money have nuclear weapons cost? In the most comprehensive study done to date, of the U.S. arsenal, the estimate is about $4 trillion over 50 years (1995 dollars).[10] This represents between one quarter and one third of all U.S. military spending since World War II. While difficult to compute and compare such expenditures the Soviet Union probably spent an equivalent amount. The second tier powers, with arsenals 50 to 100 times smaller than the two superpowers, obviously spent correspondingly lesser amounts, though start up costs were large, and calculated on a per capita basis, they were significant. Because of Great Britain's collaboration with the U.S. the costs were reduced. China's costs are impossible to determine at this point. On a per capita basis they are almost assuredly lower than the other nuclear powers, but given the under development of the Chinese economy during the Cold war the opportunity costs for the Chinese people were large. France for many years spent about one third of its military budget on nuclear weaponry, with a few years rising to forty percent or more. In recent years the share has dropped to about 20 percent.

[10] Nuclear Weapons Cost Study Project Committee, "Four Trillion Dollars and Counting," *Bulletin of the Atomic Scientists*, November/December 1995, pp. 32-52, is an extensive excerpt.

Table 1.
United States Nuclear Forces, end-1995.

Type Name	Launchers/ SSBNs	Year deployed	Warheads x yield (megaton)	Total warheads*	Total megatons*
ICBMs					
LGM-30G Minuteman III	525			1,575	429
Mk-12	(200)	1970	3 W62 x .170 (MIRV)	(600)	(102)
Mk-12A	(325)	1979	3 W78 x .335 (MIRV)	(975)	(327)
LGM-118A MX/Peacekeeper	50	1986	10 W87 x .300 (MIRV)	500	150
sub-total	**575**			**2,075**	**579**
SLBMs					
UGM-96A Trident I C4	192/8	1979	8 W76 x .100 (MIRV)	1,536	154
UGM-133A Trident II D5	192/8			1,536	304
Mk 4		1992	8 W76 x .100 (MIRV)	(1,152)	(115)
Mk 5		1990	8 W88 x .475 (MIRV)	(384)	(182)
sub-total	**384/16**			**3,072**	**451**
Bomber/weapons**					
B-1B Lancer	82	1986	ALCM .05-.150	1,000	150
B-2 Spirit	8	1994	B53/61/83 bombs	1,400	950
B-52H Stratofortress	76	1961	ACM .05-.150	400	60
sub-total	**166**			**2,800**	**1,150**
Strategic Total	**1,125**			**~8,000**	
Non-Strategic					
Sea-launched cruise missile	--	1984	.05-150	350	53
B61 Tactical Bombs	--	1980	10-170	800	136
TOTAL				**9,150**	**~2,400**

Does not include spares and reserve. * Numbers may not add due to rounding. ** B-1B's and B-2s do not carry ALCMs or ACMs. The first 16 B-2s initially will only carry the B83. Eventually all B-2s will be able to carry both B61 and B83 bombs. **ACM**--advanced cruise missile; **ALCM**--air-launched cruise missile; **ICBM**--intercontinental ballistic missile, range greater than 5,500 kilometers; **MIRV**--multiple independently targetable reentry vehicles; **SLBM**--submarine-launched ballistic missile; **SSBN**--nuclear-powered ballistic missile submarine.

Table 2.
Russian (C.I.S.) Nuclear Forces, end-1995.

