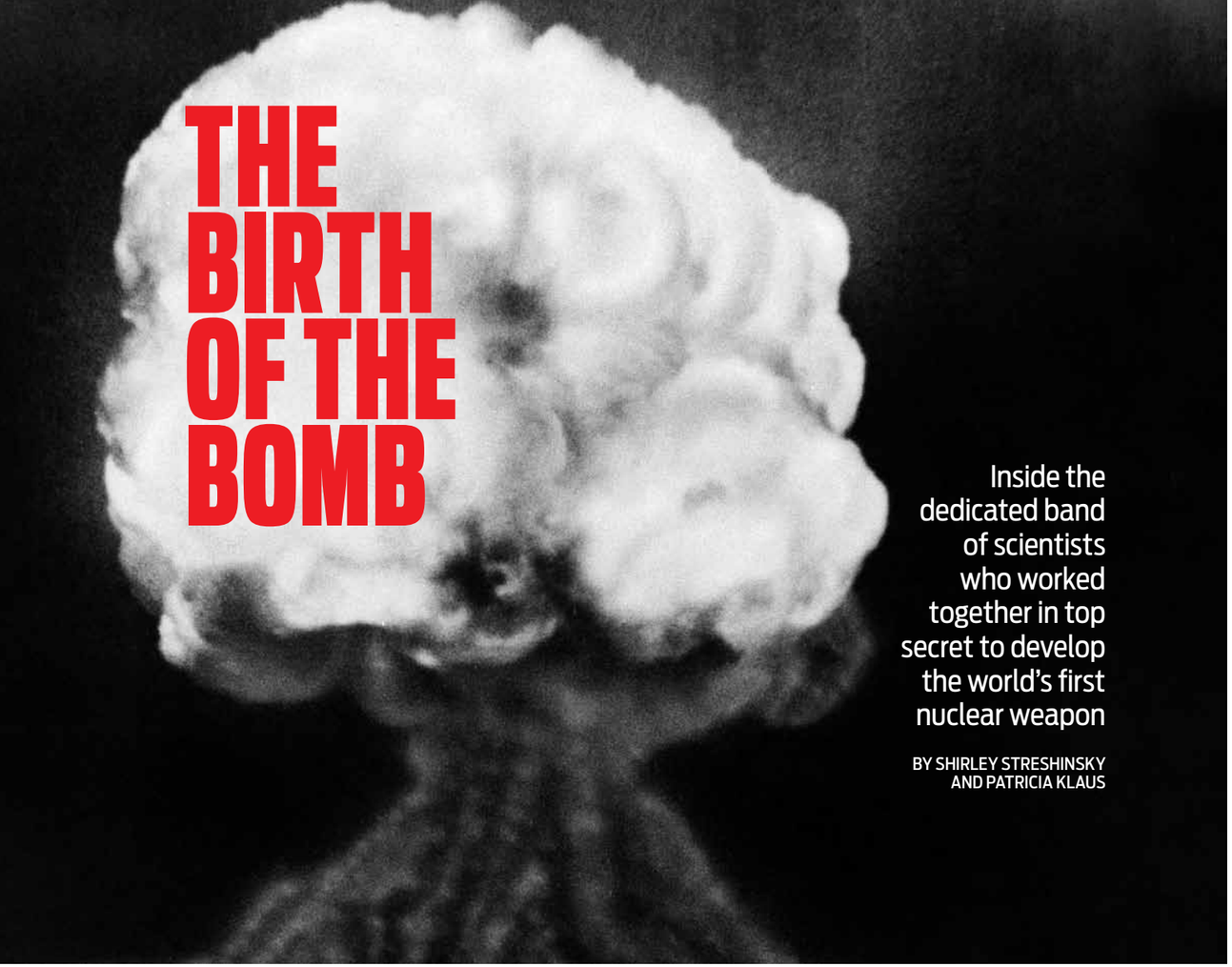


THE BIRTH OF THE BOMB

Inside the dedicated band of scientists who worked together in top secret to develop the world's first nuclear weapon

