

Appendix A

Nuclear Arms Chronology

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1763

—July 13: British give blankets with small-pox to Indians that attacked Fort Pitt.

1915

—April 22: Germans use chlorine gas weapons at Ypes.

1919

—June: Soon after World War I, Ernest Rutherford creates nuclei (${}^4\text{He} + {}^{14}\text{N} \rightarrow {}^1\text{H} + {}^{17}\text{O}$). "Talk softly please. I have been engaged in experiments, which suggest that the atom can be artificially disintegrated. If it is true, it is of far greater importance than a war."

1920

—Rutherford speculates on existence of the neutron at the Royal Society of London.

1931

—November: Harold Urey discovers deuterium in hydrogen's optical spectra.

1932

—February 27: James Chadwick observes knock-out protons to discover the neutron. (${}^4\text{He} + {}^9\text{Be} \rightarrow {}^{12}\text{C} + {}^1\text{n}$)

1933

—January 28: Adolph Hitler becomes Chancellor of Germany.

—March 4: Franklin Roosevelt becomes President of the United States.

—April: Eleven scientists who had won the Nobel Prize or would win it later were fired from German Universities because they were Jewish. Johannes Stark and Philip Lenard's "Aryan physics" is not accepted by physicists.

—October: Leo Szilard recalls, "It occurred to me in October 1933, that a chain reaction might be set up if an element could be found that would emit two neutrons when it swallowed one neutron." This idea becomes a classified British patent in 1935 before uranium fission is discovered.

1934

—Artificial radioactivity discovered by Marie Curie and Frederic Joliet (alpha particles) and by Enrico Fermi (neutrons).

—June 30: Adolph Hitler leads assassination of storm-trooper rival, Ernst Rohm and others, army taken over.

1938

—December: Fermi receives Nobel prize for physics for discovery of transuranic elements (actually fission of uranium) and departs for the "new world" of the United States.

—December 22: Otto Hahn and Fritz Strassman identify barium isotopes and a few days later, Lise Meitner and Otto Frisch conclude that uranium nucleus was fissioned by neutrons.

1939

- January to May: Many experiments on uranium fission.
- April 29: Conference in Berlin to consider a German bomb and nuclear reactor.
- August 2: Szilard and Edward Teller obtain a letter from Einstein on the possibility of uranium weapons, which Roosevelt receives from Alexander Sachs on October 11, 1939.
- September 1: Hitler invades Poland. US Ambassador to Germany William Dodd (1933-37) writes Roosevelt (Sept.18), "If the [democracies] had co-operated, they would have succeeded. Now it is too late."

1940

- June 3: Paul Harteck fails to produce neutron multiplication in Hamburg reactor (185 kg natural UO₂, 15 tonnes CO₂ ice).

1941

- January: Experiments at the Berlin "virus house," using a 300-kg uranium reactor with impure graphite, cause incorrect rejection of graphite as a moderator in favor of heavy water from Vermork, Norway.
- July: British "Maud" Committee reports that a weapon could be made with 10 kg ²³⁵U; US National Academy Sciences endorses bomb program.
- August: Hamburg group begins construction of ultracentrifuges to obtain ²³⁵U. Centrifuges explode in April 1942, but they attained 7% enrichment by March, 1943.
- October: Neils Bohr and Werner Heisenberg indirectly discuss nuclear weapons, described in Michael Frayen's play *Copenhagen*.
- December 6: Roosevelt directs substantial financial and technical resources to construct uranium bombs.
- December 7: Japan attacks Pearl Harbor.

1942

- May: Germans observe first neutron multiplication (13%) in Leipzig using 570 kg U and 140 kg heavy ice.
- October 2: First of 3700 German-V2 flights.
- December 2: First nuclear chain reaction at Chicago's Stagg Field by Fermi.

1943

- February 28: Vermork heavy water factory destroyed by Allies after a failed attack on November 19, 1942.
- March 15: J. Robert Oppenheimer moves to Los Alamos, New Mexico.
- March: Glen Seaborg suggests Pu weapons might be jeopardized by ²⁴⁰Pu as a spontaneous neutron emitter.
- Resumption of Soviet nuclear experiments.

1944

- Enigma Code decrypted at Bletchly Park, UK.
- August: Bohr presents memorandum on international control of nuclear weapons to British Prime Minister Winston Churchill and Roosevelt.
- November: First batch of spent fuel obtained from Hanford reactors.
- November: Samuel Goudsmit's Alsos mission obtains documents in Strasbourg, which imply that German weapons program made little progress.

1945

- January: First Pu reprocessing production at Hanford.
- January 20: First ²³⁵U separated at the K25 gaseous diffusion plant, Oak Ridge, Tennessee.
- April 25: UN Charter signed by 50 nations in San Francisco.
- May 4: End of war in Europe.
- June 11: The Franck Report on the demonstration of the bomb and its international control sent to US Secretary of War.
- July 16: US explodes first atomic bomb, 19-kt *Trinity*, at Alamogordo, NM with electronics shielded to avoid EMP pulse, 300-m crater.

