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Encyclopedia article on the Los Alamos National Lab

The Los Alamos National Laboratory occupies 43 square miles of canyons and mesas in Northern New Mexico, about 35 miles northeast of Santa Fe. It was founded in 1943 as the research and test facility for the Manhattan Project, which developed the first nuclear weapon during World War II under the guidance of Dr. J. Robert Oppenheimer. Today, the Lab's staff of scientists and support personnel continues to apply their technical expertise toward issues of national security, as well as to a large and diverse range of programs in energy, nuclear safeguards, biomedical science, environmental protection, computer science and materials science.

Los Alamos is divided into 50 technical areas situated according to topography, functional relationships and historical developments at the site. Half of the Lab's employees and floor space are located in TA-3, the main technical area. What is arguably the greatest concentration of scientific computing power in the world is housed here, in the Central Computing Facility and Advanced Computing Laboratory. TA-3 also includes the materials science, earth and space, chemistry, physics and cryogenics laboratories, a Van de Graaff particle accelerator, the Director's office, administrative offices and the main library.

When Dr. Oppenheimer first arrived in Los Alamos with a select group of scientists, they were housed in the school buildings of the former Los Alamos Ranch School for Boys. Today, only the Fuller Lodge and the buildings comprising "bathtub row" remain from the original TA-1 complex. The Los Alamos Historical Museum is also located here. At the Health Research Lab (TA-43), scientists study long-term health and environmental effects of energy and defense technologies, and research new techniques for diagnosis and treatment of disease. Other facilities at Los Alamos include an explosives research and testing facility, a Weapons Engineering facility, the Pajarito Site where the fundamental behavior of nuclear chain reactions is studied, and the Plutonium Facility, which performs most of the Lab's nuclear materials activities.

The roots of Los Alamos lie in Nazi Germany's discovery of nuclear fission in 1939. Renowned nuclear physicist Werner Heisenberg experimentally performed the procedure, in which a slow neutron splits a heavy atom into two atoms of approximately half the weight of the original, releasing tremendous amounts of energy. German refugee scientists in America were concerned about the uses Adolf Hitler might make of the discovery, and persuaded Albert Einstein to write a letter to President Franklin Roosevelt warning him of the danger. The result was a U.S. commitment to nuclear research, with the goal of producing an atomic weapon before the Germans.

By the time the United States entered World War II in December 1941, several projects investigating the feasibility of nuclear weapons were under way. Theoretical physicist J. Robert Oppenheimer of the University of California convened a summer study in June 1942 to review the current research. Theorists Hans Bethe, John Van Vleck, Edward Teller, Felix Bloch, Richard Tolman and Emil Konopinski concluded that a fission bomb was feasible. After the conference, Oppenheimer's UC team oversaw a number of experimental studies at scattered sites around the country. Given the difficulties of coordinating these studies, it soon became clear that the

project needed a remote laboratory which could bring the scientists together as a team while ensuring military security.

In late summer 1942, Brigadier General Leslie Groves was selected to head the nuclear weapons effort, soon christened “The Manhattan District,” after the Corps of Engineers’ practice of naming projects after its headquarters’ city. Groves had previously successfully overseen the Army Corps of Engineers’ Pentagon construction project. In the first week on board, Groves secured top military priority for the project, created a new government department to oversee it (the precursor to the Department of Energy) and acquired a site in Tennessee for a plutonium production plant. His next task was to name a director for the proposed weapon design lab. Groves selected Dr. Oppenheimer, who had previously built strong theoretical physics departments at Cal Tech and UC Berkeley.

In November, 1942, a site was acquired which satisfied the project’s terrain, security and access requirements. The Los Alamos Ranch School for boys in Northern New Mexico also offered 54 school buildings that could be used as immediate lodging for the staff. Because the school buildings were the only houses in Los Alamos with bathtubs during the war, these residences were nicknamed “Bathtub Row.” 62,000 additional acres of land surrounding the school was also acquired by the Army. To the existing buildings were added soldiers' barracks, a mess hall, officers' quarters, an administration building, a theater, an infirmary, apartments, a bachelor dormitory, and laboratory technical buildings. These were built with great urgency, though the remote location of the site would prove to be a hindrance in the construction effort.