BY SHIRLEY STRESHINSKY AND PATRICIA KLAUS

SEVENTY SUMMERS AGO ON JULY 16, an apocalyptic nuclear explosion in an empty New Mexico desert valley called *Jornado del Muerto* – Journey of the Dead – signaled the dawning of the atomic age. That first test was the culmination of three years of rigorous, exhausting work on the most profound secret of World War II: the development of the world's first atomic bomb in the town of Los Alamos, a secret outpost located on a high mountain mesa where an extraordinary band of civilian scientists – physicists, chemists, mathematicians among them – accomplished what some had thought, and even hoped, to be impossible. These "longhairs," as Army General Leslie Groves called the scientists, understood that a nuclear explosion of unimaginable magnitude was theoretically possible; they assumed not only that the Germans were working on such a doomsday weapon, but had a head start.

POST Perspective

In one of history's most chillingly opportune quirks, Hitler in his rage against Jews caused some of the most brilliant European scientists to seek refuge in Great Britain and the U.S. Welcomed with open arms, quite a few turned up at Los Alamos where they became crucial in the race to produce the world's first nuclear weapon. Italy's Enrico Fermi, Denmark's Niels Bohr, and Germany's Hans Bethe were among those who joined forces with Americans like Richard Tolman, who became vice chair of the National Defense Research Committee and General Groves' chief scientific advisor, and physicist J. Robert Oppenheimer, who led the effort to design the weapon.

Oppenheimer was a superb theorist, but as director of the Los Alamos site his task in every way Herculean was to orchestrate the work of this amazing coterie of scientists. The town was both an army camp and a village with homes for the scientists and the families they were allowed to bring with them, all of it surrounded by barbed wire. The average age was 26; Oppenheimer celebrated his 39th birthday in 1942, not long after he arrived in Los Alamos with his wife Kitty and their 2-year-old son. All the young families were locked into this isolated mountain retreat for the duration, unable to tell their folks back home where they were or why they were there. In fact, most of the wives had no idea what their husbands were doing in the long days and nights spent in the top secret Technical Area. Security was so high that even those who did know never used the word bomb. It was either "the gadget" or "the device."

Robert and Kitty Oppenheimer

Kitty was Robert's first and only wife; she was 29 when they married; he became her fourth husband. Being "Kitty's husband" had to be one of the most exasperating roles he assumed at Los Alamos; she was what a later generation would call "high maintenance." One of the secretaries called her "a sexy dame," others were not so kind. Men tended to like her, women did not, in part because Kitty made it clear that she was not going to take on the social role expected of the director's wife; she preferred the cocktail hour to tea parties, big talk to small talk. Yet she did join many of the young wives in taking advantage of what they called "rural free delivery" in the local hospital. Kitty gave birth to a second child, a girl, while at Los Alamos.

There was nothing reticent about Kitty; she insisted on knowing the secret mission of Los Alamos. Another who knew was Richard Tolman's wife, Ruth, a psychologist. The Tolmans had been close to Robert since he arrived in California in 1928 at age 24; he was a wunderkind in the new field of nuclear physics and would stay in the Tolmans' Pasadena guesthouse when he was dividing his time between Caltech – the California Institute of Technology – where Richard Tolman was dean of the graduate school, and the University of California at Berkeley. During those years, Ruth Tolman became Robert's confidant and, over time, best friend. One of Robert's secretaries reported that he always had one of Ruth's letters in his pocket. She destroyed the letters he wrote to her, but enough of her letters survive as witness to the depth of their bond. Inevitably, rumors of an affair were floated, but never proved, and were disavowed by those who knew them well.