Type	Name	Launchers	Year deployed	Warheads x yield (megaton)	Total warheads	Total megatons
Strategic Forces						
ICBMs						
SS-18 M4/M5/M6	Satan (RS-20)	186	1979	10 x .550/.750 (MIRV)	1,860	1,023
SS-19 M3	Stiletto (RS-18)	170	1979	6 x .550 (MIRV)	1,020	561
SS-24 M1/M2	Scalpel (RS-22)	36/10	1987	10 x .550 (MIRV)	460	253
SS-25	Sickle (RS-12M)	345	1985	1 x .550	345	190
sub-total		**748**			**3,685**	**2,027**
SLBMs						
SS-N-18 M1	Stingray (RSM-50)	208 (13)	1978	3 x .500 (MIRV)	624	312
SS-N-20 M1/M2	Sturgeon (RSM-52)	120 (6)	1983	10 x .200 (MIRV)	1,200	240
SS-N-23	Skiff (RSM-54)	112 (7)	1986	4 x .100 (MIRV)	448	45
sub-total		**440**			**2,272**	**597**
Bomber/weapons						
Tu-95MS6	Bear H6	31	1984	6 AS-15A ALCMs or bombs	186	47
Tu-95MS16	Bear H16	57		16 AS-15A ALCM or bombs	912	228
Tu-160	Blackjack	25	1987	12 AS-15B ALCMs or 12 AS-16 SRAMs, or 12 bombs	300	75
sub-total		**113**			**1,398**	**350**
Strategic Total		**1,452**			**7,355**	**~3,000**
Non-strategic Forces						
Antiballistic missiles (ABMs)						
Surface-to-air missiles (SAMs)						
Air-to-surface missiles (ASMs)					2,750	
Sea-launched cruise missiles (SLCMs)						
Gravity bombs						
ASW weapons						
					~10,100*	

*Does not include spares and reserve

Table 3.
British Nuclear Forces, end-1995.

Type	Designation	No. Deployed	Year first Deployed	Range (km)	Warhead x yield	Warheads in stockpile
Aircraft[a]						
GR.1	Tornado	96	1982	1,300	1-2 x 200-400 kt	100[b]
SLBMs						
A3-TK	Polaris	48	1982	4,700	2 x 40 kt	70[c]
D-5	Trident II	16	1994[d]	7,400	4-6 x 100 kt	128

a The Royal Air Force operate 8 squadrons of dual-capable Tornado GR.1/1A aircraft. These include 4 squadrons at RAF Bruggen, Germany (Nos. 9, 14, 17, 31); 2 squadrons previously at RAF Marham were redeployed to RAF Lossiemouth in 1994. They replaced the Buccaneer S2B in the maritime strike role and were redesignated Nos. 12 and 617; and 2 reconnaissance squadrons at RAF Marham (Nos. 2, 13). Each squadron has 12 aircraft.

b The total stockpile of WE-177 tactical nuclear gravity bombs was estimated to have been about 200, of which 175 were versions A and B. The C version of the WE-177 was assigned to selected Royal Navy (RN) Sea Harrier FRS.1 aircraft and ASW helicopters. The WE-177C existed in both a free-fall and depth-bomb modification. There were an estimated 25 WE-177Cs, each with a yield of approximately 10 kt. After several unilateral actions leading to numerical reductions, extension of service life, and elimination of the naval mission, the government announced on April 4, 1995 that the remaining WE 177s would be witdrawn by the end of 1998, ending the RAF's nuclear role.

c Apparently the UK produced only enough warheads for three full boatloads of missiles, or 48 missiles, with a total of 96 warheads.

d HMS Vanguard went on its first patrol in December 1994. HMS Victorious is scheduled to deploy in mid-1996. The MOD announced that "each submarine will deploy with no more than 96 warheads, and may carry significantly fewer."

Table 4.
French Nuclear Forces, end 1995.

Type	No. deployed	Year first deployed	Range (km)	Warhead x yield	Warheads in stockpile
Land-based aircraft					
Mirage IVP	18	1986	1,570	1 x 300 kt ASMP	15
Mirage 2000N/ASMP	45[a]	1988	2,750	1 x 300 kt ASMP	45
Carrier-based aircraft					
Super Etendard	24	1978	650	1 x 300 kt ASMP	20
Land-based missiles					
S3D	18	1980	3,500	1 x 1 Mt	18
Hadès[b]	[30]	[1992]	480	1 x up to 80 kt	[30]
SLBMs[c]					
M-4A/B	64	1985	6,000	6 x 150 kt	384

a Only 45 (three squadrons--EC 1/4 and EC 2/4 at Luxeuil and EC 3/4 at Istres) of the 75 Mirage 2000N aircraft have nuclear missions.