- August 6, 9: Atomic bombs destroy Hiroshima (Thin Man uranium, 13 kton, 3 m by 0.7 m diameter) and Nagasaki (Fat Man plutonium, 22 kton, 3.3 m by 1.5 m). Each weapon kills 70,000 prompt deaths and 140,000 within a year.
- August 15: End of war in the Pacific.

1946

- June 14: Bernard Baruch presents the Acheson–Lilienthal plan to the UN to internationalize the atom. "We are here to make a choice between the quick and the dead."
- June 30: First underwater detonation on ships by US at Bikini Atoll.
- July: Demonstrations in Times Square, New York City, against nuclear testing.
- December 31: Atomic Energy Commission takes over nuclear weapons program from US Army.

1948

- April, May: US atomic tests, Eniwetok Atoll in the Marshall Islands.
- November 4, 1948: UN General Assembly adopts US plan for international atomic control; USSR opposed.

1949

- April 4: NATO established.
- August 29: First Soviet atomic test, 22 kt of a US design at Semipalatinsk.
- October 30: AEC General Advisory Committee gives approval to build more powerful U bombs rather than the H bomb.

1950

- January 27: Klaus Fuchs confesses he transmitted atomic secrets to the Soviets.
- January 31: US President Harry Truman announces the decision to proceed with the H bomb.
- March: Worldwide peace offensive to "ban the bomb" (the Stockholm Appeal) signed by more than 500 million people.
- June 25: North Korean army crosses 38th parallel, starting a war that lasted until July 1953.

1951

- January 21: First of 928 US tests at Nevada Test Site.
- May 9: *George*, DT–boosted atomic bomb, 225 kton.

1952

- January: UN Security Council establishes Disarmament Committee.
- June: Lawrence Livermore Laboratory established.
- October 3: First of 12 British nuclear tests at Monte Bello Islands, W. Australia.
- November 1: US explodes first fusion device *Mike*, 10.4 Mtons at Eniwetok (liquid deuterium, not deliverable).

1953

- April 18: *Badger* test in front of 2800 troops at Nevada Test Site.
- May: Utah officials ask AEC to stop Nevada tests because of fallout on St. George, Utah.
- August 12: First Soviet fusion device exploded on a tower in Siberia (probably not deliverable).
- Fall: India and Australia propose a total ban on nuclear weapons to the UN.
- December 8: "Atoms for Peace" speech by US President Dwight Eisenhower at UN.

1954

- January 21: First nuclear-powered submarine, USS Nautilus, launched.
- March 1: Castle–Bravo, 15–Mton H bomb test, affects Marshall Islanders and Lucky Dragon.
- April: British Parliament petitions Churchill, Eisenhower, and Malenkov to control nuclear weapons.
- April 12 to May 6: AEC hearings deny Oppenheimer his access to nuclear secrets.
- August 30: Atomic Energy Act of 1954 emphasizes peaceful uses of atomic energy.

1955

- January–December: Reports of increasing global nuclear fallout.
- May 6: West Germany joins NATO.
- May 14: Warsaw Pact Organization established.

- August 8–20: First International Conference on Peaceful Uses of Atomic Energy in Geneva.
- November 22: First deliverable, high yield, Soviet H bomb, 1.6 Mton, Semipalatinsk.

1956

- US National Academy of Sciences panel finds genetic effects from fallout of nuclear tests to be slight compared with effects from natural radiation background. Adlai Stevenson makes fallout an issue in US presidential campaign.

1957

- May 15: First British H bomb exploded of 0.3 Mton at Christmas Island in the Pacific Ocean.
- July 6–11: First Pugwash Conference advocates test ban; Soviet scientists attend.
- August: AEC inaugurates Plowshare Program for peaceful nuclear explosions.
- September 19: Rainier, the first underground test at 1.7 kilotons at Nevada Test Site.
- September 29: Soviets evacuate 10,000 from Mayak reprocessing plant explosion. US keeps the secret.
- October 1: International Atomic Energy Agency inaugurated in Vienna.
- October 4: First satellite Sputnik I put into orbit by USSR.
- December 2: Shippingport electric power reactor reaches full power of 60 MW.

1958

- January 1: European Atomic Energy Community (Euratom) established.
- January 31: Explorer I, first US satellite, put into orbit.
- November 1958–September 1961: US, UK, USSR observe informal moratorium on nuclear tests.

1959

- September 2: Vela Uniform Seismic Project established by US Department of Defense.
- November 24: US/USSR sign a memorandum of cooperation for utilization of nuclear energy.

1960

- February 13: First nuclear test by France, 70 kton, in the Sahara Desert.
- May 1: U-2 spy plane shot down over USSR.
- July 26: USSR suggests 3 on-site inspections/year as part of a test ban.
- November 15: First Polaris missile launched from a US submarine.

1961

- January 17: Eisenhower's farewell address discourses on “the military-industrial complex.”
- February 1: US launches Minuteman-I missile.
- March 31: Pravda suggests the use of H bombs to obtain fresh water from Soviet glaciers.
- April 12: Yuri Gagarin becomes the first cosmonaut in orbit.
- May 29: US and UK agree to draft Comprehensive Test Ban (CTB) Treaty with 12 on-site inspections/year.
- August: Installation of first US seismic stations in a network of 60 countries.
- September 1: USSR resumes nuclear tests.
- September 15: US resumes nuclear tests.
- October 30: Soviet *Tsar* bomb, 58-Mton partial test of 100–150 Mton, Novaya Zemlya.

