

Jumbo: Silent Partner in the Trinity Test

FEATURE

The 2004 SPS Congress featured a visit to the Trinity site. An artifact of the Trinity test is “Jumbo.” Two nuclear bomb designs were developed during WWII: the uranium-235-fueled gun barrel design “Little Boy,” and the plutonium-fueled implosion design “Fat Man.” The gun barrel design was sufficiently simple that it was never tested to full explosion before its use on Hiroshima. The Fat Man design, which ultimately fell on Nagasaki, was the more technically ambitious. Because the gun barrel assembly was too slow for plutonium, it was necessary to compress a spherical core of plutonium in a millionth of a second to supercritical density. This was done with a spherical arrangement of two kinds of conventional high explosives whose different burning rates focused the implosion and triggered the nuclear explosion of the plutonium. The production of the plutonium cores cost roughly a billion 1945 dollars. Their value led to the concern that if the implosion did not result in fission, the plutonium would be dispersed beyond recovery. That fear led to an interesting side story in the events leading up to the Trinity test, told here from the original sources.

...[Robert] Oppenheimer had to face [General Leslie] Groves who was [concerned about] Oppenheimer’s announcement that it would be necessary to conduct a full test of the new implosion weapon. Groves was strapped by some estimates he had given to Stimson, the Secretary for War, on when the bomb would be made available. He saw the test as a possible waste of precious plutonium which would be used in the first practical weapon. Oppenheimer had to explain how disastrous it would be to discover at the last minute that the plutonium weapon would not work, but it was only after [George] Kistiakowsky proposed a safety device for the test that Groves agreed to it.

I proposed a solution of building a huge steel container, which we called Jumbo [Kistiakowsky said] the function of which being that, if we put our bomb in the center, and detonated it and there was no nuclear reaction, the Jumbo

would not rupture and the plutonium would be inside and could be recovered. So Jumbo was built—it cost half a million dollars—and it was towed out to the site in Southern New Mexico, but it wasn’t used. Why wasn’t it used? Because if the bomb had worked, it would have been impossible to follow it with very sophisticated instrumentation to find out just how well it worked.

This was obvious to everyone at the time. We agreed to it. But then everyone thought the chances were a hundred to one against the bomb working.[1]

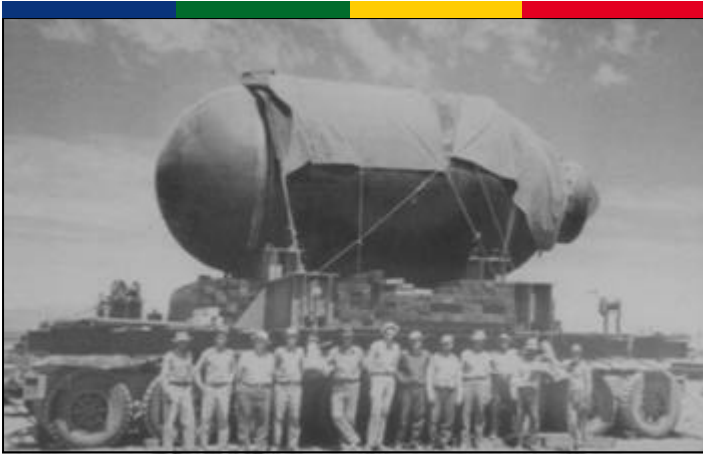
With doubt and uncertainty hanging over the project throughout 1944 it is not surprising that one of the first and most heavily emphasized efforts in the test preparations was planning for the recovery of active material in case the nuclear explosion failed to take place. In 1944 there was



At Trinity, Jumbo was erected on a tower 800 feet from Ground Zero. It survived the explosion unscathed.

Photograph courtesy Los Alamos National Labs.

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These men unloaded Jumbo from its traincar and prepared it for the cross country haul on this specially built trailer equipped with 64 wheels.

Photograph courtesy Los Alamos National Labs.

barely enough plutonium available to conduct the essential experiments and the outlook for increased production was dim. It seemed absolutely essential that the active material not be wasted in an unsuccessful test.[2]

If we surround the core of active material by a shell of inactive material the shell will reflect some neutrons which would otherwise escape. Therefore a smaller quantity of active material will be enough to give rise to an explosion. The surrounding case is called a tamper.

...Possible tamper materials [included] gold, tungsten, rhenium and uranium.

The active materials seemed so precious that everything else in contrast seemed cheap. The notion of vaporizing a few hundred pounds of gold in the explosion did not strike us as odd.[3]

Scientists toyed with the idea of using a water recovery method in which the bomb, surrounded by air space, would be suspended in a tank of water and fragments would be stopped by a 50 to 1 ratio of water to high explosive mass. They also investigated the possibility of detonating the bomb over a huge sand pile and putting the sand through placer operations to mine whatever plutonium might be embedded there. Neither of these methods appeared particularly promising and the decision was made early in the game to attempt to contain the blast in a huge steel vessel.

Although the container, promptly dubbed Jumbo, became a high priority project at the outset and all test plans, until the last minute, were based on the assumption that it would be used, there is little evidence that the idea met with much enthusiasm in Los Alamos.