b Although the first regiment was activated at Suippes in eastern France on 1 September 1991, the plan to deploy Hadès was shelved soon after and the missiles and warheads were placed in storage. The program had an original goal of 60 launchers and 120 missiles and was eventually cut to 15 launchers and 30 missiles. The Pluton has been retired.

c Upon returning from its 58th and final operational patrol on 5 February 1992, SSBN Le Redoutable was retired, along with the last MSBS M20 missiles. The remaining five submarines (Le Terrible, Le Foudroyant, L'Indomptable, Le Tonnant and L'Inflexible) are capable of carrying the MSBS M4A/B missile. Although there are 80 launch tubes on the 5 SSBNs, only 4 sets of SLBMs were bought, and thus the number of TN 70/71 warheads in the stockpile is calculated to be 384, probably with a small number of spares. Le Triomphant was launched on 13 July 1993 and will enter service in 1996, followed by Le Téméraire in 2000 and Le Vigilant in 2002 or 2003.

Table 5.
Chinese Nuclear Forces, end-1995.

Type	NATO designation	No. deployed	Year first deployed	Range (km)	Warhead x x yield	Warheads in stockpile
Aircraft[a]						
H-6	B-6	120	1965	3,100	1 x bomb	
Q-5	A-5	30	1970	400	1 x bomb	150
H-7	B-7?	0	1996?	?	1 x bomb	
Land-based missiles[b]						
DF-3A	CSS-2	50	1971	2,800	1 x 1-3 Mt	50
DF-4	CSS-3	20	1980	4,750	1 x 1-3 Mt	20
DF-5A	CSS-4	7	1981	13,000+	1 x 3-5 Mt	7
DF-21	CSS-6	36	1985	1,800	1 x 200-300 kt	36
DF-31	CSS-?	0	Late 1990s?	8,000	1 x 200-300 kt	?
DF-41	CSS-?	0	2010?	12,000	MIRV	?
SLBMs						
JL-1	CSS-N-3	12	1986	1,700	1 x 200-300 kt	12
JL-2	CSS-N-4	0	Late 1990s	8,000	1 x 200-300 kt	?
Tactical Weapons						
Artillery/ADMs, Short-range missiles				low kt		150

a All figures for bomber aircraft are for nuclear-configured versions only. Hundreds of aircraft are also deployed in nonnuclear versions. Aircraft range is equivalent to combat radius. Assumes 150 bombs for the force, with yields estimated between 10 kt and 3 Mt.

b The Chinese define missile ranges as follows: short-range, < 1,000 km; medium-range, 1,000-3,000 km; long-range, 3,000-8,000 km; intercontinental range, > 8,000 km. The nuclear capability of the M-9 is unconfirmed and not included.

Table 6.
Nuclear Milestones.

	United States	Soviet Union	Britain	France	China
Current number of warheads in stockpile (end-1995)	10,000--active 5,000--awaiting disassembly	12,000--active 12,000--awaiting disassembly	300	485	425
Peak number of warheads in stockpile/year	32,500/1967	45,000/1986	350/1975	538/1991	450/1993
Total number of warheads built	70,000 1945-1990	55,000 1949-1995	900 1952-1995	1250 1960-1995	650 1964-1995
Number of known test explosions (end 1995)	1,030	715	45	209	43
Testing Milestones					
First fission test, type/yield	16 July 1945 Plutonium/23 kt	29 August 1949 Plutonium/20 kt	3 October 1952 Plutonium/25 kt	13 February 1960 Plutonium/60-70 kt	16 October 1964 U-235/20 kt
First test of boosted weapon/yield	8 May 1951 Item/46 kt	12 August 1953 Joe 4/400 kt	19 June 1956 ? Mosaic G2/98 kt	24 September 1966 Rigel/150 kt	9 May 1966 c. 200 kt
First multistage thermonuclear (hydrogen bomb) test, yield	31 October 1952 10.4 Mt	22 November 1955 1.6 Mt	8 November 1957 1.8 Mt	24 August 1968 2.6 Mt	17 June 1967 3 Mt
Number of months, 1st fission bomb to 1st multistage TN	87	75	61	102	32
First airdrop explosion nuclear weapon, aircraft	6 August 1945 B-29	6 November 1955 Bear	11 October 1956 Valiant	19 July 1966 Mirage IVA	14 May 1965 Hong 6