1962

- February 20: John Glenn becomes first US astronaut in orbit.
- July 6: *Sedan* excavation experiment as a *Plowshare peaceful nuclear explosion*; 10–M tons of earth displaced.
- July 9: Electromagnetic pulse from *Fishbowl* test, 1.4 Mtons, 400 km above Johnston Atoll, turns off 300 streetlights on Oahu, Hawaii (1200 km away).
- September 3–7: Tenth Pugwash Conference proposes "black box" monitoring for CTBT verification.
- October: US reduces requirement to 8–10 inspections/year for a CTBT.
- October 15 to November 20: Cuban missile crisis, 162 warheads, and blockade.
- December 19: Communist Party Secretary Nikita Khrushchev accepts 2–3 inspections/year and 3 unmanned seismographic stations (black boxes) in USSR.

1963

- January: Secret test ban talks between US and USSR.

- February 19: US accepts 7 inspections/year, provided any mysterious event may be challenged.
- April: Khrushchev withdraws offer of 3 inspections/year.
- June 20: US and USSR sign "hot line" agreement.
- August 5: US/USSR/UK sign Limited Test Ban Treaty, banning nuclear explosions in atmosphere, space and underwater.

1964

- August 4: Gulf of Tonkin resolution sends US troops to Vietnam under President Lyndon Johnson.
- October 16: China explodes first nuclear bomb.
- October 22: Salmon, a US cavity-explosion, muffles seismic signal in a salt dome, near Hattiesberg Mississippi.

1965

- June: Large Seismic Array (LASA, Montana) starts detecting nuclear explosions.

1966

- January 17: B-52 bomber crashes near Palomares, Spain with 4 unarmed H bombs, 2 by sea and 2 by land.
- September 24: First French H bomb, in Tuamato Archipelago, Polynesia.

1967

- January 27: Outer Space and Celestial Bodies Treaty bans nuclear weapons in orbit and space.
- February 14: Treaty for Prohibition of Nuclear Weapons in Latin America signed in Mexico City (Tlatelolco); all nations must ratify for the treaty to enter into force.
- June 17: First Chinese H bomb, 3.3 Mton, Lop Nor.
- June 23–25: President Johnson and Soviet Premier Alexi Kosygin begin SALT and ABM talks in Glassboro, NJ,
- December 10: Gasbuggy Plowshare explosion in New Mexico to stimulate natural gas production.

1968

- July 1: Nuclear Non-Proliferation Treaty (NPT) opened for signature.
- August: Soviet GALOSH ABM system deployed around Moscow.
- August 24: French H bomb, 2.6 Mton, Fangataufa Atoll.

1969

- July 20: US Apollo 11 lands on moon.
- November 3: UN Committee on Disarmament proposes global exchange of seismic data to monitor a CTB treaty.
- November–December: Preliminary SALT talks in Helsinki.

1970

- January: Administration of President Richard Nixon cuts Plowshare budget.
- March 5: NPT enters into force with 46 nations in 1970 and 190 in 2013.
- November 30: Atlantic-Pacific Interoceanic Canal Commission rejects use of nuclear explosives.
- December 18: Largest US release of radioactivity from *Baneberry* test.

1971

- March 30: US deploys Poseidon SLBM.
- June 15: Three Russian nuclear explosions set off to increase oil productivity.

1972

- May 26: SALT I and ABM treaties signed by Nixon and Soviet First Secretary Lenoid Brezhnev in Moscow.
- June: UN Conference votes 48 to 2 to halt nuclear testing; France/China oppose, US/UK abstain, USSR absent.
- October: US detects Soviet SS-18 flight test.
- November: SALT II negotiations begin.

1973

- May 30: Protocol establishes the ABM/SALT Standing Consultative Commission.
- June 22: World Court issues an injunction to France to refrain from testing on Mururoa in Pacific Ocean.
- October 17, 1973 to March 17, 1974: OPEC embargoes oil to US/Netherlands.

1974

- May 18: India sets off a 12-kton, Pu-device under Rajasthan Desert, expands nuclear club beyond *WWII P-5*.
- November 24: US/USSR agree to limit strategic launchers (to 2400) and MIRV launchers (to 1320).

1975

- January 19: AEC reorganized into NRC (regulatory) and ERDA (development, became DOE on August 4, 1977 and weapons became NNSA in 1999)
- October 1: Grand Forks, North Dakota Safeguard ABM site is activated. It was closed 4 months later because of its ineffectiveness against Soviet MIRVs at a cost of \$21 billion from 1968–78 (1998\$).

1976

- Public key encryption invented.
- January 29: France cancels its reprocessing exports for South Korea and Pakistan (1978).
- October 28: US President Gerald Ford postpones reprocessing of spent fuel to obtain Pu.

1977

- April 7: US President Jimmy Carter postpones indefinitely commercial reprocessing, halts Clinch River Breeder Reactor and calls for an International Fuel Cycle Evaluation (INFCE) to make the nuclear cycle more resistant to proliferation.
- October 19, 1977, to February 26, 1980: 40 nations prepare INFCE report.