During the war, Richard was stationed in Washington, D.C., and Ruth followed him there. Her last assignment was with the Office of Strategic Services (OSS), an intelligence agency that was a forerunner of the CIA. The Tolmans' guest rooms in their Washington home were often occupied by top-ranking visiting scientists, including Robert Oppenheimer. Ruth's close relationships with two of the men central to the building of the atomic bomb gave her a unique perspective on the moral issues raised by a weapon that would make the world an infinitely more dangerous place. Niels Bohr, the great Danish physicist who represented the conscience of the scientific community, hoped that the shocking magnitude of the weapon would act as a deterrent to war itself.

In the spring of 1945 in Los Alamos, as the scientists worked feverishly to complete and test the bomb, the battle of Berlin raged to its inexorable close. Hitler committed suicide on April 30; on May 8, German Field Marshal Keitel (who, in a bizarre twist of fate, was a distant relative of Kitty's) signed the documents declaring surrender on the Eastern Front. That day was declared VE Day: Victory in Europe Day. In the U.S. all radio programs were interrupted, a short burst of static and then the voice of President Harry Truman proclaimed, "This is a solemn but glorious hour. ... The flags of freedom fly all over Europe." In Washington, spontaneous celebrations broke out. In England, Prime Minister Winston Churchill intoned, "We may allow ourselves a brief period of rejoicing; but let us not forget for a moment the toil and efforts that lie ahead. Japan with all her treachery and greed, remains unsubdued."

VE Day at Los Alamos was a mass of colliding emotions. Joy from the majority who did not know the secret of the Technical Area and who assumed that with Hitler defeated and the Allies clearly moving toward victory in the Pacific, they would be going home soon. Others, privy to the secret, were disappointed that they hadn't produced an atomic bomb in time to shorten the war in Europe. Still, there was relief that the Germans didn't have the weapon after all, and some questioned why work on the gadget should continue. Caught up in the relentless effort to complete this doomsday weapon, only a few admitted to having qualms about its use. Most notably, Robert Wilson, the young physicist who held a top position as head of research at Los Alamos, objected to the use of the bomb on Japanese civilians. Yet no one stopped working; they were close now, they would wait for the test. The Manhattan Project had cost almost $2 billion,

At 5:30 a.m. Jane Wilson saw a "blinding light like no other light one had ever seen. The trees, illuminated, leaping out at one. The mountains flashing into life."

ADAPTED FROM *AN ATOMIC LOVE STORY: THE EXTRAORDINARY WOMEN IN ROBERT OPPENHEIMER'S LIFE*, BY SHIRLEY STRESHINSKY AND PATRICIA KLAUS. (TURNER, 2013). PHOTO COURTESY LOS ALAMOS NATIONAL LABORATORY

PHOTOS COURTESY OF J. ROBERT OPPENHEIMER MEMORIAL COMMITTEE

including centers in Washington state and Tennessee. With such an enormous investment, results were expected. The race to develop the bomb shifted to Asia, and beyond to a post-war struggle with the USSR.

Richard Tolman traveled to Los Alamos in May, and would have noted growing tension among the scientists. General Groves pressed for an early test of the gadget before Truman's scheduled meeting with Stalin in mid-July; Robert hesitated, still wanting to make adjustments to the bomb's design. But powerful forces were urging the project forward. Americans were sick of war, sick of death, sick of a culture that seemed to prefer death over surrender. Three months earlier, one of Air Force General Curtis LeMay's B-29 bombing raids on Tokyo unleashed a storm of flames and gases that killed some 100,000 Japanese civilians. On Okinawa that spring, there were just short of 50,000 American military casualties; kamikaze attacks alone killed more than 4,900 Americans. Japanese military and civilian casualties were reported to have been near 200,000. These obscene numbers splattered across the headlines of newspapers and on news programs nationwide. The bomb, those who knew about it wanted to believe, would bring Japan to its knees and put an end to these horrors.

POST Perspective

Oppenheimer finally agreed: They would test the device on July 16; he code-named it Trinity. Later he would say he wasn't certain why he had chosen the name, recalling that it came from a Donne poem: "Batter my heart, three person'd God." Those who knew him well recognized echoes of Jean Tatlock, Robert's first important love, who had read poetry with him.