	United States	Soviet Union	Britain	France	China
Number of known atmospheric tests (includes underwater)	215	219	21	50	23
Largest atmospheric test	28 February 1954 15 Mt	30 October 1961 50 Mt	4 April 1958 3 Mt	24 August 1968 2.6 Mt	17 November 1976 4 Mt
Last atmospheric test	4 November 1962	25 December 1962	23 September 1958	15 September 1974	16 October 1980
First underground test	26 July 1957	11 October 1961	1 March 1962	7 November 1961	23 September 1969
Largest underground test	6 November 1971 5 Mt	27 October 1973 2.8-4 Mt	5 December 1985 <150 kt	25 July 1979 120 kt	21 May 1992 660 kt
Megatons expended in all tests	179	285	8.9	14	23.4
Megatons expended in atmospheric tests	141	247	8	10	21.9
Current test site	Nevada	Novaya Zemlya	Nevada	Mururoa Fangataufa	Lop Nur (Malan)
Weapon Development Milestones					
Atomic bomb developers	J. Robert Oppenheimer Gen. Leslie Groves	Igor V. Kurchatov Lavrenti Beria	William G. Penney John Cockcroft Christopher Hinton	Gen. Charles Ailleret Pierre Guillaumat	Nie Rongzhen Liu Jie, Li Jue Deng Jiaxian
Hydrogen bomb developers	Stanislaw Ulam Edward Teller	Andrei Sakharov Yuliy B. Khariton Yakov B. Zeldovich	William Cook Keith Roberts Bryan Taylor	Robert Dautray	Deng Jiaxian Yu Min Peng Huanwu
First operational ICBM	31 October 1959 Atlas D	1960 SS-6	none	2 August 1971 S2 IRBM	August 1981 Dong Feng-5

	United States	Soviet Union	Britain	France	China
First nuclear-powered naval vessel enters service	January 1955 *Nautilus* SSN	August 1958 *November* SSN	1963 *Dreadnought* SSN	January 1971 *Le Redoutable* SSBN	1974 *Han* SSN
First SSBN patrol with Polaris-type SLBM	15 November 1960 *Washington* Polaris A1	1968 *Yankee* SS-N-6	Mid-June 1968 *Resolution* Polaris A3T	28 January 1972 *Le Redoutable* M1 SLBM	1986 *Xia* JL-1
First MIRVed missile deployed	19 August 1970 Minuteman III	1974 SS-18/SS-19 ?	Dec 1994 Trident II	April 1985 M4A SLBM	none yet
The Nuclear Infrastructure					
Assembly/disassembly plants	Pantex, near Amarillo, Texas	Nizhnyaya Tura (Sverdlovsk-45), Yuryuzan (Zlatoust-36), Avanguard (Arzamas-16)	Burghfield Royal Ordnance Factory, near Reading	Centre d'Etudes de Valduc (Cote d'Or)	Suhei (Gansu), Guangyuan (Sichuan)
Plutonium production (no. of reactors)	Hanford (9) Savannah River (5)	Chelyabinsk-40 (6) Tomsk-7 (5) Krasnoyarsk-26 (3)	Calder Hall (4) Chapelcross (4) Windscale (2)	Marcoule (3) Chinon-2,-3 (2) Bugey-1 (1) Phénix (1) Celestin-1,-2 (2)	Jiuquan (Gansu) (1) Guangyuan (Sichuan) (1)
Uranium enrichment plants	Oak Ridge Portsmouth Paducah	Verkniy-Neyvinsky Krasnoyarsk Angarsk Tomsk	Capenhurst	Pierrelatte	Lanzhou, Heping (Sichuan)
Chief design labs	Los Alamos Lawrence Livermore	Arzamas-16 Chelyabinsk-70	Aldermaston	Limeil-Valenton	Ninth Academy Mianyang (Sichuan)
Current directors/ administrators	Hazel O'Leary, Sec DOE; Siegfried Hecker, LANL; Bruce Tartar, LLNL	Viktor Mikhailov, Minister of Atomic Energy V.A. Belugin, director, Arzamas-16; V.Z. Nechai, director, Chelyabinsk-70	Donald Spiers, Controller of Establishments Research and Nuclear; Brian Richards, director of Aldermaston	Jacques Bouchard, director, Direction des Applications Militaires	Hu Side, director, Chinese Academy of Engineering Physics (CAEP)

