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The Weight

The technology currently resting in my head was a vital part of the twisting timeline of metal and circuitry that comprised the rapidly evolving mechanical history humanity has strived to keep up with. Sitting in a dusty room, I have plenty of quiet time to ponder the value of nuclear technology. After having been assigned to write up an essay about America's history with the atom bomb, I traveled to the Blooming Prairie Public Library early one Saturday and cleared out a space for nearly all their books on any related subject and my computer—full of open tabs to articles and journals. The first thing that jumps out to me is an account of an interested party tracking down what still remained of the Manhattan Project, where the first nuclear bombs came from. Professor and historian Alex Wallerstein had the opportunity to reach out and touch a formative part of our world.[1] He held in his hand both the arming plugs of the first atomic bomb used to directly take human lives. These two plugs, one green ("safe") and one red ("armed"), were a vital part of "Little Boy"—dropped by an American B-29 on Hiroshima on August 6, 1945.[2] These strange cylinders were so light, weighing no more than a pound collectively, but I could feel my arm buckle when

[1] Alex Wellerstein, "What Remains of the Manhattan Project" *nuclearsecrecy.com*, 12 June 2015.

[2] Jim Laurier, "Destroyers of Worlds," *World War II* 30, no. 3 (2015): 68; Alex Wellerstein, "What Remains of the Manhattan Project"; Glenn T. Seaborg, "Contributions to Advancing Science," *osti.gov*, July 2005.

-Picture of Alex Wallerstein holding the arming plugs for "Little Boy"

I thought of what they were once attached to; the tiny metal objects had such horrible weight to them, even if just in one's imagination. Even without feeling them directly, their history alone could account for so much. Created for the sole purpose of deactivating and arming a nuclear weapon, these plugs came into being after the Manhattan Project's development and assembly of a multitude of these bombs in Los Alamos, New Mexico.[3] The red plug was a spare, as the genuine article was vaporized with the rest of the over 9,000-pound bomb, along with over 140,000 Japanese people in the ensuing "explosion equal to 12,500 tons of TNT" on that fateful day towards the end of World War II.[4] The heft of the metal and the gravity of so many fates all coalescing into two vile masses depicted in Wallerstein's hand. Morris Jeppson, the weapons test officer and assistant weaponeer of the B-29 bomber *Enola Gay*, was responsible for switching one for the other while in the air; "Jeppson brought multiple spares with him since if he had dropped one during the operation, it would have aborted the mission."[5] One such spare, as well as the actual "safe" plug from "Little Boy", made their way from Jeppson's hands to retired American physicist, philanthropist, and collector of military and historic artifacts, Clay Perkins, for $167,000 at auction in 2002.[6] Thanks to the appreciation for history and the achievements of Physics that Perkins has, Wellerstein is able to hold these insurmountably meaningful little tools. The only surviving parts from the original bomb, one of the only two atomic bombs ever used in combat in the entire history of human civilization resting with some room to spare in his hand.[7]

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[3] Seaborg, "Contributions to Advancing Science."

[4] Paul Guinnessy, "Components of 'Little Boy' Sold at Auction," *Physics Today* 55, no. 8 (August 2002): 23; Jim Laurier, "Destroyers of Worlds," 68.

[5] Alex Wellerstein, "What Remains of the Manhattan Project."

[6] Paul Guinnessy, "Components of 'Little Boy' Sold at Auction," 23.

[7] Marc Stockbauer, "The Designs of Fat Man and Little Boy" *stanford.edu,* 18 August 1999.

