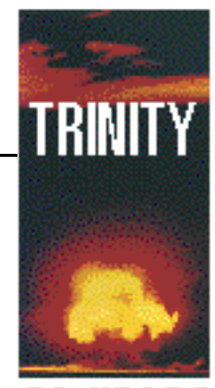


Nuclear Naiveté

The scientists who assembled the f irst atomic bombs used ev erything from tape to tissue — and learned a deadly lesson in r adiation when a scre wdriver slipped.

BY LARRY CALLOWAY
Of the Journal

Raemer Schreiber watched with a cold eye as a team headed by physicist Louis Slotin pieced together the core of the first atomic bomb in the McDonald ranch house 50 years ago Thursday.

The young Purdue physicist would do the same job in August on Tinian, the huge B-29 base in the Pacific's Mariana Islands.

The first plutonium bomb made in the secret city of Los Alamos was a puzzle of spheres within spheres. The 5-foot outer sphere of precisely machined high-explosive wedges inside the steel casing was already on the floor beneath the test tower in the barren Jornada del Muerto.

Slotin slipped the golf-ball-size "initiator," which would provide the initial burst of neutrons, inside the hollow plutonium sphere. The plutonium weighed only 13.6 pounds. Then the core was locked into a plug of natural uranium "tamper" that would fit into the center of the fat device, often called "the gadget."

The story that the first atomic bomb was put together with Kleenex and Scotch tape probably got started that night. "One of the ways of finding out if two pieces were close to each other was to take a piece of Kleenex and lay it in there and put it together and see if you could pull the Kleenex out," says Schreiber, 84, sitting comfortably at his desk in his newly painted home on Trinity Drive in Los Alamos.

"Well, people standing back in the corner seeing this and not knowing what was going on got the assumption that the whole thing was put together with Kleenex and Scotch tape. Scotch tape was used to hold plugs in so they didn't fall out when you were handling the stuff, but it was so thin it didn't matter," he says.

Schreiber handled many plutonium bomb spheres in his Los Alamos career. "They're warm to the touch. They're coated with nickel. And the only radiation is the very soft so-called alpha particles that'll be stopped by a piece of paper. So if you had even a very thin nickel layer on the outside, you were all right. We did wear rubber gloves," he says.

Busy with their thoughts

It's natural to assume that the Los Alamos people who saw the Trinity test on July 16, 1945, were jubilant and enthusiastic about its outcome. They were young — the largest age group was 27 — and their uncertain two-year project had just succeeded dramatically.

But many out there in the desert were like Marvin Wilkening, then 27, of the University of Chicago, stationed at Base Camp and worried about the neutron and gamma-ray detectors he was responsible for. The light and the fireball were fantastic, says the retired New Mexico Tech physics professor. "But, boy, I didn't have much time to think about anything else but to see the equipment was working."

Schreiber had the same scientific attitude. He, too, was at Base Camp and was glad everything worked, but he says, "I don't think there was much communication. After all, it was 5:30 in the morning and nobody'd had much sleep that night. There was the awe of the spectacle. I think everybody was pretty busy with their own thoughts."

Later, he saw the steel tower was gone. "And if you were careful, you could see the desert was pressed down a little bit and there was that green stuff on the ground, which was molten glass. But there wasn't much there to start with, so it wasn't that impressive."

This sequence shows the Trinity Site explosion, starting from the top.

Counting on shock

Fat Man was exploded over Nagasaki on Aug. 9, 1945. According to nuclear researcher Chuck Hansen, the Los Alamos implosion bomb fissioned 21 percent of its 13.6 pounds of plutonium for a yield of 23 kilotons.

By comparison, the Little Boy of Hiroshima, a simpler "gun" design, fissioned only 1.2 percent of its 132 pounds of uranium 235, for a 15-kiloton yield. Only five Little Boys made it into the U.S. stockpile, Hansen says. The implosion design became the basis of the nuclear arsenal, and implosion cores became the triggers for advanced thermonuclear weapons.

The number of fatalities at Hiroshima and Nagasaki are uncertain, but historian Richard Rhodes accepted the estimate that the two bombs killed 140,000 men, women and children by the end of 1945 and 200,000 by 1950.

