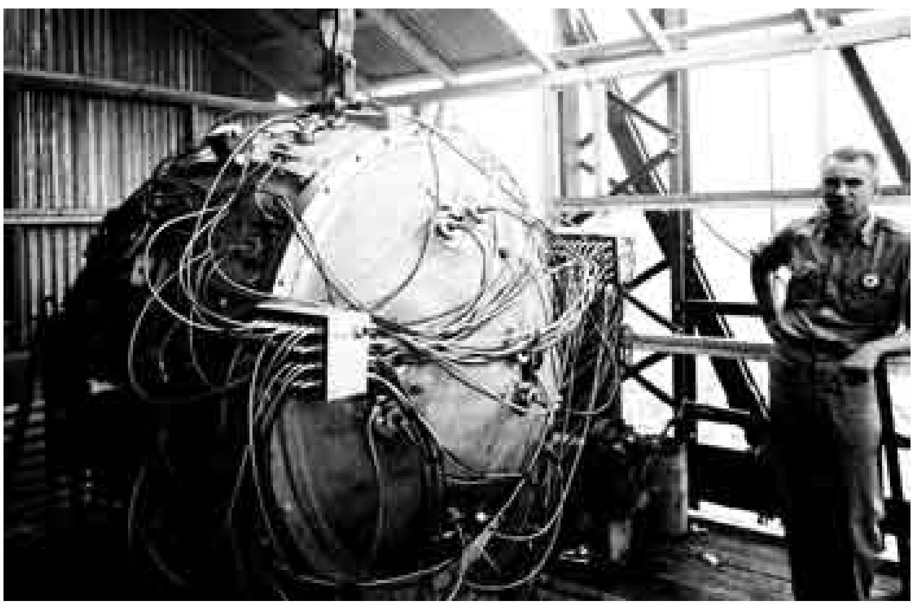
The Beauty of the Bomb

It is terrible, and it is miraculous

by Stephen Zanichkowsky

An unframed photocopy of the first atomic bomb ever built has been pinned to my workshop wall for at least five years now. It's from a modern edition of *The Los Alamos Primer*, a book of the lectures given in 1943 by a physicist named Robert Serber to introduce new Los Alamos laboratory personnel to the task at hand. That first bomb was set off in the American desert in the summer of 1945, after two years of intense work by thousands of people. The picture I have was taken the day before, at the top of the bomb tower. The bomb is a five-foot sphere studded with plugs and cables, and it really looks like an invention: homemade, heavy-duty, no-nonsense. Like something you'd drop to the bottom of the Mariana Trench to sniff out sulfur-sucking tubeworms. In the photograph, one man stands near the bomb. He radiates the hands-on surety and toughness and pride of an earlier generation. He looks like a mechanic in the purest sense of the word, and that's what he was. His name was Norris Bradbury, and he was in charge of assembling the pieces.



Morris Bradbury and the "gadget" at the test site, July 15, 1945.
(COURTESY OF LOS ALAMOS NATIONAL LABORATORY)

The project that produced this gadget—that's what those who worked on it called it—cost two billion 1945-era dollars. Today A-bombs are cheaper to make, because of black-market plutonium and because the technical problems have been solved. One of the things I most appreciate about the bomb is that original effort, the *theoretical* effort that first went into it. The leaps of imagination, the intuition, the new modes of thought in physics and mathematics. The people who thought up this thing were almost superhuman in their intellectual capacity.

Another thing that fascinates me is how the first bomb worked. Why should metals behave in an entirely unimaginable way simply by being compressed? This is how it was done: The wires detonated an outer casing of 32 castings of mixed fastand slow-burning explosives, creating a spherical implosion converging toward the center. This compressed a uranium shell, which in turn reduced a grapefruit-size lump of plutonium to more than twice its initial density. Inside the core was a mysterious and still classified device called an initiator that spit out a handful of neutrons, which then instigated a chain reaction in the plutonium. Countless trillions of plutonium atoms fissioned in the next few millionths of a second, each releasing a bit of its binding energy in the form of X rays and heat. For the first time ever, humans had released energy that had nothing to do with the “stored sunlight” found in coal, oil, and wood. Energy was squeezed from a lump of ore.

Ah, the inconceivable complexity of atoms. Why do some form compounds while others remain inert? How do they radiate light? What is radioactive decay? Why do some elements form different versions (isotopes) of themselves? What keeps the electrons in orbit? Miraculously, these questions were answered without the aid of computers or electron microscopes. Physicists did it with understanding, mathematics, curiosity, and a willingness to imagine the unbelievable.

My fascination with the bomb began with the launching of *Sputnik*. “If they can do that,” my father muttered, “they can deliver the bomb.” It was that simple. I was too young to be afraid of the bomb itself; what could a five-year-old know about that? But the duck-and-cover drills were another matter. Even while implying that surviving atomic war was as simple as staying clear of falling plaster, the drills conveyed a sense of wordless urgency that slowly seeped into the bloodstream. Eventually, although we couldn’t know this at the time, hydrogen bombs rendered precautions worthless, and the drills fell out of style. When we stopped ducking and covering, though, we also stopped thinking about the bomb, and maybe that was part of the government’s plan. I mean, how could they formulate domestic policy on something with basically no upside?

By the early 1960s the bomb and its attendant exotica had invaded popular culture and taken up permanent residence in my psyche. Mutant monsters appeared on television, spawned in nuclear blasts on the ocean floor; space invaders unleashed death rays from their fingertips. In the real world, the Americans sailed a nuclear sub under the polar icecap, while scientists and engineers talked about lasers and quasars and electricity “too cheap to meter” pouring from nuclear reactors. But when the Cuban Missile Crisis occurred; you could feel suspicion and dread on the sidewalk. The atomic future, for better or worse, had arrived.

