

## Wartime Atomic Bomb Projects

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The discovery of nuclear fission was anticipated but was a surprise nonetheless. Radiation was discovered in the 1890s, and it was conjectured that there was great energy potential in the atom. Investigation into the topic ensued, and H. G. Wells even posited an “atomic bomb” (a phrase he coined) in his 1914 novel *The World Set Free*; but in the book, world leaders decide that using such a device would be lunacy and form a world government. The German scientists Otto Hahn and Fritz Strassmann started performing experiments in 1938, bombarding uranium with neutrons as Enrico Fermi had done in the early 1930s, but with different results. Uranium was at the time the heaviest element in the periodic table; Hahn and Strassmann imagined that under bombardment it would turn into an ever higher, new element. In fact, the uranium split into two elements in the middle of the periodic table. The men wrote to the physicist Lise Meitner—then in Stockholm, since Jews were less than welcome in her native Vienna—asking her to explain this confusing development. She did so, saying that the nucleus of the uranium atom being unstable, nuclear fission (a term she coined) would release a huge amount of nuclear energy—far more than would a chemical reaction—and the consequent chain reaction would release energy on a vast scale. (It is an interesting side-note to Meitner’s career was that it was Hahn, not she, who got a Nobel Prize for this work, because a member of the Nobel Committee didn’t like her; indeed, she had to enter the institute where she worked through the back door in order not to frighten male students who found the idea of a brilliant female physicist terrifying.)

Despite widespread apprehension among the scientific community about the dangers of nuclear technology, a number of governments proceeded to investigate the subject, but kept reaching an impasse when trying to discover how to achieve a chain reaction. Niels Bohr theorized that one particular isotope—Uranium 235—might work; but U-235 constituted only a small percentage of the uranium available, the means of separating it out (now called “enrichment”) remained unclear, and it seemed that a huge amount would be needed. The project of developing an atomic bomb simply did not seem realistic.

The problem of quantity was dispensed with by Otto Frisch (Meitner’s nephew) and Rudolph Peierls, then refugees in England, who determined that only a pound or so of U-235, not tons, was required. The Military Application of Uranium Detonation (MAUD) Committee, composed of top-level physicists, likewise issued a report declaring that a much smaller amount of U-235 than formerly supposed would suffice. Despite the

infelicitous circumstance of England being in the middle of a war, the fear that someone else (i.e., Germany) might build an atomic bomb impelled Winston Churchill to pursue the project.

According to Holloway, the reason Germany did *not* in fact produce a bomb was that, first, its research sector was highly disaggregated and prone to vicious competition within itself, and, second, that mistakes were made in the science. The German physicists realized (as did the Americans and the British) that a nuclear reactor would produce a new element (later called plutonium), but they miscalculated by relying for a moderator on heavy water (rather than graphite) which was in short supply. They also apparently diminished the credibility of their project by asking the government for too little money. Finally, leading German physicist Werner Heisenberg and a number of his colleagues viewed the Nazi regime with antipathy, and may have dragged their heels in its service (there lingers the suspicion that Heisenberg sabotaged the bomb project). For a variety of reasons, then, the German effort went nowhere.

In 1942, U.S. president Franklin Delano Roosevelt was informed that it would be feasible to build an atomic bomb, and the Manhattan Project was begun. The Soviet Union, Japan, and possibly the French also set up projects to test the viability of constructing an atomic bomb; but Josef Stalin had the Battle of Stalingrad to cope with, the Japanese concluded that even the U.S. wouldn't be able to build such a device, and French research, if any took place, was halted by the German occupation. The Manhattan Project was therefore essentially alone in pursuing this aim. In December 1943, Fermi achieved the first self-sustaining chain reaction (basically the first reactor), in Chicago. Contrary to the general impression that the Manhattan Project consisted of a tiny cabal of nuclear physicists, in fact it employed around 120,000 people, with special hubs of activity at the University of California, Berkeley, the University of Chicago, and Columbia University. Plus the big industrial sites at Hanford in Washington and Oak Ridge in Tennessee. The Project was important not just because of the bomb, but because it was a model of scientific cooperation—particularly in comparison to research communities in Germany and the Soviet Union.

In 1943 the laboratory at Los Alamos was set up, with J. Robert Oppenheimer in charge. Very much at the last minute, in July 1945, the lab managed to produce the requisite plutonium and U-235, and the first atomic bomb test (of the plutonium-core bomb “Fat Man”—it was assumed that the U-235 bomb “Little Boy” would perform satisfactorily) took place at Alamogordo.

Churchill was adamant that Britain should make a vigorous return to atomic research, and struck a deal with Roosevelt whereby he sent a sixty-person mission to the Manhattan Project, on the condition that after the war the American president could make a ruling on Britain's use of nuclear energy. Stalin's atomic bomb project, headed by Igor Kurchatov, was abetted by Klaus Fuchs, a member of the British mission, who turned information over to the Soviets (enabling them to test a copy of the American plutonium bomb in 1949). Stalin was shocked by the bombing of Hiroshima, having received no intelligence

about U.S. plans to use the bomb; he promptly responded by making the Soviet bomb project a major priority, with over 600,000 employed by 1951.

The decision to drop the bomb on Japan was foreshadowed in a meeting between Roosevelt and Churchill at Hyde Park, New York, in September 1944. Harry Truman knew nothing about these discussions, being informed about the bomb only upon his assumption of the presidency on April 12, 1945. His Interim Committee under Secretary of War Henry Simpson engaged in discussion of *how*, not *whether*, to use the bomb: revoking Roosevelt's decision was never a real option. It is useful also to consider that the Hiroshima and Nagasaki bombings were not isolated events, but a one in a series of acts of mass destruction that had been taking place for some time. Tokyo had been firebombed twice, with huge casualties ensuing; the British and American bombing of Germany had resulted in the deaths of 600,000 people: fifty million people had already been killed in World War II. Even so, Truman and Simpson understood that deployment of the atomic bomb would have especially terrible consequences.

A Target Committee was set up, and decided that Kyoto should not be bombed. When the order to drop the bomb was issued, it stated that the bombs should be used as they became available. This latter decision accounts for the explosion of the second bomb: it was a predetermined part of the whole. Apparently it was never asked what could have been done in order to avoid using the bomb (setting up a naval blockade, for example). On the question of whether the bomb actually brought the war to an end, the Soviet answer was that it was *they* who had done this; the Western view was that it was the bomb. [A photograph of Hiroshima, looking like a moonscape after the bomb, was shown.]

The Soviet entry into Japanese-occupied Manchuria had been encouraged by the U.S., which promised Stalin the southern half of Sakhalin, some islands, and certain rights for his participation on that front. However, at the Potsdam Conference (July–August 1945) neither Truman nor Churchill were as eager as before for Soviet collaboration, as “Russia was being weird.” But Stalin wanted what had been promised him, and gave the order to attack.

Of the four countries actively contemplating construction of the atomic bomb, Germany seems to have given up on the process, Britain to have been unable to pull it off, and the Soviets incapable of making a decision about the issue. Only the United States capitalized on the nascent technology. Why? There was a combination of scientific expertise and military/political urgency in America that was not in evidence elsewhere, for one thing. And there was the worry about Germany's producing a bomb first (shared with England, and ironic since Germany had no intention of attempting the feat, apparently feeling that if Germany couldn't build a bomb, who could?).

Now that we're stuck with this technology, the question is how to manage it. Oppenheimer's view was that World War II had been the most destructive war in history, and we had made something that would make it even more destructive: how were we to live with it? It's a question we're still trying to answer.