The firebombing of Tokyo by conventional weapons took an estimated 100,000 lives one night in March 1945. Schreiber, mindful of this, says, "Just the fact you could do the same thing with one airplane and one bomb proved the efficiency, but it didn't change the effect very much. But the firebombing, the saturation bombing of the B-29s, was not bringing Japan to its knees, and the shock effect of one airplane being able to wipe out a city, I think, is what finally convinced the Japanese military they had to give up."

A big bomb's little heart

At 4 a.m. on July 26, 1945, Schreiber, accompanied by a detachment of MPs, picked up a box the size of a car battery, only lighter, at a vault in Los Alamos. The 10-inch box had magnesium sides to dissipate a gentle heat. The heat source was a bomb core carefully packed to be safe, to avoid what scientists describe as critical mass. The box was protected by four rubber bumpers on each side.

"We had three GI sedans, and we drove in the middle one. With the core in the trunk of the sedan, we drove down to Albuquerque," he recalls. They all flew out of Kirtland Field in two C-54 cargo planes carrying nothing but "a box of documents and some guards and my little box and me."

Nobody talked about the box. Those were the rules. Next day, over the Pacific, Schreiber says, "I was sitting up in the co-pilot's seat. The co-pilot was sacked out. And the pilot was reading his dime novel, and we ran into this storm. I says, 'Should I get out of here and let the co-pilot come in?' He says, 'No, I need the instrument time.'

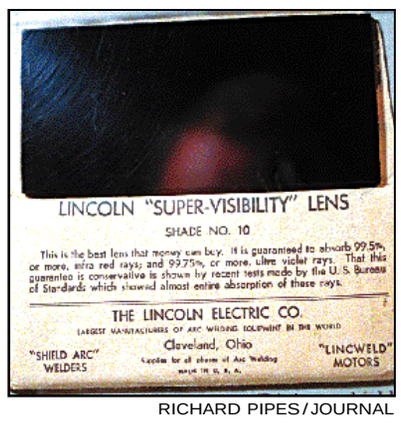
"About that time, one of guards came up and tapped me on the shoulder and says, 'Sir, your box is bouncing around back there, and we're scared to touch it.' So I went back and corralled it and got a piece of rope and tied it to one of the legs of the cots."

At Tinian, Schreiber was met by some of the Los Alamos group that had received the rest of the bomb code named "Fat Man." At the other side of the Tinian base, another group had a crude uranium bomb, called Little Boy with a core too heavy for one man to carry.

Schreiber put his little box in a fenced, Marine-guarded quonset hut and went to eat.

RICHARD PIPES/JOURNAL

Raemer Schreiber assembled the Fat Man bomb core and escorted it across the Pacific. The bomb exploded over Nagasaki on Aug. 9, 1945.



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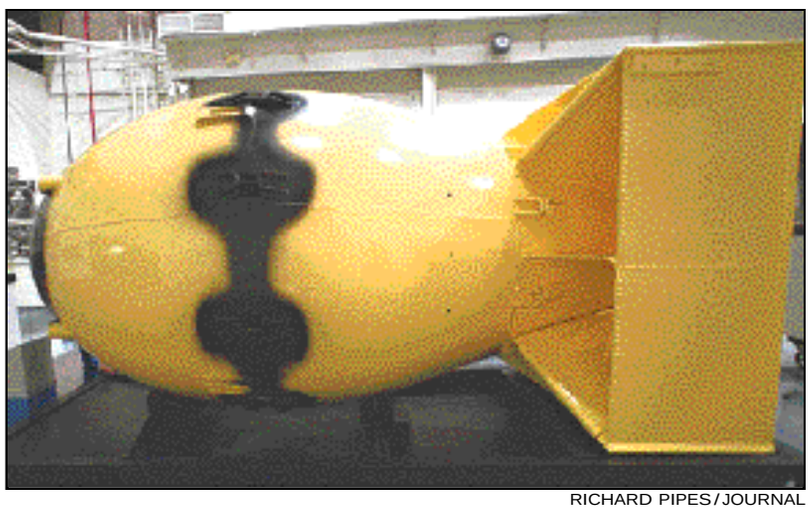
A Lincoln "Super-Visibility" lens used by observers to watch the Trinity Site explosion is on exhibit at the Bradbury Science Museum in Los Alamos.