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What was the bomb? Why did they call it *the* bomb, as if there were only one in stock? It was out there, but what did it look like? It was something I learned to fear on the basis of hearsay alone. Here was this huge thing, which existed in the same way God did: You heard a lot about it but you couldn't picture it and you couldn't know anything about it for certain until you were dead. Trapped in a surreal world of bomb drills and Martians and reactors, I didn't even know whether or not to be afraid. By the time I was of draft age, both sides had stockpiled warheads and missiles by the tens of thousands, and I assumed the world would polish itself off in short order. Still, in a corner of my mind I kept wondering what it was all about. What made this particular bomb so special? I began to find out in 1986 with the reappearance of Halley's comet. Our country didn't launch any cameras, so I bought a small telescope and tracked the comet around New England. This got me reading astronomy. I learned that Halley's nucleus was something like the size of Manhattan and that it lost about 20 feet of ice off its surface on each 76-year trip. Most fascinating was the fact that radiation pressure from the sun, not the comet's motion, created the tail.

Radiation pressure? This single detail intrigued me so much that I signed up for a night course in astrophysics at Harvard. My love affair with the bomb began in that class, where I fell in love with radiation. There I first realized the true nature of the electromagnetic spectrum: gamma rays, X rays, ultraviolet light, visible light, infrared, microwaves, radio waves, a continuous stream of emanations differing only in their wavelengths, each flowing seamlessly to become the next. The entire universe operates through radiation, and the only difference between deadly gamma radiation and pure day-light is a difference in wavelengths measured in millionths of a millimeter. We know this because of the spectrograph, a Rosetta Stone that translates radiation into images as informative as spoken language. Consider all we have learned from the Hubble Space Telescope, the cyclotron, MRI machines, lasers; practically everything we know about matter comes from the study of radiation. The electromagnetic spectrum is probably as close as I'll ever come to understanding what "God" means.

Bomb physics is the unacknowledged child of astrophysics. Both studies consist essentially of three things: radiation, subatomic particles, and nuclear forces. If you spend even a small amount of time studying solar metabolism, you'll end up hypnotized by the fireball. At least that's what happened to me. Starting with astronomy, I ended up with a book collection that would raise eyebrows among Patriot Act enforcers: Serber's lectures; the Farm Hall tapes from when German scientists were first told about the bomb; transcripts from J. Robert Oppenheimer's hearing. Books on plutonium, X-ray pindown, branching theory, capture cross sections, explosive lenses. Videos of fission and fusion explosions, mushroom clouds like no tomorrow. Ask me anything you want.

The books I turned to the most, however, were about Bohr, the Curies, Heisenberg, Fermi, and the everparanoid Teller. Within the framework of the history of physics, these people towered like gods, and I couldn't free myself from the minutiae of their wonderland. What is binding energy? Why are neutrons released when you split uranium? What did Einstein mean about mass being equivalent to energy? Mostly, how could physicists prove anything about the stuff they postulated? Well, they proved much of it at Los Alamos, maybe 30 years of atomic theory, in fact. In the end I couldn't free myself from the shadow of that place either; though I hate the fact that we dropped bombs on Japan, I find it stupefying that a few grams of matter, turned completely into energy, melted a city in nine seconds. Even after all these years I can see the core crunching, see the plutonium fissioning wildly, the neutrons branching out as powers of two: 2-4-8-16-32 and so forth for 80 generations until the reaction outgrows its own physics and dies away. A tiny amount of energy is released with each fission, not enough to budge a cigarette ash, but when I multiplied out the progression, I got a number 25 digits long.

And here lies my uncertainty. In one sense, the bomb is simply a result of the laws of nature, its discovery as inevitable as Kepler's deduction of the laws of planetary motion. I am amazed by the centuries of discovery that led us to understand that an atom contains energy that can be released, studied, and used. What else is out there that we don't know? Bomb work must have felt like heroin; after getting drawn in you could lose all ability to reckon consequences. I would have worked on it, definitely; I would have been too curious to stop myself. First it was just fission, but fusion beckoned just around the corner, and there were more corners after that. Always more corners. I excuse myself by saying I would never have dropped the bomb on Japan. I remind myself that physics brought us lasers, electron microscopes, laptops, cell phones, CT scanners, maglev trains. If laptops and cell phones helped bring down the World Trade Center, can I excuse the hydrogen bomb by telling myself that *anything* can be used as a weapon?

Over the next century biochemistry is going to bring us the same changes that physics brought in the last. We will clone ourselves; we will extend the human lifespan by 20 years; we will eliminate some diseases and bring on others; we will create death-resistant bacteria and at the same time try to figure out how to kill them. In the end, we will usurp a power previously reserved for the gods: we will decide what a human being should be like. There were people in 1945 who thought we should have quit right after Trinity, once the bomb went off at the top of that tower. Perhaps they were right, but how do we stop ourselves from seeking? As Freeman Dyson put it, "I have felt it myself. The glitter of nuclear weapons. It is irresistible if you come to them as a scientist… . It is something that gives people an illusion of illimitable power … when they see what they can do with their minds."

The bomb is a fact we are doomed to live with, and I live with it by looking for whatever beauty it might contain.

Stephen Zanichkowsky has written for Men's Health, More, *and* The Atlantic *and is the author of the memoir* Fourteen: Growing Up Alone in a Crowd.

Reference

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