As early as March 10, 1944, Oppenheimer wrote to General Groves outlining the plans and possibilities for "a sphere for proof firing," pointing out that "the probability that the reaction would not shatter the container is extremely small." He promised, however, that the Laboratory would go ahead with plans and fabrication of the vessel.

But this was easier said than done, and by the following summer Jumbo had become the most agonizing of the project's endless procurement headaches.

In late March, Hans Bethe, head of the Theoretical Division, wrote in a memo to Oppenheimer that because of the numerous engineering problems, which he described in discouraging detail, "the problem of a confining sphere is at present darker than ever."

But the problem was tackled, nonetheless, by section X2-A of [Kenneth] Bainbridge's group with R. W. Henderson and R. W. Carlson responsible for engineering, design, and procurement of the vessel. In May, scale model "Jumbinos" were delivered to Los Alamos where numerous tests were conducted to prove the feasibility of the design.

Feasible though the design appeared to be, there was scarcely a steel man in the country who felt he could manufacture the container. Specifications required that Jumbo must, without rupture, contain the explosion of the implosion bomb's full complement of high explosive and permit mechanical and chemical recovery of the active material. To do this required an elongated elastic vessel 25 feet long and 12 feet in diameter with 14 inch thick walls and weighing 214 tons....

Eventually, the Babcock and Wilcox Corporation of Barberton, OH, agreed to take a crack at the job and the order was placed in August 1944. The following spring the tremendous steel bottle began its roundabout trip from Ohio in a specially built flat car, switching from one route to another wherever adequate clearance was assured. In May 1945, the jug was delivered to a siding, built for the purpose by the Manhattan District, at Pope, NM, an old Santa Fe railroad station that served as a link with the Southern Pacific and the Pacific Coast in the 1890s. There it was transferred to a specially built 64-wheel trailer for the over-land trip to the test site.

But it was too late. During the last months before the test, all of the elaborate recovery schemes were abandoned. By then there was greater promised production of active material, there was greater confidence in the success of the bomb, and, more importantly, there was increasing protest that Jumbo would spoil nearly all the sought-after measurements that were, after all, the prime reason for conducting the test at all.

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Jumbo stands unscathed, its tower crumpled around it.

Photograph courtesy Los Alamos National Labs.

The fate of Jumbo, however, was not absolutely settled until the very last minute. On June 11, 1945, just a month before the test, Bainbridge, in a memo to Norris Bradbury, then in charge of bomb assembly, wrote that “Jumbo is a silent partner in all our plans and is not yet dead... We must continue preparations for (its) use until Oppenheimer says to forget it for the first shot.”

And a silent partner it remained. Ultimately the magnificent piece of engineering was erected on a tower 800 feet from Ground Zero to stand idly by through the historic test...[4]

Jumbo’s fate was to be erected on a tower base less than three hundred yards from Point Zero as a somewhat crude evaluation of the force of the explosion. From Groves’ point of view it was, no doubt, better than nothing.[5]

Once the decision had been made, in the spring of 1944, to conduct the test, the search began for a suitable test site... To please the scientists, security and safety people alike, the site requirements were numerous... And there was the ever-present question: could Jumbo be delivered there?... On August 14 Oppenheimer wired Groves in Washington that he thought there would be no problem in obtaining the land for [the test] but, concerned as usual about Jumbo, specified that “the northern part will be satisfactory to us provided the El Paso-Albuquerque line of the Santa Fe can carry a 200-ton load either from El Paso north or from Albuquerque south to the neighborhood of Carthage.”[6]

...At that instant—5:29:45 a.m. Mountain War Time on July 16, 1945—came an incredible burst of light, bathing the surrounding mountains in an unearthly brilliance. Then came the shock wave that knocked over two men at S 10,000, then the thunderous roar. A vast multi-colored cloud surged and billowed upward. The steel tower that held Jumbo, 800 feet away, lay crumpled and broken on the ground.[7]

With one end buried in the ground, Jumbo stood unscathed, its tower crumpled around it.[8]

After the War, the Army detonated some 500 pounds of high explosive inside Jumbo, blowing out the hemispherical ends. The cylindrical core of Jumbo remains at the Trinity Test Site today. Fragments of Jumbo are on display elsewhere, such as in a monument standing in the town square of Socorro, NM.

REFERENCES

- [1] P. Goodchild, *J. Robert Oppenheimer, Shatterer of Worlds* (Fromm, 1985), pp. 118–119.
- [2] *Los Alamos: beginning of an era, 1943-1945*, Los Alamos Historical Society (1986), p. 31.
- [3] Robert Serber, *The Los Alamos Primer* (Univ. of Calif. Press, 1992), pp. 29–30.
- [4] Ref. 2, pp. 31–32.
- [5] Ref. 1, p. 155.
- [6] Ref. 2, pp. 32–33.
- [7] Ref. 2, p. 53.
- [8] Ref. 2, p. 32.



What’s left of Jumbo at the Trinity Test Site.

Photograph by Dwight E. Neuenschwander, Southern Nazarene University.