1978

- January 11: Nuclear Suppliers guidelines forwarded to IAEA.
- March 10: Nuclear Nonproliferation Act (NNPA) tightens nuclear export criteria.
- April 4: Anwar Saddat of Egypt and Menahin Begin of Israel sign Camp David Accord in Washington.
- July 13: Euratom ends US embargo of nuclear fuel to Europe (NNPA required renegotiation) with a brief meeting.

1979

- April, 6: US cuts economic and military aid to Pakistan because it is making weapons-grade uranium.
- June 8: First Trident with SLBMs launched.
- June 18: Brezhnev and Carter sign SALT II Treaty in Vienna.
- September 22: Vela satellite bhangmeter picks up a signal over the South Atlantic, perhaps a 3 kton explosion.
- December 12: NATO agrees to negotiate INF Treaty, while building Pershing-II and ground launched cruise missiles.
- December 26: USSR invasion of Afghanistan removes SALT II from US Senate consideration.

1980

- July 15: Office of Science and Technology Policy concludes the light signals recorded by a Vela satellite over the South Atlantic on September 22, 1979 were probably not from a nuclear explosion. Others disagree.
- December: Tomahawk submarine-launched cruise missile flies 600 miles to sea and returns to land with 5-m accuracy.

1981

- April 12–14: Space shuttle Columbia orbits Earth 36 times.
- June 7: Israel destroys Iraq's Osirak reactor, an act that was condemned but later appreciated after Gulf War.
- November 13: Senate ratifies Protocol I of Tlatelolco Treaty; US cannot deploy weapons in Puerto Rico, Virgin Islands, or Guantanamo Naval Base.
- November 30: US tables Zero-Zero INF proposal in Geneva.

1982

- June 14, Argentina surrenders to UK in the Falkland War.
- June 29: Strategic Arms Reduction Talks (START) begin in Geneva.
- July 16: Ambassadors Paul Nitze and Yuli Kvitsinsky walk in Geneva woods, trying to cut INF weapons by 50%.
- 1982: USSR places 300 SS-20 missiles on its western border.
- November: US President Ronald Reagan adopts dense-pack basing for MX missiles.

1983

- March 23: Reagan calls for SDI "to make nuclear weapons impotent and obsolete."
- April 6: Scowcroft Commission recommends Midgetman (road-mobile, single-warhead) and 100 MX.
- Summer: Large phased-array radar construction discovered at Krasnoyarsk.
- November 23: Soviets leave Intermediate Nuclear Force (INF) negotiations as Pershing-II and GLCM are deployed.
- December 8: Soviets suspend START negotiations.

1984

- January: Strategic Defense Initiative Organization (SDIO) created.
- January 23: Reagan's first "Soviet Noncompliance" report released to Congress amid controversy.
- January 30: Soviets respond with an *aide memoire* to US State Department on US noncompliance.
- June 10: Homing Overlay Experiment (HOE) intercepts midcourse missile in limited test of kinetic kill vehicles.

1985

- January 8: Sec. State George Schultz and Amb. Andrei Gromyko agree to negotiate on START/INF/ ABM/SDI.
- February 20: Nitzze criteria for SDI deployment in terms of reliability, survivability and marginal cost.
- October 6: Reagan encourages broad interpretation of ABM Treaty to test other physical principles in space.
- October 14: Schultz states that a broad interpretation the ABM Treaty "is fully justified" to allow SDI testing.

1986

- July: Natural Resources Defense Council sets up seismographs in the Soviet Union.
- September: First B-1 bomber squadron becomes operational.
- October 7: Mordechai Vanunu publishes photos of the Israeli Dimona nuclear weapons facility in the London Times. He is drugged and taken to Israel for solitary confinement until April 22, 2004.
- October 11-12: Reagan and Soviet leader Mikhail Gorbachev agree to cut strategic weapons by 50% at Reykjavik.
- November 28: The 131st B-52 bomber with air launched cruise missiles is deployed, exceeding the 1320 warhead limit on MIRVed launchers, negating SALT II. US is first country to publicly renounce an arms control agreement.
- December: First 10 Peacekeeper missiles become operational in Minuteman-III silos in Wyoming.

1987

- February: Soviets end unilateral nuclear testing moratorium after 18 months.
- April 7: Missile Control Technology Regime signed to slow missile proliferation.
- April 23: APS Directed Energy Weapons Study (DEWS) Group "estimates that even in the best of circumstances, a decade or more of intensive research would be required [for an informed decision on DEWS]."
- August: First of six South African gun-type weapon is qualified.
- September 15: Schultz and Soviet Foreign Minister Eduard Shevardnadze sign Nuclear Risk Reduction Accord.
- December 8: Reagan and Gorbachev sign Intermediate Nuclear Force Treaty.

1988

- May 27: US Senate ratifies INF Treaty (93-5), the first ratification of an arms control treaty since 1972.
- June 28: Office of Technology Assessment testifies it disagrees with the charge of "likely violation of TTBT."
- August-September: Joint Verification Experiment on nuclear tests carried out by US/USSR.