The teams that had been working on the theoretical calculations at scattered university sites under Oppenheimer's direction would form the nucleus of the new laboratory. But of the 33 scientists Oppenheimer originally recruited from across the country, only 15 eventually came to Los Alamos. Edward Condon, who had directed the Westinghouse Research Laboratory, agreed to serve as Oppenheimer’s assistant. Others on the new team included experimental physicist Robert Bacher and theorist Hans Bethe of Cornell, UC physics professor Edwin McMillan, John Manley and Robert Serber of the University of Illinois, Washington University theorist Edward Teller, and University of Chicago experimentalist Samuel Allison. Enrico Fermi, who successfully triggered the first nuclear chain reaction in December 1942, arrived in 1944 to head his own division.

Soon Oppenheimer’s original estimates of a scientific and technical staff of 100 and a total population of 650 proved to be much too conservative for the huge problem at hand, which involved inventing a brand new technology from purely experimental discoveries in nuclear physics, metallurgy, chemistry and ordnance. By 1943 the population of Los Alamos, including civilian and military staff, support personnel and their families had soared to 1,500. By January 1945 it had reached 5,700.

The first year of the Lab was spent designing a nuclear gun-type weapon that worked by firing one part of a mass of fissionable material (critical mass) into another, but this technique was found to be impossible using plutonium. Since so much had already been invested in the plutonium manufacturing plants in Tennessee and Washington, the gun device was scrapped. In the second year of its existence, therefore, the Laboratory was reorganized to solve the much more difficult problem of an implosion-type bomb which detonated a high explosive around a hollow sphere of uranium, thereby crushing it into a critical mass. Because of the uncertainties surrounding the new weapon, it was decided that, unlike the gun, the implosion

bomb would have to be tested. The Trinity test site, named by Oppenheimer after a John Donne poem, was selected in the central New Mexican desert.

Robert Christy of the Theoretical Physics Division of the Lab produced a conservative design for what was called, for security reasons, "the gadget." The design was ordered fixed by General Groves in February 1945 so that the device could be ready for a test by July. Though detonators, fuses and high-explosive lenses required by the design had yet to be perfected, Los Alamos scientists and technicians succeeded in producing all of the components by July 13.

At 5:29 a.m. on July 16, 1945, the first nuclear bomb exploded at the Trinity site with a force of 21,000 tons of TNT, vaporizing the tower it stood on. It released four times the heat of the interior of the sun, created a pressure of 100 billion atmospheres and was seen 250 miles away. Los Alamos had succeeded in producing a nuclear weapon only two years, three months and 16 days after its inception.

By this time, Germany had surrendered, but the War in the Pacific against Japan was still on, and despite the protests of scientists against using the new super weapon on civilian targets, a nuclear bomb was dropped on Hiroshima, Japan on August 6, 1945. Three days later another bomb destroyed Nagasaki, the Japanese surrendered, and the nuclear age had begun. In the future, the technology pioneered at Los Alamos would be used not only for weapons but also for nuclear reactors producing energy for consumers and propulsion. The team's theoretical findings would provide the basis for many scientific discoveries regarding the physical nature of the universe.

During the US-USSR nuclear standoff, the so-called "Cold War" of the 1960s through 1980s, Los Alamos was charged with overseeing the development, construction, transportation and maintenance of the U.S.'s $13.5 trillion nuclear weapons stockpile. Since the end of the Cold War, the defense mission of the Lab has shifted toward developing environmentally sound nuclear technologies and reducing the danger caused by the spread of nuclear weapons.

The tradition of a multidisciplinary approach to complex scientific problems that began with the Manhattan Project continues at the Lab today with a scientific, technical and support staff of nearly 10,000 people. Current and future programs include environmental research related to energy, waste disposal, air pollution, and global warming; life sciences studies in genetics and biomagnetism, helping scientists understand and treat diseases of the brain; developing lasers as a tool in applications ranging from medical technology to defense; and the use of particle accelerators to investigate the basic components of matter.

Since WWII, when Los Alamos scientists pioneered the use of the first electronic computer, the Lab's unique, computing-intensive requirements have stimulated computer science research, including the development of supercomputer technology.

The Laboratory offers a number of offerings of interest to the curious visitor. The Bradbury Museum presents a history of the Lab from the Manhattan project up to today, and includes interactive exhibits, demonstrations and films that explore the development of the first atomic bomb and related scientific topics. A 25-mile driving tour through the Lab grounds stops at historical sites such as the original "bathtub row," as well as many of the modern facilities. Los Alamos also contains the remains of prehistoric Native American settlements, including cliff dwellings and a pueblo, at the Tsirege Ruins and the Bandelier National Monument.