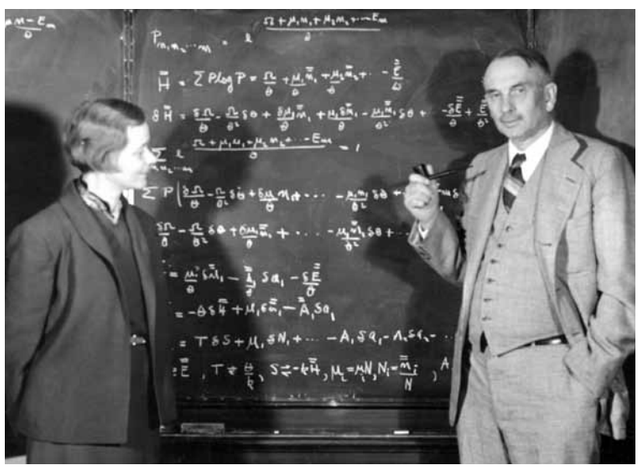
Robert's younger brother Frank, also a physicist, was at the Oak Ridge, Tennessee, facility where he worked to extract pure U-235 (the uranium isotope that could sustain the fission chain reaction necessary for a bomb). Robert asked that Frank join him for the critical test, and General Groves obliged.

An electric suspense hovered over Los Alamos that summer, an increasing feeling of anticipation, even though most of the 5,000 residents did not know what was about to happen 240 miles to the south at *Jornado del Muerto*. The wives who did know couldn't be sure which of the others shared that knowledge; sometimes they seemed to be taking a breath between every syllable.

After the Trinity blast, Oppenheimer chose, from the Bhagavad Gita, just this: "Now I am become Death, the destroyer of worlds."

On July 15, 1945, the tension at the Trinity site was palpable. Most of the Tech Area scientists had arrived. Generals and VIPs began to fly into a nearby Army airfield. Robert had made a pact with Kitty: If the bomb worked, he would send her a banal message, "You can change the sheets."

Scorpions and rattlesnakes, field mice and frogs populated the scrubby desert. A tall tower was ready, the gadget was in place for the scheduled 4 a.m. test the next morning. As darkness fell, the winds rose, then great flashes of lightning slashed the night sky and thunder echoed off the surrounding hills. The air seemed filled with portent. Frank would remember the frogs, how they seemed to migrate to a pond and then filled the night with the sounds of wild copulating. He would remember, "The only living things around there [were] coming together." He joined his brother in the bunker; they would see the thing through together.



Ruth and Richard Tolman

PHOTO COURTESY OF THE ARCHIVES, CALIFORNIA INSTITUTE OF TECHNOLOGY

In Los Alamos in the first dark hours of that day, Jane Wilson, whose husband Robert, head of the research division, had questioned the morality of the bomb, would remember, "the air seemed empty and bitter cold, although it was July." The wives who knew about the test kept vigil. Some watched from their porches; a small group gathered on Sawyer's Hill, near a ski run, where the view to the south was open. The pine trees stood black against a starless sky. Four o'clock came and went. They waited, scanning the sky, silent and afraid for their husbands at the test site. Jane would write: "4:30 a.m. The gray dawn rising in the east, and still no sign that the labor and the struggle of the past three years meant anything at all." And they continued to wait.

At 5:30 Jane Wilson saw a "blinding light like no other light one had ever seen. The trees, illuminated, leaping out at one. The mountains flashing into life." And then the slow, monstrous rumble that announced the birth of the atomic age.