These awkward little objects certainly do not strike the eye as anything special. A regular person might assume they were spare parts for an antique car rather than implements of such catastrophic gravity. Bombs, fallout, energy, machines, and death; is that what nuclear power is? This miracle of science and technology, an atomic legacy that came from long before even the first World War, continues to shape the way humans interact with one another and their environment to this day.[8]

Stemming from the theories of Ancient Greece regarding the nature of the universe's composition, all manner of intellectuals and thinkers have pondered the atom. The first real "deep dive" into using modern technology to explore this unit of creation was led by physicist J. J. Thomson in 1897, in which he discovered the electron.[9] Much like most human endeavors aided by technology, the discoveries increased at a rapid rate, allowing for science to make leaps and bounds towards the discovery of fission in 1938. Within the confines of a radiochemist lab in Nazi Germany, the atom, dubbed "atomon", or "that which cannot be divided" by its Greek ushers, was split in two roughly equal parts by Otto Hahn and Fritz Strassmann.[10] Along with the discoveries and theories of renowned thinkers of the era like Albert Einstein, the importance and danger of fission and generating untold energy from this split would be realized nearly immediately, although the true consequences of this discovery might not be entirely tangible until the first atomic weapons arrived. Einstein, with the help of physicist and escapee from Nazi oppression, Leo Szilard, wrote directly to the president at the time, Franklin D. Roosevelt, to inform him of the recent research on Fission Chain Reactions in Germany and the potential to

[8] Seaborg, "Contributions to Advancing Science."
[9] Ibid.
[10] Ibid.

create “extremely powerful bombs”.[11] Imagine Roosevelt, having a letter from what would be seen by some as the greatest mathematical mind of the century, detailing the possible threat of a nation described as inhuman and evil unilaterally wielding true tools of armageddon. Somehow, the letter did not convince the president, as he was concerned for finding the necessary funds to throw to this unheard-of venture, in fact, it took “a second… [to] convince [Roosevelt of the value of exploring atomic energy.”[12] Miraculously, the project proceeded—imagining a future in which the Nazis reached nuclear power first makes the arming plugs seem light by comparison. Fueled by the fearful tensions of facing the might of the imposing German army in possession of a weapon with the potential to harness nuclear power, the Manhattan project, with significant government support, studied, tested, and finally developed the bombs that would strike Japan.

Rolling the cylinders slowly across my mind, I think of all the human effort spent crafting and perfecting these objects and the weapons they were created to control. Finding the most effective combination of engineering and physics necessary to produce the biggest bang—grim work. The detailed description of the inner-workings of these destructive engines reads like dystopian science fiction, diving into the weaponized parts all kept compartmentalized and ready to react with one another upon the notice given by the red plug lying on Wallerstein’s palm.

The basic structure of the Fat Man was based on a series of 6 concentric nested spheres. The outermost was the explosive lens system, followed by the absorber shell, the Uranium reflector shell, the plutonium pit, and lastly the innermost shell, the neutron initiator. The shell system basically worked as an implosion device. The outer shell was made of high-powered explosive that, when detonated, compressed the inner spheres and charged the uranium… Surrounding the tamper was an 11.5 cm thick aluminum sphere also weighing 120 kg. The primary purpose of this sphere, called the "pusher" or "absorber shell", was to reduce the effect of the Taylor wave. The Taylor wave is the rapid drop in pressure that occurs behind a shock wave. In other words, the scientists wanted as much pressure behind the shock wave as possible in order to increase the destructive power. By reducing the Taylor wave, the pressure of the transmitted shock wave

[11] Seaborg, “Contributions to Advancing Science.”
[12] Ibid.

increases, enhancing the pressure reached at the center of core, and thereby increasing the size of the explosion.[13]

Pages of condensed scientific and engineering expertise, simplified to the point where even a layperson could get the basic gist of the genius. All these components and approaches to creation that required precision and careful crafting were documented, but there was not a necessarily consistent level of care taken in each bomb's construction. While the books detailing the "Fat Man" praised its costly but effective design, those addressing the creation of "Little Boy" simultaneously lauded and insulted it as "a terribly unsafe weapon design," stating that "once the gun was loaded with the propellant, anything that ignited it would cause a full yield explosion of


A mushroom cloud towers over Nagasaki on Aug. 9, 1945. Less than a week later the Japanese government accepted the Allied demand for unconditional surrender.