1989

- June 4: Chinese shoot 100's in Tiananmen Square. By 2012, many rebel students now national leaders.
- November 9: Fall of Berlin Wall.

1990

- October 24: Last Soviet nuclear test, as Gorbachev calls for a moratorium.
- November 19: NATO and Warsaw Pact sign Conventional Armed Forces in Europe (CFE) Treaty, limiting tanks/planes to same levels, a 60% reduction for WTO and no reduction for NATO. Enters into force in 1992, ending the Cold War.

1991

- April 3: UN Resolution 687 requires destruction of Iraq's nuclear/bio/chem weapons.
- July 10: South Africa signs NPT and later destroys its 6 nuclear weapons.
- July 31: US and USSR sign START I, each cutting from 12,00 to 7000 actual warheads.
- September 27/October 5: US President George H.W. Bush and Soviet leader Gorbachev reciprocal-unilateral measures place missiles to be cut by START I off alert, and remove surface-ship and ground-based tactical weapons.
- November 26: Last British test at NTS.
- November 27: Sam Nunn–Richard Lugar Act passes, giving Russia first \$400 million to destroy weapons.
- December 1: Ukraine votes to become independent of USSR, followed by 13 other Soviet Republics and Russia.

1992

- March: US ends military Pu reprocessing, HEU production stopped in 1964.
- March 9: China joins the NPT regime.
- March 24: Open Skies Treaty signed, allowing monitoring by overflights of NATO and Warsaw Pact aircraft.
- May 23: START's Lisbon Protocol signed by US/Russia/Ukraine/Belarus/Kazakhstan, all agreeing to join NPT.
- August 3: France joins NPT regime.
- September 23: Last US nuclear test, *Divider*. Bush-I signs testing ban legislation.
- October 1: US Senate ratifies START I with the Biden condition calling for "the adoption of cooperative measures to enhance confidence in reciprocal declarations [for warheads and fissile materials]."

1993

- January 3: US/Russia sign START II, cutting deployed strategic warheads from 7000 to 3500.
- February 18: US/Russia agree on sale of 500 tonnes of HEU, blended to LEU reactor fuel.
- March 3: France joins the NPT.
- April 1: IAEA declares North Korea in violation of the NPT.
- September: US/Russia agree to start Materials Protection Control and Accounting program with lab-to-lab assistance.
- September 27: President Bill Clinton proposes Fissile Material Cut-off Treaty banning production of weapons Pu/HEU.
- December: UN adopts resolution calling for a Fissile Material Cut-off Treaty.

1994

- April 30: Nuclear Proliferation Prevention Act (Glenn-Pell Act) provides for sanctions on nuclear testing.
- May 30: US/Russia detarget strategic missiles, but they can be quickly reprogrammed.
- June 23: US Vice President Gore and Russian Prime Minister Viktor Chernomyrdin agree to close last 3 Russian Pu-production reactors by 2000 with some US aid to establish another power source.
- September 20: Clinton and Russian President Boris Yeltsin agree to exchange data on warheads and Pu/HEU.
- October 1: Russia stops plutonium production, except at 3 reactors where waste heat is used to heat cities.
- October 23: US/N–Korea sign "Agreed Framework" to eliminate N. Korean nuclear program and get S. Korean reactors.

1995

- March 1: Clinton announces permanent removal of 100 tonnes of Pu/HEU from US stockpile.
- May 10: Clinton and Yeltsin agree to declarations/inspections on excess Pu/HEU from weapons.
- May 12: NPT extended indefinitely after the 5 nuclear weapon states promise to join a CTBT.
- August 11: Clinton announces US will support a zero-yield CTBT.
- December 19: Wassenaar Arrangement on export controls replacing Cold War controls.

1996

- January 26: Senate ratifies START II by 87–4, cutting to 3500 total warheads each and banning land-based MIRVs.
- January 27: France conducts last test and supports a zero-yield CTBT.
- March 25: US joins South Pacific Nuclear-Free Zone.
- April 11: Pelindaba Treaty for Nuclear-Free Africa signed by 43 African states.
- July 29: China's last nuclear test, 2 months before signing CTBT.
- September 10: UN opens CTBT for signature, banning nuclear tests everywhere, for all time, at any yield. Only India, Bhutan and Libya are opposed.
- September 17: US/Russia/IAEA agree to trilateral inspections on excess SNM.

- September 24: All five nuclear weapon states sign the CTBT at the UN.
- 1996: Last nuclear warheads from former Soviet Republics returned to Russia.

1997

- April 29: Chemical Weapons Convention enters into force.
- March 21: Clinton and Yeltsin in Helsinki call for START III reductions to 2000–2500 deployed, strategic warheads and "measures relating to the transparency" for inventories and destruction of strategic warheads.
- May 15: IAEA adopts Additional Protocol to give IAEA more powers.
- May 27: Yeltsin signs NATO-Russian Founding Act.
- September 7: Russian General Alexander Lebed claims that "up to 100 suitcase bombs are not under the control of the Armed Forces of Russia."

1998

- May 11, 13 and 28: India and Pakistan conduct multiple underground nuclear tests.
- August 31: North Korea launches a Dong-I missile over Japan.
- September 22: US and Russia sign Nuclear Cities Agreement to help 10 Russian closed weapon cities.

