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Title: Top Ten Weapons Breakthrough in Los Alamos' History

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Top Ten Weapons Breakthroughs in Los Alamos' History

Mark Chadwick and Michael Bernardin, 10/8/2018

1. Invention of the Atomic Bomb

The dawn of the Nuclear Age occurred on the morning of July 16, 1945, when Los Alamos conducted the Trinity test. Scientists and engineers from the U.S., Britain, and Canada proved the feasibility of weaponizing energy from plutonium nuclear fission using an implosion mechanism.

2. Demonstration of Principles of Thermonuclear Fusion and Boosting

Los Alamos was the first to produce thermonuclear fusion in Operation Greenhouse's George test (1951). Its following test, Item, demonstrated the boosting of fission yield. The concept of hollow-boosting was proved-out in Operation Teapot (1955).

3. Invention of the H-bomb

Los Alamos demonstrated the feasibility of radiation coupling between a fission primary and a thermonuclear-fueled secondary in a full-scale thermonuclear explosion (Ivy-Mike, 1952). Los Alamos then successfully designed and tested practical thermonuclear devices in the Operation Castle series (1954), leading the way to US stockpile high-yield weapons. These secondary designs, together with hollow-boosted primary designs, set the template for the U.S. stockpile.

4. Battlefield Nuclear Weapons

By the early- to mid-1950s, Los Alamos had enabled the world's first battlefield nuclear weapons with nuclear warheads for the Army's Honest John and Corporal short-range missiles, the Air Force's Matador cruise missile, and the Army's 11-inch artillery-fired atomic projectile.

5. One-point Safety and Hydronuclear Tests

Los Alamos was a pioneer of one-point safety—the concept of preventing nuclear yield in the event of an unintentional high-explosive detonation. Ingenious hydronuclear tests to elucidate stockpile-related safety issues began in 1960. These experiments produced modest amounts of fission but were engineered to avoid nuclear explosions.

6. Conventional and Insensitive High Explosives

Los Alamos developed the plastic bonded conventional high-explosive PBX 9501 to improve safety while maintaining performance, and to facilitate compact warhead designs. Los Alamos was the first to produce the insensitive high explosive (IHE) PBX 9502 beyond the lab scale, and to test and field nuclear warheads with IHE.

7. Strategic Intercontinental Ballistic Missiles (ICBMs) and Submarine-Launched Ballistic Missiles (SLBMs)

Los Alamos designed powerful, miniaturized, hardened, W76, W78, and W88 MIRV'd (multiple independently-targetable reentry vehicle) warheads in the 1970s and 1980s. These remain the cornerstone of the U.S. deterrent.

8. Los Alamos Designed the Majority of the US Stockpile

Historically, of the 63 types of nuclear weapons entered into the U.S. stockpile, Los Alamos designed 46 and Livermore designed 17. Of today's seven nuclear weapons, five are Los Alamos designed, the B61 gravity bomb, the W80 cruise-missile warhead, and the W76, W78, and W88 reentry warheads.

9. Gas Transfer Systems for Improved Performance Margins

Los Alamos developed gas transfer system technologies to improve overall weapon performance margins and increase component lifetimes. These solid-storage gas transfer systems deliver a boost gas mixture containing negligible helium-3 with nearly constant tritium and deuterium quantities over the lifetime of the system.

10. Los Alamos: DOE's Center of Excellence for Plutonium R&D

Since 1943, Los Alamos has designed a wide variety of pit-types and plutonium alloys tailored to meet specific weapon requirements. It has the nation's only facility capable of handling large quantities of plutonium for pit manufacturing, power sources, and R&D. Early in its history Los Alamos first measured the critical mass of plutonium, and to this day leads experimental and simulation work in nuclear criticality and criticality safety.

Nuclear Deterrence Today

The great majority of the warheads in today's stockpile are Los Alamos designed. Los Alamos is responsible for the sea-leg of the nation's deterrent, the U.S. component of the NATO deterrent, and a MIRV capability for the ICBM leg of the deterrent. The modernization programs W76-1, W88 Alt, and B61-12, together with the Stockpile Stewardship and Surveillance programs and our Production Agency missions, are assuring a continued effective deterrent in the coming decades.