[13] Marc Stockbauer, "The Designs of Fat Man and Little Boy."
-Picture from "Enola Gay," *Military History* 32, no. 2 (July 2015): 62.

the bomb. For this reason, the propellant was not loaded into the weapon on the ground… one of the bombers placed the cordite in the gun after take-off in case a crash or fire occurred."[14] Another piece of the history of these weapons—the bombers that had to fly with these portable calamities. I only thought about them briefly when I first read about the arming plugs, but the temptation not inflict such damage must have been there, although, a surprising amount of these articles and books make little to no mention of that possible urge. Each of the high-quality digital restorations of photographs from the era come with captions that skew history in a rather glorious direction: the first one depicting a smiling and waving Colonel Paul Tibbets, the pilot of the *Enola Gay*, which carried "Little Boy" to Nagasaki, the next showing off the imposing mushroom cloud that foreshadowed the acceptance of "the Allied demand for unconditional surrender", the next highlighting the "catastrophic destruction" of Japan along with the clarification that "the attacks helped convince Emperor Hirohito that continuation of the war was futile," and so on.[15] Being directly connected to the end of World War II, through any means, would surely be a mark of national pride, but I cannot help but think having a mushroom cloud in your past might feel more like iron than smoke on the soul.

The Manhattan Project was an expensive, monumental, and morally ambiguous endeavor including some of the greatest scientific and engineering minds the world could offer, but, surprisingly, little is ultimately leftover from all the toil and trouble. The library certainly has enough facts about it, but the whole thing reads like a story of heroes defeating villains in finding some mythical treasure. The average person thinks back to big names in nuclear testing like the

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[14] Marc Stockbauer, "The Designs of Fat Man and Little Boy."
[15] "Enola Gay," *Military History* 32, no. 2 (July 2015): 61-63.

Trinity site, but "given its size, and importance, perhaps one would expect more."[16] Even if a person decided to go to the historical "ground zero" for the nuclear arms race, they would only find a quiet and isolated patch of the Jornada del Muerto desert of southern New Mexico.[17] While plenty of monuments exist as testament to the explosive activity, besides the destroyed remains of the firing tower for "the gadget" (the test-bomb's codename) and the farmhouse where the plutonium core for the bomb was assembled about a bus trip away, there would be no obvious indicator of the tremendous explosion that turned sand to glass and blew out windows in populated towns miles away on 16 July 1945.[18] The Trinity site was far from the only place where nuclear weapons were tested, and as potentially traumatic as having a distant explosion wreak havoc on the daily lives of New Mexico denizens, it was far from the worst example of testing.

Starting in 1946 and continuing all the way to 1996, nuclear testing in took place from the Marshall Islands to Johnston Atoll (an unincorporated US territory eight-hundred-sixty miles from Hawaii) and Christmas Island (an Australian territory in the Indian Ocean).[19] The Marshall Islands, a chain of volcanic isles and coral atolls that comprise a country in Oceania played host to sixty-seven atomic bomb tests from 1946 to 1958.[20] More specifically, the twenty-three island grouping known as Bikini Atoll was used for experimentation, this included the first test of a

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[16] Alex Wellerstein, "What Remains of the Manhattan Project."

[17] Julian Smith, "Trinity Test Site," *New Scientist* 206, no. 2755 (2010): 61.

[18] Julian Smith, "Trinity Test Site," *New Scientist* 206, no. 2755 (2010): 61.

[19] Steve Brown, "Archaeology of Brutal Encounter: Heritage and Bomb Testing on Bikini Atoll, Republic of the Marshall Islands," *Archaeology in Oceania* 48 (2013): 27; Laura Pitkanen and Matthew Farish, "Nuclear Landscapes," *Progress in Human Geography* 42, no. 6 (2018): 862.