1999

- October 13: US Senate rejects CTBT (51–48) in spite of 150 signatory nations.

2000

- April: Duma ratifies CTBT (April 21) and START II (April 14), contingent on constraint of ABM demarcation.
- May, 22: NPT review conference agrees to the 13 steps for progress on nuclear disarmament.
- September 1: Gore/Chernomyrdin agree to dispose of 34 tonnes Pu each, as MOX fuel or buried in a repository.

2001

- May 1: President George W. Bush states he will withdraw US from ABM Treaty to test/deploy ABM options.
- May 31: INF continuous Perimeter and Portal Monitoring ends as INF 13-year period ends.
- September 11: Osama bin Laden's al Qaeda uses US commercial planes to kill 3000 in destroying the World Trade Center and damaging the Pentagon. The US joins Afghan resistance forces to topple Taliban government, producing a new leader, Hamid Karzai. The 9-11 event creates a *major paradigm shift* to focus on terrorism over other matters.
- September-October: Letter-borne anthrax contamination in US postal system and buildings.
- December: G. W. Bush administration funds CTBT research, but not that which aids CTBT entry-into-force.
- December 4: US and Russia complete START I reductions to 6,000 accountable warheads.
- December 7: US ends discussion on verification of Biological Weapons Convention.
- December 13: G.W. Bush formally starts process to withdraw from ABM Treaty 6 months hence.
- December 14: Navy Area Theater Ballistic Missile Defense system, covering small areas, is cancelled.

2002

- January 4: DoD Ballistic Missile Defense Office elevated to Missile Defense Agency.
- January 8: Nuclear Posture Review sets path to 1700–2200 deployed, operational US warheads by 2012, while retaining up to 5000 warheads on "active and inactive reserve" that can be deployed in days to years. The "new triad" combines offense, defense, conventional arms and rapid information. Targeted countries are Russia, China, Iran, Iraq, Libya, N. Korea and Syria in possible conflicts between Israel/Iraq, N. Korea/S. Korea, PRC/Taiwan. The NPR suggests that new designs are needed to create a 5-kiloton earth-penetrating bomb to attack underground bunkers. Congress shortens preparation time for test-sites readiness for this weapon.
- January 23: Bush administration continues US/Russia Pu-MOX disposition but cancels geological immobilization.
- January 29: Bush labels North Korea, Iran and Iraq as an "axis of evil arming to threaten the peace of the world."
- March 14: India integrates the Agni-2 missile (2000 km, 1000 kg) into its armed forces.
- May 24: Presidents George W. Bush and Vladimir Putin sign the Strategic Offensive Reductions Treaty, which reduces *operational* warheads to 1700-2200. SORT allows response forces of some 2400 additional warheads, adds no new verification measures, and expires on December 31, 2012, the same date the limit of 1700-2200 is required. Russia retains 138 SS-18s and many SS-19s which would have been removed under START II.
- October 16: US announces North Korea admits having a clandestine centrifuge program to make HEU.
- November 4: Cuba accedes to the NPT, completing Western Hemisphere. UN conference lobbies nuclear weapon states to agree to a negative security assurance, so non-weapon states would not fear nuclear weapons.

- November 27: UN inspections begin in Iraq, pursuant to UN resolution 1444 that required Iraq to disarm its weapons of mass destruction, or be in “material breach.” In 1997, Iraq declared 8 presidential palaces off limits, leading to an end of inspection.
- December 8: Iraq declares its lack of weapons of mass destruction as required by UN resolution.

2003

- January 10: North Korea withdraws from NPT after IAEA inspectors are removed (Dec. 27) and Governing Board “deplores in the strongest terms” (Jan. 6) the reprocessing restart, claimed two weapons and beginning centrifuges.
- March 2: Department of Homeland Security established with a budget of \$30 billion.
- March 6: Senate ratifies Strategic Offensive Reduction Treaty. Iraq-war anger delays Russian Duma to May 14.
- March 19: US/UK invade Iraq for a 3-week war, without explicit support from the UN, which wanted more time for more inspections. Unrest in Iraq continues after the war, without evidence for weapons of mass destruction.
- March 31: US mildly sanctions Pakistan’s Kahn Research Institute for exporting centrifuge equipment to N. Korea in trade for missile technology.
- April 22: Los Alamos builds first US Pu pit in 15 years, a beginning for a plant to make 125 pits/year by 2018.
- April 25: North Korea tells US in Beijing that it has Nuclear weapons.
- June 6: IAEA Board of Governors charges Iran with a violation over clandestine centrifuges discovered on Feb. 20.
- August 28: North Korea informs China, Japan, Russia, South Korea and the US that it may test in the near future.
- December 14: Saddam Hussain captured.
- December 19: Libya announces it will dismantlement its nuclear weapons programs.