Table 7.
Estimated Nuclear Stockpiles 1945-1995.

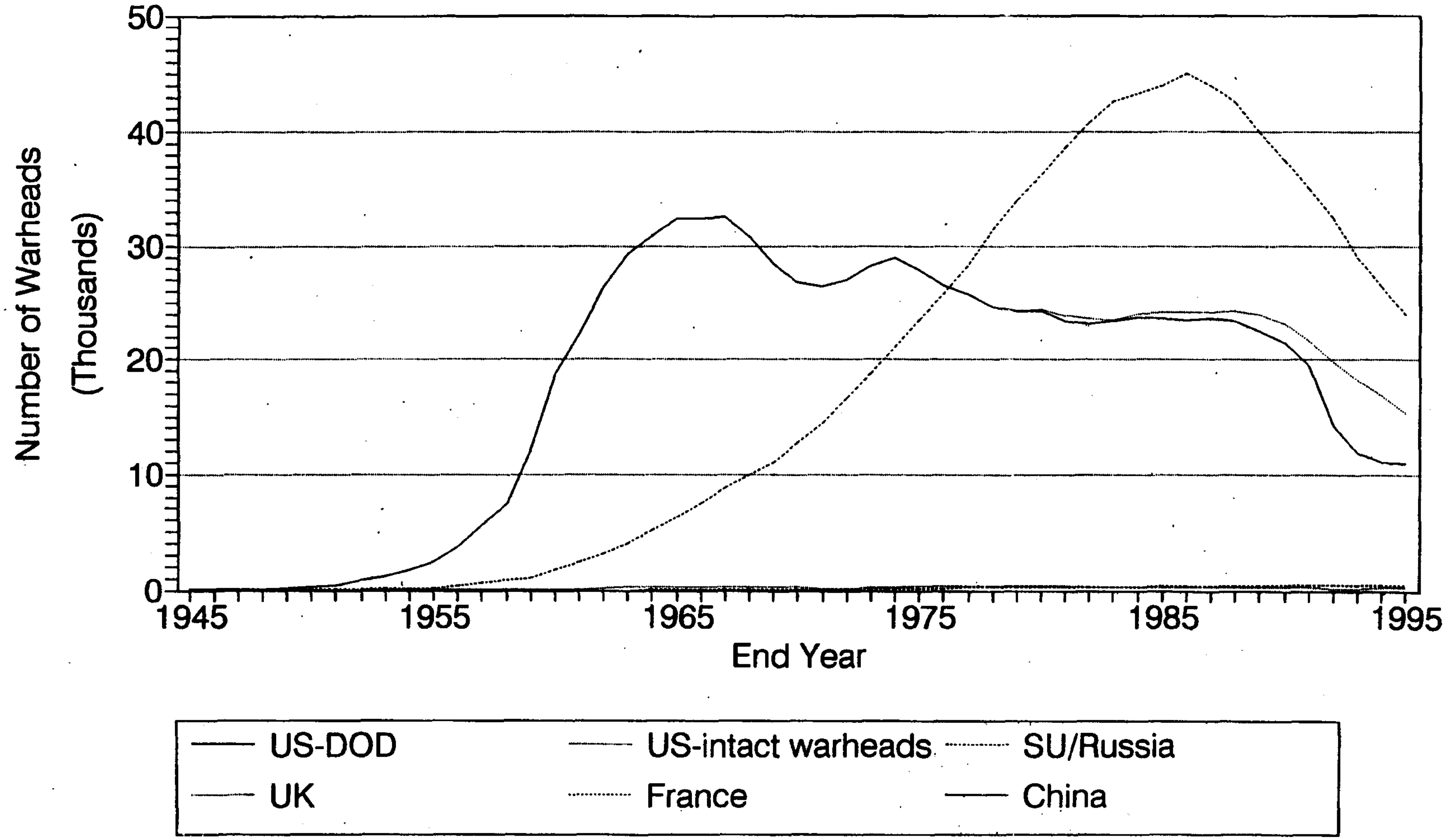
End Year	US	SU	UK	FR	CH	Total
1945	2	-	-	-	-	2
1946	9	-	-	-	-	9
1947	13	-	-	-	-	13
1948	50	0	-	-	-	50
1949	170	1	-	-	-	171
1950	299	2	-	-	-	301
1951	438	5	-	-	-	443
1952	841	10	0	-	-	851
1953	1,169	120	1	-	-	1,290
1954	1,703	150	5	-	-	1,858
1955	2,422	200	10	-	-	1,858
1956	3,692	400	15	-	-	2,632
1957	5,543	650	20	-	-	4,107
1958	7,345	900	22	-	-	6,213
1959	12,298	1,050	25	-	-	8,267
1960	18,638	1,700	30	-	-	13,373
1961	22,229	2,450	50	-	-	20,368
1962	26,317	3,100	205	-	-	24,729
1963	29,300	4,000	280	-	-	29,622
1964	30,817	5,100	310	0	0	33,580
1965	32,400	6,300	310	4	1	36,232
1966	32,472	7,550	270	32	5	39,047
1967	32,516	8,850	270	36	20	40,348
1968	30,858	10,000	280	36	25	41,697
1969	28,497	11,000	308	36	35	41,209
1970	26,780	12,700	280	36	50	39,891
1971	26,506	14,500	220	36	75	39,871
1972	27,000	16,600	220	45	100	41,371
1973	28,250	18,800	275	70	130	44,020
1974	28,950	21,100	325	116	150	47,591
1975	27,950	23,500	350	145	170	50,690
1976	26,552	25,800	350	188	185	52,173
1977	25,775	28,400	350	212	190	53,104
1978	24,677	31,400	350	228	200	54,953