[20] Steve Brown, "Archaeology of Brutal Encounter: Heritage and Bomb Testing on Bikini Atoll, Republic of the Marshall Islands," 26.

deliverable hydrogen bomb, which obliterated "three of Bikini's islands and produced radioactive fallout that resulted in the deaths of, and ill-health effects for, Marshallese, American, and Japanese people and for the atoll itself."[21] Each new test built upon the deposition of native people, adding to the heavy feeling permeating the subject—a hidden gravity slowly revealing itself to me. For the indigenous Bikinians, the effect of these egregious tests is readily apparent, but the historical imprint of those same tests is not always so clear-cut. The effect of fallout from Bikini Atoll contaminating a Japanese fishing crew inspired the long-lasting cultural icon in movie-monster *Godzilla* (and plenty of derivatives), which began as cautionary allegories against the monster of nuclear abuse.[22] The Japanese people have taken such inhuman incidents in stride, remaking *Godzilla* as a more heroic and cartoonish figure as well as establishing Hiroshima and Nagasaki memorials while continuing to interact with the United States.

The weight of these objects increases with every book, article, or account I glance over in this library. My head gets tired, but I cannot let myself forget, especially after all the pride I held in the "American victory" of beating the forces of evil to the nuke. What did people of the time think? The immense amounts of pride that originated from the end of the second World War and the defeat of such a vile campaign as Hitler's assault on Europe is undeniable. Sensationalist efforts in Hollywood took advantage of the "nostalgia" surrounding the atom bomb and its usage. Filmmakers presented works like *Fat Man & Little Boy* (a 1989 movie) in a style of "'nostalgia without melancholy' where the past has become a commodified… and the troubled, tenuous connections that made historical self-awareness so satisfying are lost in easygoing

[21] Ibid, 26.
[22] Laura Pitkanen and Matthew Farish, "Nuclear Landscapes," 867.

consumption."[23] Not only was the representation of nuclear weapons creation put under some thoroughly heroic lenses, but international contributions to the effort were oft overlooked.[24] Historical airbrushing of tragic and impactful events that are deeply rooted in the American tradition makes holding the arming plugs in my mind that much harder—pride is usurped slowly by leaden guilt. Theoretical physicist Julius Robert Oppenheimer, often referred to as the "father of the atomic bomb" for his prominent role as the wartime lead of the Manhattan Project, represented in popular media of the time like *Fat Man & Little Boy* as "uncharismatic and manipulative", has been cited looking back on his experience with nuclear weapons with disdain, wishing nothing more than to have them banned.[25] The most telling quote of his reflections on the creation of the first atomic bomb is undoubtedly, "I am responsible for ruining a beautiful place."[26]

In the modern day, nuclear tensions have faded a bit from the broiling days of cold war, and with mutually assured destruction looming over the heads of all human life, no one would be so insane as to pull such a heavy trigger. Although the nuclear race that brought about the first bombs was tense due to the cutting edge that splitting the atom was on technologically, over the next half-century, proliferation of nuclear weapons began.[27] The "nuclear culture" that emerged from the first atomic explosion was one that could never be reverted.[28] With leaps and bounds in

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[23] Christoph Laucht, "An Extraordinary Achievement of the 'American Way': Hollywood and the Americanization of the Making of the Atom Bomb in *Fat Man & Little Boy*," *European Journal of American Culture* 28, no. 1 (2009): 47.

[24] Ibid, 43.

[25] Lindsey Michael Banco, "The Biographies of J. Robert Oppenheimer: Desert Saint or Destroyer of Worlds," *Biography: An Interdisciplinary Quarterly* 35 (2012): 499–500.

[26] Ibid, 499.

[27] Seaborg, "Contributions to Advancing Science."

[28] Lindsey Michael Banco, "The Biographies of J. Robert Oppenheimer: Desert Saint or Destroyer of Worlds," 492.

the mechanical world, science, unfettered now by even the unsplittable atom, would progress its way like a juggernaut through discovery after discovery, always followed by a nuclear shadow.

My alarm goes off, blaring to me the signal that it's about time to head out. I stare down to the pile of information amassed at the desk, slowly moving over to each worn shelf to return each resource. Trying to ignore the dull aching that's built up in my head, I deposit the books and let out a long sigh. With a last look around the place, from the beginning of the nuclear timeline detailing atomic theory, to the end of the library's information with the controlled fission taking place in power plants today. I walk out of the library, and I do not look back.

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