2004

- February 4: Pakistan President Pervez Musharraf pardoned Abdul Qadeer Khan for supplying centrifuge technology to Iran, Libya and North Korea.
- February 20: IAEA report states that Libya had ordered 10,000 centrifuge tubes, but was now cooperating.
- July 9: The Senate Intelligence Committee Report rebukes the October 2002 National Intelligence Estimate that “Baghdad has chemical and biological weapons by stating that this conclusion “overstated both what was known and what intelligence analysis judged about Iraq’s chemical and biological weapons holdings.” The CIA did not invite DOE to test alleged centrifuge tubes. The administration’s charge of Iraq’s purchase of uranium was incorrect.
- July 22: The *9/11 Commission Report* states “we have seen no evidence that these or other earlier contacts ever developed into a collaborative operational relationship [Al Qaeda/Iraq].”
- September 30: Report on Iraq Weapons of Mass Destruction released by Charles Duelfer (Chief Iraq WMD Inspector). It agreed with the results of David Kay (“we were all wrong”). The report concluded Iraq’s nuclear program ended in 1991, that Iraq unilaterally destroyed its chemical weapons in 1991 and that Iraq abandoned its ambitious biological weapon plans, but Saddam retained his desire for WMD.
- October 19: Brazil agrees to IAEA inspections of centrifuges, hoped as a precedent for Iran.
- December 7: US intelligence organized under centralized National Intelligence Director.

2005

- January 31: Elections in Iraq with high Shiite/Kurd turn-out but negligible Sunni participation.
- February: Iran nuclear program evident as FR/FRG/UK try diplomacy and US exerts pressure.
- February 10: North Korea claims it has nuclear weapons and refuses to join 6-party talks.
- March 6: China questions US data on DPRK nuclear weapons, suggests 2-party, US/NK talks.
- July 29: State department absorbs its arms control bureau into the non-proliferation bureau.
- September 19: North Korea commits to abandon its nuclear weapons program, returning to the NPT and safeguards.
- September 24: IAEA finds Iran in noncompliance to the NPT.

2006

- March 2: President Bush and Prime Minister Manmohan of India agree to cooperate on peaceful nuclear power, this requires amending the 1978 NNPA nonproliferation law and obtaining unanimous consent from the Nuclear Suppliers Group. India would place 14 of its 22 reactors under India-specific IAEA safeguards.
- April: Iran declares it has 164 centrifuges. US joins France, Russia and UK to dissuade Iran from enriching uranium on its soil. Brazil continues its work on its enrichment plant since 2004.

—October 9: DPRK test of 0.6 kt detected by 22 IMS seismic stations (with 30 certified). RadioXe detected by IMS and portable sensors.

—December 10: President Ehud Olmert lets slip that Iran is “aspiring to have nuclear weapons as America, France, Israel, Russia.”

2007

—January 11: China uses a kinetic-kill, anti-satellite weapon to destroy a Chinese weather satellite. Arms race in space or a nudge to control ASAT weapons?

—February 13: Six party talks yields “initial actions” plan to implement September 2005 pledge by DPRK to abandon nuclear weapons and programs. This later fails.

—March 2: NNSA chooses the LLNL to design Reliable Replacement Warheads. Congress denies funding in 2008.

—July: First W-88 produced in 18 years at Los Alamos, to build 20–50 per year.

2009

—April 5: President Obama states in Prague his intention to move towards abolition of nuclear weapons, with NEW START and CTBT ratifications. He stated his intention to remove troops from Iraq, but send more troops to Afghanistan, until perhaps 2013.

—May 25: DPRK 3-kt test detected by 61 IMS seismic stations, but not the radioXe signal.

—September 25: US, UK and France announce that Iran is building a covert enrichment facility inside a mountain near Qom. Previously Iran indicated it might restrain its enrichment program.

—November 29: Indian Prime Minister Singh states India is willing to join NPT as NWS.

2010

—April 5: Nuclear Posture Review removes 1st US response of nuclear attacks on NNWS bio-chem attacks, but retains this response for the 9 states, which have nuclear weapons. No new ICBMs proposed.

—April 8: New START signed in Prague with limits of 1550 operational strategic weapons and 700 deployed launchers. Tactical weapons not covered, as usual, but they consist of about 250 for the US and 2000 for RF, down from the Cold War numbers of 8000 and 23,000. Prompt Global Strike conventional weapon ICBMs to count as nuclear systems, not to be deployed until 2015-20.

—May: NPT Review Conference obtains consensus, with modest progress in a time of difficulty.

—June: Stuxnet cyberwar attack on Iran, destroying 1000 of 5000 centrifuges.

—June 9: UN Security Council sanctions cut military imports to Iran and restrict proliferating companies on a 12-3 vote. Brazil and Turkey offer a partial solution to allow reactor fuel, but not constrain higher enrichments.

2011

—February 5: New START enters into force, passing Senate Dec. 22, 2010 on 71–26 vote, 1550 operational warheads.

2012

—NNSA and JASONs declare Pu pit lifetimes of over 100 years, using ²³⁸Pu fast decay.

—April 15, 2012: Saudi Arabian Aramco oil company under cyber attack.

—September 25: 100th Joint Actinide Shock Physics Experimental Research (JASPER) to obtain Pu equation of state from Pu projectiles.

—November 29: UN votes 138/9/41 to recognize Palestine as a nation.

—November: Oak Ridge’s Titan computer does 17.6 petaflops, same as 7 billion people doing 3 million calculations a second.