The Oppenheimer brothers lay face down in the dugout, 6.2 miles from ground zero, side by side, their eyes closed and arms covering heads. "But the light of the first flash penetrated and came up from the ground through one's lids," Frank remembered. Then there was the fireball, and very quickly "this unearthly hovering cloud. It was very bright and very purple and very awesome. ... And all the time ... the thunder of the blast was bouncing back and forth on the cliffs and hills." The brothers Continued on page 83

FROM THE ARCHIVE

UNDERSTANDING THE ATOM

A lesson in quantum physics

BY J. ROBERT OPPENHEIMER

After the war, as chief advisor to the U.S. Atomic Energy Commission, Oppenheimer was persistent in lobbying for international control of nuclear energy. His efforts aroused the ire of politicians and led to the revocation of his security clearance in 1954. While this action reduced his influence, the great physicist continued to lecture and work in his field. In the following brief excerpt of a much longer article published in the Post *in 1958, he describes for the lay reader the importance of the wave-particle theory of atomic matter.*

Ground zero. Manhattan Project leaders J. Robert Oppenheimer and General Leslie Groves inspect remains of the Trinity test on September 9, 1945.

The notion that matter consists of atoms is an ancient one. The curious speculated about it long before they could be sure such things as atoms existed, let alone what they were or how they behaved. It was not until the 19th century that the atomic hypothesis achieved some progress. This was due partly to the discoveries of chemical laws determining what elements combine with which, and in what proportions; and partly to theoretical studies of how matter in bulk behaves in terms of the motions and properties of the atoms and molecules composing it. Yet even at the beginning of the 20th century distinguished physical scientists doubted the truth of the atomic hypothesis.

The last doubts vanished early in this century. We began to get direct evidence of how atoms behaved. The principal agent of discovery was a new set of experimental techniques for inducing and recording phenomena. These techniques show that atoms are not, in the literal Greek sense of the word, atoms at all. That is, they are not indivisible and immutable. ...

One phase of investigation concentrated on electrons. [Physicist Ernest] Rutherford discovered what force a nucleus exerts on the electrons in an atom. The next step was to discover how the electrons responded to those forces. This seemed at first comparatively simple. The investigators applied Newton's laws, which describe the motions of bodies subject to forces. They had a rude shock. Those laws proved to be inapplicable.

It took two decades to find out why this was so. It was cleared up by the discovery of the wave properties of electrons. Electron behavior, it seemed, could be described only in terms of both particles and waves. Because of the great variety of wave forms which may represent an electron, there are some waves which represent a precisely located particle and others which represent a particle with a definite velocity; but there are none which represent both of these properties.

A new approach to physical phenomena recognizing these facts was needed. It had to transcend Newtonian mechanics, replacing its strict determinism with statistical laws, reconciling the wave and particle behavior of all matter. This new approach had to recognize limitations on the possibility of observing the physical systems. Prediction of probability had to replace predictions of certainty. This theory is called the quantum theory of the atom.

This great atomic theory, which rivals Einstein's theory of relativity as an intellectual achievement, pointed up the narrowness of all earlier scientific descriptions and was indispensable to later progress.

—"The Mystery of Matter" by J. Robert Oppenheimer, July 5, 1958

Continued from page 33

looked at each other and one said, only, "It worked." This band of unlikely warriors in their jeans and porkpie hats, the men General Groves had called "the longhairs," had figured out how to unleash the fury of the universe.

A scientist rushed over to Groves and all but shouted, "The war is over." The General, solemn, answered: "Yes, after we drop two bombs on Japan."

Richard Tolman was one of the VIPs at Trinity; that same afternoon he boarded an Army plane bound for the nation's capital. With him was General Groves and his executive officer Tom Farrell, along with James Conant, Vannevar Bush, and Ernest Lawrence. The scientists, Conant wrote, were "still upset by what they had seen and could talk of little else, to the annoyance of Groves, whose thoughts were already grappling with the details of the 'upcoming climax' in Japan."

When Richard arrived at his Washington home he was weary but excited, overwhelmed by what he had witnessed and eager to talk to Ruth. He would have offered Conant's description of the event: "A cosmic phenomenon like an eclipse. The whole sky suddenly full of white light like the end of the world." Or Tom Farrell's religious incantation of the detonation wave that had followed the flash: a "strong, sustained roar which warned of doomsday and made us feel that we puny things were blasphemous to dare tamper with the forces heretofore reserved to the Almighty." They understood that these forces were about to be loosed on Japan as the war in the Pacific moved toward a nuclear culmination.