1979	24,300	34,000	350	235	220	56,882
1980	24,472	36,300	350	235	235	59,120
1981	23,882	38,700	350	250	280	61,652
1982	23,684	40,800	335	275	330	63,537
1983	23,513	42,600	320	275	360	65,454
1984	24,062	43,300	270	280	380	67,093
1985	24,209	44,000	300	280	415	68,327
1986	24,218	45,000	300	360	425	69,294
1987	24,187	44,000	300	355	425	70,298
1988	24,329	42,500	300	420	415	69,322
1989	24,015	40,000	300	415	430	67,974
1990	23,206	37,500	300	415	435	65,165
1991*	21,611	35,000	300	505	435	61,946
1992*	19,755	32,500	200	540	435	57,886
1993*	18,199	29,000	200	540	435	53,430
1994*	16,830	26,500	250	525	435	48,359
1995*	15,430	24,000	300	485	435	44,500
				485	425	40,640

* For US and Soviet Union/Russia includes warheads with active, operational forces and retired, non-deployed warheads awaiting dismantlement and weapons in reserve. The estimate for the former SU/Russia is 50 percent active, 50 percent retired/reserve.

Table 8
Total Warheads Built, 1945-1995

United States	70,000
Soviet Union	55,000
Great Britain	950
France	1,250
China	650
Total	~128,000

Estimated Nuclear Stockpiles



Estimated Nuclear Stockpiles, 1995