RICHARD PIPES/JOURNAL

A replica of "Fat Man," the type of bomb tested at Trinity Site, is at the National Atomic Museum at Kirtland Air Force Base.

A slow-killing terror

Rhodes wrote that the firebombings were only 10 percent fatal compared with the 54-percent fatality rates of both atomic bombs. The new weapons also brought a new, slow-killing terror: radiation. It's something Schreiber encountered personally the following May.

He was head of the core assembly team for Operation Cross Roads, a postwar Navy show in which two Fat Man bombs destroyed a fleet of surplus war ships at Bikini Atoll in the Pacific.

One day, in a Los Alamos testing lab, the cores for Cross Roads were being checked out. Schreiber and Ted Perlman were taking readings from the initiators at one side of the room, and, 20 feet away, Louis Slotin, the man who assembled the core of the Trinity bomb, was seated at a table with a plutonium assembly.

"All of a sudden," says Schreiber, "there was this flash and a clatter and Louis says, 'Well, that does it.' "

Meaning: Slotin probably knew in an instant he was a dead man.

The bomb core sat in a nested set of hemispheres of beryllium, a neutron reflector. "What he did was to lower one of the hemispheres of beryllium over the core sitting in the bottom half and hold it open with a screwdriver. The idea was to lower it down to where there was just a small gap and, if it gets critical, then you could stop it at that point. You could waggle the screwdriver and make it multiply or quit," Schreiber says.

"But the screwdriver slipped. The thing dropped completely closed, and that made it super critical, prompt critical. It was stopped by the expansion of the core and beryllium, but it was enough to put out a lethal shot of radioactivity."

Slotin flipped the assembly open with his bare hands. "It stopped it from sitting there and cooking, which would have been a pretty sad mess," Schreiber said.

"So it got Louis, and it didn't do Al Graves any good. He was a little farther away. All that happened to him was that he lost his hair.

"We all got the hell out of there. We went back up around the corner in back of the shielding wall, and he (Slotin) and Al Graves proceeded to try to write down the events, to make a record of it."

Soon Slotin began to get nauseated and a little crazy. They all were taken to the hospital. Everybody was OK except Slotin, who died in agony nine days later.

From then on at the lab, critical assembly tests were by remote control. Schreiber was put in charge of building a facility in which the plutonium and the handlers were a quarter mile apart. Did they need that much distance?

"Well, we didn't know," he says, meaning they weren't taking any more chances.

COURTESY LOS ALAMOS NATIONAL LABORATORY

Louis Slotin, who assembled the core of the Trinity bomb, later suffered a lethal shot of radioactivity.

Facts about plutonium

Chemical description: A heavy metal, 50 percent heavier than lead. Silvery and brittle. Element No. 94 in the periodic table.

Symbol: "Pu." Toxic and radioactive. A re-created element long gone from Earth.

Nuclear description: Fissionable in all forms, but plutonium-239 is bomb material. In "subcritical'' forms, emits only mild alpha particles, which can be stopped by a sheet of paper. A product of the fissioning of uranium in nuclear reactors. One kilogram (2.2 pounds) has potential nuclear energy equal to 20,000 tons of high explosive.

Los Alamos wartime code word for plutonium: "Forty Nine," a combination of the last digit of the element's atomic number (94) and the last digit of the bomb isotope (239). Also called "ploot."

World total plutonium, February 1941: An invisible speck in the lab of Glenn T. Seaborg.

World total plutonium, July 1945: A little more than 12 kilograms, enough for two bombs, the Trinity test device and "Fat Man," dropped on Nagasaki.

World total plutonium, 1995 (Los Alamos National Laboratory estimate): 1,200 tons. Of this, about 200 tons is weapons-grade material (89 tons of it ours) and 1,000 tons is in spent fuel from nuclear power plants.

What to do with plutonium: Bury it, burn it (in future advanced reactors) or store it until somebody comes up with a better idea.