On August 6, the weapon was loaded onto a Boeing B-29 Superfortress named the Enola Gay. Its target was Hiroshima. President Truman broke into the airwaves to announce that the largest bomb ever used in the history of warfare had been dropped on a Japanese city. "It is a harnessing of the basic power of the universe. The force from which the sun draws its power has been loosed against those who brought war to the Far East." Three days later on August 9, another atomic bomb dropped from the bay of another Superfortress, obliterating Nagasaki. Soon after Japan's Emperor Hirohito broadcast an announcement to his "good and loyal subjects" that he had ordered his Imperial Forces to surrender. General Groves' mission had been accomplished.

Physicists Phil Morrison and Robert Serber had been sent to Tinian Island in the Pacific to help prepare the crews for Hiroshima and Nagasaki. In the aftermath, they were sent into the ravaged cities. Stunned, the horror began to seep in; the two returned to Los Alamos where Morrison reported on Hiroshima: "One bomber and one bomb had, in the time it takes a rifle bullet to cross the city, turned a city of 300,000 into a burning pyre."

Oppenheimer now seemed to express himself only in terms of sorrow and terror. After the Trinity blast, he chose, from the Bhagavad Gita, just this: "Now I am become Death, the destroyer of worlds." After Hiroshima and Nagasaki, he would speak of scientists having blood on their hands, of knowing sin, of being guilty of a complicated hubris in their creation of a new world. The gods were battering his heart.

Kitty and Robert took off for the Oppenheimer family's ranch – a two-hour drive from Los Alamos – for a week, his first break in three years. Fall was approaching and the ranch offered the illusion of being removed from the madness. The two took long horseback rides through the woods and into meadows scattered lavishly with penstemon and blue gilia and yarrow, through all the places that had given him pleasure and peace before the war. Now there was neither pleasure nor peace in Robert Oppenheimer's world.

When they returned to Los Alamos from the ranch, Kitty said that Robert was in such an emotional state that she didn't know how she (not he) could stand it. Robert left almost immediately for Washington for a two-week trip; he would talk to the Tolmans about the struggle for control of nuclear arms that – as physicist Neils Bohr had predicted – had already begun. Some Los Alamos scientists wanted to outlaw atomic weapons, another group led by Edward Teller was pushing to create thermonuclear or "super" bombs, massively more destructive than those dropped on Japan. A majority of the scientists believed the answer was in international controls and in an open exchange of information with all countries, including the Soviet Union – in effect, giving up any advantage the U.S. monopoly might offer in exchange for a chance to prevent an arms race. Other countries would, the scientists knew, soon clamor to build their own atom bombs.

Suddenly Robert Oppenheimer was catapulted into a new and very public role. The American press was presenting him as a hero, the Father of the Atomic Bomb, just as Robert was telling the American Philosophical Society that "we have made a thing, a most terrible weapon that has altered abruptly and profoundly the nature of the world ... an evil thing." Yet, as he attempted to explain time and again, the angst Robert felt was not for his role in the making of the bomb – Trinity had proved that inevitable. If not he, someone else would have led the effort. He was distressed that the pure science he loved had been perverted to create this "evil thing," opening a Pandora's box of horrors. Seventy years later, reasonable people take comfort that nuclear holocaust has been averted, and that the United States continues to lead the efforts to defuse lethal threats wherever they rise.

Shirley Streshinsky is a magazine journalist, novelist, and biographer whose recent book co-authored with historian Patricia Klaus is An Atomic Love Story: The Extraordinary Women in Robert Oppenheimer's Life, *from which this excerpt was adapted. Patricia Klaus attended the University of California at Santa Barbara, and then Stanford University where she earned a Ph.D. in modern British history.*