2013

—January 23: Iran notified IAEA it is installing IR-2M centrifuges. Iran has 160 kg of 20%-HEU, needing 240 kg for a warhead’s input steam.

—February: China’s People’s Liberation Army cyber-attacks over 60 US high tech companies.

—February 12: DPRK third nuclear test, 7 kton, under Kim Jong Un.

—May 13: CTBT ratified by 159 nations (not US, China) of 183 signatories (not India, N. Korea, Pakistan), with 36 of 44 nuclear capable nations ratified. Monitoring capability believed to be at 0.1-kt level for tamped explosions, and 1–2 kt for cavity shots. Certified IMS stations (275), testing (20), under construction (20), planned (22).

—March 11: N. Korea nullifies 1953 Korean armistice. Restarts Yongbyon reactor on April 2.

- March 13: 2 million small pox vaccines prepared, only US and RF have small-pox samples.
- April: 12 more ground-based interceptors sent to Alaska in response to N. Korea.
- April 2: UN votes 154/3/23 to regulate global conventional arms trade of \$70 billion/year, U.S. uncertain.
- April 9: US ship-board lasers shoot down slow drones.
- April 15: Tsarnaev brothers attack Boston Marathon. US follows UK lead with 30 million cameras to observe.
- May 23: Command of US drones moved from CIA to DoD.
- May 23: Iran has 14,244 of 50,000 planned centrifuges, 700 are IR-2, more potent. Obama's red line of 240 kg of 20% medium enriched uranium may be crossed in the fall of 2013.
- May 31: Nuclear Regulatory Commission gives license for laser enrichment in North Carolina to General–Electric Hitachi.
- June 3: Supreme Court allows arrested suspects of serious crimes to be DNA tested for unknown other crimes.
- June 6: Edward Snowden leaks are published in the Washington Post and Manchester Guardian. NSA's *PRISM* program tracks global email, web searches and other internet traffic. On June 9, *Boundless Informant* program tracks global phone calls. Snowden fights extradition from Hong Kong to Russia, but fails (July 2) to obtain passage to Equator or other states.
- June 6: Obama acknowledges phone-call and email lists of US citizens are kept, but he states they not accessed for US domestic citizens until evidence is presented to the FISA court.
- June 19: In Berlin, Obama states he is willing to reduce New Start limit of 1550 by 1/3 in a reciprocal, unilateral agreement (not a treaty), monitored under New Start. Putin wants ABM concessions to do this. The level of 1000 was last seen in 1954. Nunn Lugar renewed after 20 years with emphasis on securing nuclear materials, and not on missile and CW destruction.
- July 3: Prime Minister Mohamed Morsi of Egypt, representing the Muslim Brotherhood, is overthrown by Egyptian military with the support of secular parties. The Arab Spring oscillates away from democracy, without major regrets by the democracies.
- July: National Security Administration admits that domestic phone call, email and postal information is collected, but only read after approval by the Foreign Intelligence Surveillance Court (FISC). There are calls to expand oversight of FISC, which has been accused of leniency.
- August 9: A panel of UN experts from 25 nations suggest ways to enhance cyber security with cooperative measures and with enhancements to international law.
- September 6: The National Security Agency foils encryption by hacking into computers via permitted backdoors. On September 10, Yahoo, Facebook, Google and Microsoft file suit against NSA.
- September 21: Old reports were released that describe a near catastrophe from the crash of a B52 bomber near Goldsboro, NC on January 23, 1961, 3 days after Kennedy's inauguration. Only a single switch prevented the 4–Mton bomb from exploding.
- September 26: Iraq ratifies the CTBT, after two US-Iraq wars and much chaos.
- September 27: Obama and Iranian President Hassan Rouhani talk on the phone to attempt to start meaningful nuclear negotiations. This was the first leader-to-leader contact since 1979 when President Carter and the Shah of Iran talked, just before the 444-day hostage crisis began.
- October 2: UN dismantlement inspections begin in response to the death of 1400 from sarin chemical weapons used by the Syrian government near Damascus on March 19 and August 21. Agreement between Russia, U.S., Syria and the UN Security Council (September 27) to end the Syrian CW program within a year came after threats of force by Obama and the lack of Congressional support to carry out such an attack. President Bashir al–Assad is helpful.
- November 24: Iran and *P5-plus-1 group* agree to a *Joint Plan of Action* to constrain Iran's nuclear production with instructive verification, in trade for a 10% reduction in economic sanctions. Inspections began on 20 January 2014, for six months, renewable for another six months. This could be followed with a more comprehensive agreement if the *Joint Plan of Action* is successful.
- December 18: Presidential review panel urges restraint on National Security Agency wiretaps.

2014

- February 22: Ukrainian Parliament declares President Viktor Yanukovich unable to govern after riots, following his refusal to signing a European Union trade agreement. On March 1, Russian President Vladimir Putin deploys Russian troops into Crimea, which votes to join the Russian Federation on March 16, with accession on March 18. Will Russia annex more of the Eastern Ukraine? Will water and natural gas flow to Crimea, and to Europe? Will this threaten cooperation on Iran/nuclear, Syria/chemical and other multi-lateral efforts?